OLIVER WYMAN

FALL 2014

TRANSPORT & LOGISTICS

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FINANCE | HSR Funding, 3PL Profitability
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And more...

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TO OUR READERS

Welcome to the Fall 2014 edition of Oliver Wyman's *Transport & Logistics* journal. This issue – our largest ever – is organized around four interrelated topics of interest industry-wide: transformation, marketing, finance, and operations.

TRANSFORMATION

Better economic stability is providing a platform to consider "what comes next" in terms of handling transformational shifts set to impact diverse transportation modes: E-commerce is growing rapidly, and "giants" in the space are pushing logistics in new directions. Aviation may be on the edge of moving beyond a single option for fuel. And transportation and energy industries all must face up to the implications of an aging workforce, as exemplified by our rail case study.

MARKETING

Demand for real-time, dynamic travel information is growing exponentially, in line with the widespread use of mobile technologies. We expect "Mobile 2020" to attract new businesses and players along the entire mobility management chain. From a broader perspective, this is symptomatic of a new take on marketing by major brands, which are moving from "one size fits all" to innovations that personalize each customer's experience.

FINANCE

High-speed rail funding continues to be elusive, but there are options to squeeze more operational money out of the system by optimizing asset utilization and network capacity. Similarly, we identified a half-dozen ways that global logistics companies can move more of their revenues into the earnings column. And manufacturers of planes and trains have had a particularly bad time lately, the result of project delays and cost overruns; salvation may lie in adapting the toolset of best-practice manufacturers in other industries.

OPERATIONS

A topic of value to all companies is how to better engage middle managers, who can be either the wall or the gateway to the successful implementation of change management programs. In the aviation space, we present the annual results of our MRO (maintenance, repair, and overhaul) survey and provide a snapshot of Oliver Wyman's comprehensive aviation data website, PlaneStats.com. Finally, we look at the progress that's being made in improving the safety of crude-by-rail movements, and what more can be done.

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

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TRANSFORMATION

DISRUPTIVE LOGISTICS: A NEW FRONTIER FOR E-COMMERCE

AUTHORS
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Delivery logistics, once a relatively staid business, continues to be pushed in new directions by e-commerce. E-tailers of all sizes are looking to "disruptive logistics" – a combination of delivery speed and innovation – as a way to add value, separate themselves from the pack, and keep the customer under their banner throughout the entire shopping process. Formerly well-defined borders between e-tailing and logistics are dissolving, shifting the entire e-commerce ecosystem in new ways that will impact all businesses in the space.

Some of the largest names in e-commerce are leading this change-up:

- Amazon is offering fresh products (delivering groceries via the "Fresh" business unit in large cities and for the first time stepping into last-mile delivery); moving into wholesale (through AmazonSupply, which has grown four times over since launching two years ago); and adding Sunday service (via the Postal Service in the US and parcel service DPD in the UK).
- Chinese e-commerce firms are increasingly using Amazon Marketplace and Ebay as sales channels. Amazon's warehouse and fulfillment capabilities, for example, ensure low-cost goods are customs-cleared and ready to be shipped quickly.
- Google is taking on Amazon for same-day: Only days after Amazon announced it was expanding same-day shipping to more cities, Google launched its Shopping Express service in Los Angeles and New York, which provides same-day service for selected retailers.
- Ebay is expanding same-day: UK startup Shutl uses the capacity of local courier firms to deliver local goods based on customer preference within 1-2 hour time windows. Ebay acquired Shutl in late 2013 and plans to expand its same-day "Ebay Now" service using Shutl's infrastructure and IT.

Exhibit 1 outlines these and other enhancements that have occurred in the logistics e-commerce space over the past 10 years. This push for logistics innovation by large e-tailers is sure to benefit customers in terms of more convenience, more service, more options, and faster delivery. But can the giants keep up the pace? What can smaller e-tailers do to ensure they aren't left behind? And how can third-party logistics (3PL) regain its role as a driving force in the e-commerce market?

EXHIBIT 1: THE QUICKENING PACE OF E-COMMERCE LOGISTICS DEVELOPMENT

1: Amazon begins offering US Amazon Prime (two-day delivery)

2: Amazon starts Fresh pilot in Seattle

3: Launch of same-day service Shutl in the UK

4: Amazon introduces branded parcel boxes

5: Amazon launches Amazon Supply

6: Amazon rolls out Fresh in LA, SF

7: Google pilots Shopping Express in SF

8: Alibaba launches China Smart Logistics Network, to support 24h delivery across China

9: Ebay acquires Shutl

10: Amazon begins Sunday delivery in US (via USPS)

11: Amazon begins Sunday delivery in UK (via DPD)

12: Google rolls out Shopping Express in LA, NY

13: Alibaba signs logistics/delivery cooperative deal with China Post

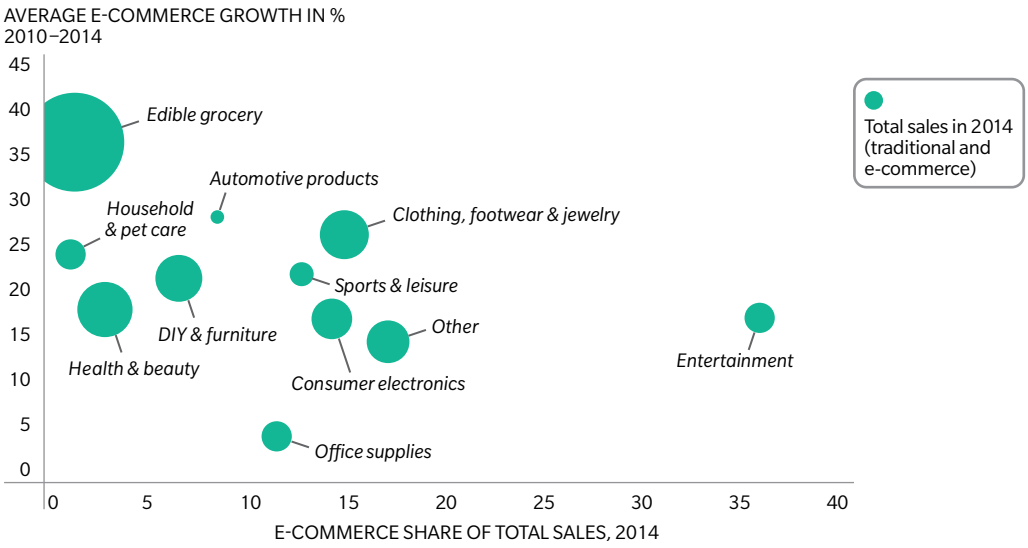
THE GIANTS: RISING SERVICE PRESSURES

The sheer size of companies such as Amazon, Google, and Alibaba allows them to dictate their needs to the logistics firms with which they partner. But continuous double-digit growth rates (see Exhibit 2) are becoming a problem: Amazon saw a big drop in performance during peak retail season this past year in the United States; some European delivery logistics markets also were down to borderline capacity. In most countries, there are only one to three firms that can operate delivery networks at scale. In some large European countries, Amazon accounts for 30 percent of the value of goods moving on the top logistics operator's network. Doing a better job on peak volume and resolving growth bottlenecks more generally thus will be critical issues for e-commerce giants in the future.

Some of the relevant issues and options include:

- E-commerce giants will need to ensure that they spread volume out and nurture a variety of logistics companies in each region, to increase market competitiveness and better leverage their buying power. Careful choices around long-term contracts and yields will be crucial.
- Increasing the number and size of fulfillment centers and warehouses raises operational complexity in order fulfillment. Diligent inventory management and supply chain process optimization is required to manage inventory and operations cost. Line-haul logistics now happens before the purchase – not as part of distribution.
- Labor conflicts and strikes pose a significant risk to growth. In Germany, for example, recent strikes at Amazon warehouses may be a reason that more warehouses are being planned in Eastern European countries. Hence risk management, both on the operational and on the branding side, is required.
- Most importantly, e-tail giants need to continue developing their own delivery logistics solutions as a powerful means of differentiation. With Google introducing Shopping Express, Ebay acquiring same-day delivery provider Shutl, and Amazon testing its own delivery services in major US cities, the game of thrones has just begun.

EXHIBIT 2: E-COMMERCE MARKET MATURITY (US, GERMANY, FRANCE, UK)



Note: Projected data for 2014
Source: Planet Retail, Oliver Wyman analysis

SMEs: HOLDING ON TO CUSTOMERS

Small and medium-sized enterprises (SMEs) in the e-tail space still need logistics companies to provide them with innovative and customer-friendly solutions that can help them narrow the gap with the giants. But if you aren't Amazon or Alibaba, what are your options?

Multi-channel retailers can successfully stand up to the major pure-play e-tailers if they are willing to work toward truly blending their online and offline business. Using their bricks-and-mortar stores to support the "touch and feel" shopping experience and brand quality is just the start. Multi-channelers must go one step further and leverage their most critical advantage vis-à-vis pure plays: Their network of stores and decentralized warehouses, which can enable them to offer faster, better delivery service and gain a competitive logistics edge in the market. For example, Macy's and Bloomingdales have just announced same-day service in a number of US markets.

Yet it won't be enough to just "plug" local same-day couriers into the existing structure. True multi-channel success will require shifting focus from offline-centered logistics to a smart, fast, and efficient multi-channel supply chain across all processes.

Pure players are increasingly stuck between the proverbial rock and a hard place: e-commerce giants driving the market on one side, and multi-channel firms leveraging their unique advantage as they move online. For these SMEs, competitive differentiation is critical, along the dimensions of brand, service, expertise, and product depth. Establishing a niche that makes a firm the "go to" for customers can combat more generalist e-commerce experiences. Sephora for beauty products and Zalando and Zappos for shoes are using this strategy, but whether they will be successful in the long run is not yet clear.

Customers will want (and get) full control of the delivery process

When it comes to innovative logistics solutions, pure-play SMEs may find introducing a physical means of differentiation such as same-day delivery tough to implement, as most have only one or a few centralized warehouses and thus cannot offer broad same-day delivery. Once same-day takes off (and customers demand it), solutions could include developing more decentralized distribution centers or teaming up with other niche SMEs to set up local same-day warehouses for critical stock. Enabling IT won't be trivial, but our analysis shows that such warehouses could be highly efficient.

Sending items toward a destination area even before the customer places the order (anticipatory shipping) could be a viable solution for fast-moving items in dense areas as well. Such anticipatory shipments can be triggered if ordering likelihood, based on big data analysis, rises above certain thresholds.

THIRD-PARTY LOGISTICS: DELIVERING INNOVATION

To serve the e-commerce market, parcel/postal logistics firms will need to pay more attention than ever to demands for speed and innovation. In terms of new delivery solutions, logistics firms will need to be faster, more predictable, more focused on the last mile, and innovative in the areas of Sunday and grocery delivery.

- Speed: 3PLs will need to offer faster delivery options, such as same-day, at scale. Integrating same-day into normal delivery options will keep costs down sufficiently to meet customers' shipping price points.
- Predictability: While one-hour delivery time windows will be the new standard, what customers really want is to determine when and where they get their packages. Such self-selected delivery windows will offer new "pay per slot" revenue opportunities (e.g., in Germany for Saturday 8-10 a.m., €5 extra; any day between 5-8 p.m., €2.50 extra).
- Last-mile touch points: Parcel lockers, to-the-door options, and parcel shops will continue to expand, with innovation around convenience, such as finding the best locations for parcel lockers, parcel shops with 24/7 hours, and delivering later in the day when people are at home.
- Sunday delivery: Amazon is setting a new standard for Sunday delivery – one the rest of the pack will be forced to follow. We expect to see Sunday delivery expand beyond the US/UK, although the speed of adoption will depend to a large extent on legal restrictions.
- Fresh solutions: Fresh/perishable goods will be the next big thing in e-commerce, meaning that logistics companies must start building scalable, cost-efficient solutions now. Major 3PLs are already testing options for delivery using normal trucks/vans and cooled vehicles.

Data management and integration will play an expanding role in logistics. Customers will want (and get) full end-to-end control of the delivery process, allowing them, for example, to change destinations in real time. This shift will require logistics providers and e-commerce platforms to be fully integrated along the whole value chain, with a constant, real-time interface for the customer. Who owns the customer could be up for grabs as a result: While e-tailers seek to control all customer communication (and contact), end-to-end logistics players can take advantage of their physical customer touch points. By generating insights into customers' behavior patterns and preferences, 3PLs can improve their own services, such as preferred delivery time windows.

In addition, logistics companies can help SMEs build out anticipatory shipping, which requires faster delivery speeds and a proactive supply chain. Completing the final destination address while the product is in shipment, for example, requires seamless data integration between the e-tailer and its 3PL. Logistics firms also will need to implement intelligent shipment steering processes to manage physical delivery efficiently and prepare their IT and operations for a world in which nothing other than a barcode identifies a parcel.

BRINGING IT ALL TOGETHER

E-commerce logistics innovation today is being driven by the e-tail giants, with logistics firms pushed out of the driver's seat and SMEs madly pedaling to keep up. While we observe many companies still in shock and overwhelmed by the speed of e-logistics innovation, we also see companies that are getting a handle on market evolution and moving in the right direction:

- Express parcel carrier DPD is driving the market with one-hour time windows.
- Supermarket chain REWE is innovating in the grocery space, including online ordering and one-hour delivery.
- Deutsche Post DHL has made bold moves toward becoming an e-tailer itself (meinpaket.de, allyoneed.com) and is piloting a same-day solution on a wide scale.
- Walmart, the world's largest retail company, is testing same-day delivery in San Francisco, CA and planning to expand testing to Denver, CO.
- Car service Uber is testing same-day delivery in Washington, D.C. Customers can order "corner store" products for immediate delivery by a private driver, via the Uber app.

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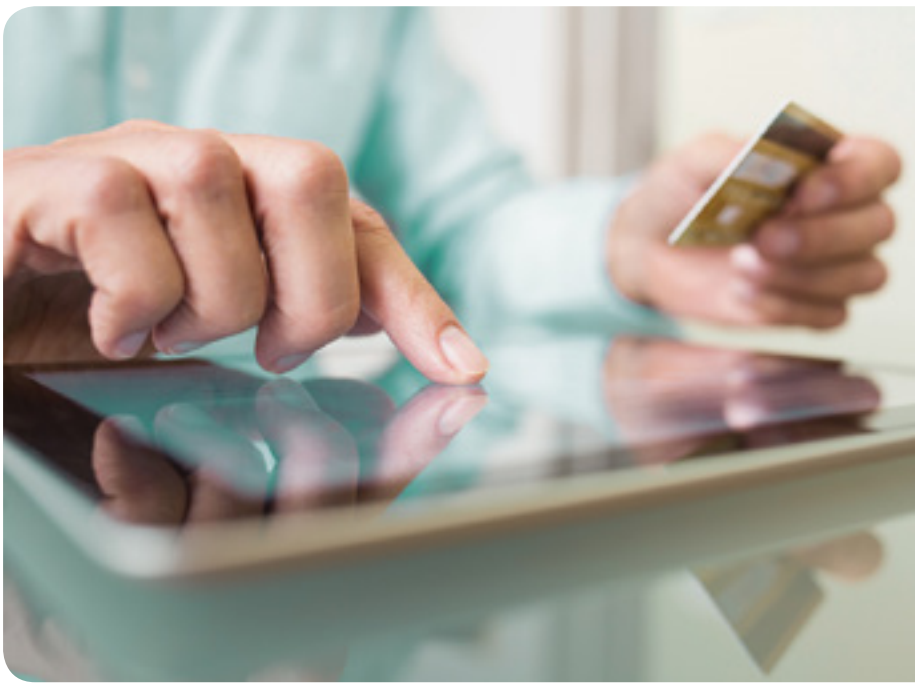

CASE STUDY: SAME-DAY BECOMING "INEVITABLE"

The biggest names in e-commerce and retail are making same-day delivery a priority

The CEO of Ebay's new same-day delivery platform, Shutl, says the rise of same-day will be inevitable. He argues that consumers measure expectations against past experience, and since the biggest names in retail and e-commerce are making same-day delivery a priority, market demand will rise quickly. And indeed, more and more e-tailers are going this route, choosing one of three existing operating models, each of which has its pros and cons:

The courier network model: This is based on local fulfillment and superior dispatch software fully integrated into retailers' existing technology. Retailers can dispatch from point-of-sale through a fleet of local couriers, which usually deliver within two hours, or within a specified one-hour window scheduled by the customer. This model provides the opportunity for all retail stores in a given urban area to become meaningful same-day market players; it is also quick to implement (as long as there is an IT link to the broker). "Cons" of this model include the need for a real-time overview of inventories across all stores and warehouses (still a hurdle for many e-tailers), nor is it all that scalable for lower-cost delivery options.

The do-it-yourself (DIY) model: Large grocery retailers in particular tend to invest in their own delivery fleets, since 3PLs may not have the type of vehicles needed, such as refrigerated trucks. Benefits include end-to-end control of processes (quality, branding, etc.) and the flexibility to adjust to changing customer requirements. "Cons" are that it's expensive, requiring substantial volume to keep down costs, and may be a complex activity to take on outside of a retailer's core competence.

The parcel carrier model: Several parcel carriers are piloting same-day solutions, with the goal of making delivery more cost efficient vis-à-vis courier services, which bundle pick-up and delivery and provide integrated routing. DHL, for example, is offering an evening delivery wave in several German cities where customers can chose a two-hour time slot in the evening for delivery (6-8 p.m. or 8-10 p.m.). While currently volumes are small, we expect this model to win mid-term over the courier-based model due to it scalability, cost advantages, and synergy with the existing asset base (delivery vans). This model does require moving beyond a classic hub-and-spoke network and more flexibility in pickup and delivery management.

With same-day poised to become a de facto standard for retailers of any stripe that want to serve metro areas, careful consideration will be needed as to which delivery model to pursue, and in what timeframe. Smaller multi-channel retailers can start by setting up a courier-based solution now. This option is particularly attractive if the retailer has a broad network of stores and IT that enables integration with one of the major courier brokers. For most companies, couriers can serve as a bridge until parcel/postal carriers roll out same-day offers. When demand rises, we expect parcel/postal will scale best. The DIY model from our perspective, will only continue to make sense for e-commerce giants.

SOLVING AVIATION'S (ALTERNATIVE) FUEL PROBLEM

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Will the aviation industry soon feel the winds of change when it comes to fuel? Ground transportation vehicles are transitioning to lower-emission fuels such as natural gas and electricity. But nearly all aircraft still run on petroleum-based jet fuel, due to a lack of commercial options. Many hands are at work on this pressing issue: Airlines, original equipment manufacturers, fuel suppliers, airports, government agencies, and researchers are coming together in working groups and coalitions with exotic monikers such as SAFUG, CAAFI, MASBI, and SAFN to develop options that may finally enable the industry to move beyond its current predicament.

Airlines know that alternative fuels are essential for the industry's long-term viability. Presently, they are at the mercy of volatile petroleum prices, spending as much as 40 percent of their annual budget on fuel. In addition, the industry will need to ramp up reductions of greenhouse gas emissions and pollution in response to regulatory pressures: The European Union has added domestic aviation to its Emissions Trading Scheme, and the United Nation's International Civil Aviation Organization (ICAO) has set a goal of carbon-neutral growth for international aviation from 2020 on. Importantly, without alternative fuels, both fuel budgets and emissions will continue to rise, given that aviation transport demand is projected to double in the next 20 years.

Increased focus and levels of government and private investment in fuel research and development in recent years are bearing some fruit: Several technologies have been approved to produce fuels that can be blended with petroleum for flight, such as hydroprocessing and Fischer-Tropsch technology. Some 1,500 commercial flights have been flown using such blended fuels, and airlines such as KLM, United, and Alaska Airlines have made multi-year commitments to buy biomass-based fuels. Longer-term, technologies such as alcohol-to-jet and pyrolysis may also provide impactful quantities of economically priced fuel. "Third generation" algal fuel and electricity could be viable future options as well.

We doubt the industry will switch to one, break-through alternative. Instead, after careful review of fuels in development, and based on our work with airlines, aerospace manufacturers, and suppliers, Oliver Wyman expects several alternative fuels could prove to be feasible in the next few decades (Exhibit 1).

EXHIBIT 1: POTENTIAL ALTERNATIVE FUELS FOR AVIATION

 SHORT-TERM	HEFA process (conversion of natural oils and animal fats into hydroprocessed esters and fatty acids)	• Commercial scale at several biorefineries, but facilities tend to favor biodiesel production for subsidized ground transportation markets; jet fuels produced more opportunistically • Current issues include feedstock cost and availability, need to reduce conversion/refining costs
	Fischer-Tropsch process (synthetic fuel from biomass or fossil fuels)	• Commercial scale using coal and natural gas as feedstocks • Has not yet been proven at commercial scale using biomass as a feedstock
 MEDIUM-TERM	Alcohol-to-jet (jet fuel from alcohols such as ethanol)	• First-generation feedstock supply chain is mature (e.g., corn, sugarcane, wood chips) but additional R&D needed to make process economically viable
	Cryogenic fuels (e.g., liquefied natural gas)	• Could cut aviation CO_2 emissions by about 15 percent and reduce nitrogen oxide pollution by 40 percent • Would require new engines and substantial infrastructure upgrades at airports
 LONG-TERM	Electricity	• Lower-cost option; could significantly reduce CO_2 and pollution from planes, depending on the fuel used to generate electricity • Would require development of electric propulsion systems, sufficiently powerful batteries, airport recharging systems

PROSPECTIVE TECHNOLOGIES

In the short term, HEFA and Fischer-Tropsch processes have potential, as they have been internationally certified to produce fuel for aviation use. While both technologies face significant economic hurdles, large subsidies in developed markets are likely to remain in place for as long as five years, which will allow these processes to be economical. In addition, both are already currently producing small (but larger than pilot) levels of fuel for discrete offtake agreements.

While fuels produced by these processes currently have a competitive advantage due to technology maturity and established government subsides, both face scaling challenges. Key hurdles for converting oils and fats are feedstock cost and availability, in large part due to land competition with food crops, and competition between jet biofuel and other oil uses (such as in feed for cattle production). Research is ongoing on more sustainable feedstocks, such as those that could use brownfields or waste land, as well as algae as a feedstock. But economical scalability is a long way off. A sustainable Fischer-Tropsch process can use plant waste, but faces challenging economics due to the high capital costs and large project sizes required to generate economies of scale.

In the medium term, we believe alcohol-to-jet technologies could have potential, due to the low cost and high availability of feedstocks. Alcohol-to-jet could use sustainable energy crops such as miscanthus and switchgrass, low-cost agricultural and forest waste, and municipal solid waste. Cellulosic feedstock prices are not correlated with food prices, since they are not tied to existing farmland.

In addition, the aggregate volume of feedstock is much larger and presents a greater opportunity to create meaningful quantities of fuel. Alcohol-to-jet produced fuel is expected to be certified for use in aircraft by ASTM this year, according to the International Air Transport Association. Traditionally, however, alcohol (in the form of ethanol) has been more valuable to blend into gasoline than to convert to jet fuel. The use of cellulosic waste for alcohol-to-jet fuel also faces technology and economic hurdles that will need to be solved.

GETTING TO LIFTOFF

To reach commercialization, all of the options above require continuing research, investment, and a consistent, supportive policy environment. (See the sidebar, "Understanding Biorefinery Investment Risks," for an example of one issue impacting commercialization.) Critically, feedstocks must be identified that are themselves sustainable, to reduce greenhouse gas emissions across the lifecycle of facilities and equipment. The industry also will need new planes and engines to accommodate some alternative fuels, as well as changes to fueling infrastructure. Developing new fuels, however, is a question of "when, not if" to ensure the long-term health of the aviation industry.

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UNDERSTANDING BIOREFINERY INVESTMENT RISKS

A corollary issue to which renewable fuels will likely be adopted by the airline industry – and indeed may be a driver of that adoption – is what fuels are likely to achieve competitiveness at commercial scale. Oliver Wyman, in conjunction with researchers at the Massachusetts Institute of Technology and Metron Aviation, has been working to assess renewable fuel refineries from just such an investment perspective.

Recently, this team developed a method to value hydro-processing refineries producing aviation-grade biofuel and renewable diesel, which could aid prospective investors in determining under what market conditions a profitable refinery could be constructed. Most critically, this methodology includes an analysis of fuel price uncertainty and uncertainty around government mandates and support, using the United States Biodiesel Blender Tax Credit and Renewable Identification Numbers (RINs) as examples of the latter.

To "build in" uncertainty, the team constructed uncertainty profiles for each key input to a discounted cash flow model previously developed at MIT. They then used Monte Carlo simulations to calculate ranges of a project's net present values. Scenarios were constructed around a potential facility's size, price correlation, and working cost of capital.

The analysis determined that a medium-sized refinery (producing 4,000 barrels per day with a cost of capital of 16 percent and medium price correlation between commodity inputs) operating today would require government subsidies for a minimum of nine years to achieve an economic return (that is, for three years of construction and six years of operation). Otherwise, the risk of the refinery losing money over its 20-year lifespan would be large enough to make financing prohibitively expensive.

Indeed, after performing 20 million years of simulations, the team found that the likelihood of any discrete year showing positive value generation was less than 15 percent, indicating that some sort of financial externality would be required for the lifespan of the refinery – or it would close as soon as subsidies expire.

While larger facilities offer a greater likelihood of producing greater value, given the uncertainty surrounding the price of inputs and products, our analysis showed that the risk and magnitude of a loss or shortfall also increases. Clearly then, until the industry achieves critical mass and some level of stability in terms of supply, demand, and government support, investors would be wise to analyze uncertainty when considering biorefinery investments.

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BUILDING A STRATEGIC RAIL WORKFORCE FOR THE FUTURE

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Many industries that require skilled workers, including the railroad industry, are facing a major challenge that will only worsen over the near-term: an aging workforce. In addition, according to the Federal Railroad Administration, recent changes to the Railroad Retirement Act have reduced the age and time-in-service requirements for retirement, meaning that nearly one-quarter of the US railroad workforce will be eligible to retire by 2015.

Class I railroads have made post-recession efforts to increase hiring, invest in recruiting programs, and retain talent. But mass retirements in the next five to ten years, coupled with an immature talent pipeline, could lead to a race to fill jobs, without sufficient insight into what railroads' strategic workforce needs will be in the future. Simply hiring to replace the current workforce is not enough: Railroads also need to evolve toward workforces with greater technological and innovative capabilities, as well as the ability to support more rapid market shifts and more sophisticated customer demands.

THE WORKFORCE PLANNING ROADMAP

Railroads face two core workforce issues: capturing and transferring knowledge and attracting talent successfully over the long term. Yet, according to the FRA's "Railroad Industry Modal Profile," formal knowledge management programs are lacking and more needs to be done to develop a healthy pipeline of interest in railroading as a career. Further, the FRA cited the potential for skills gaps to develop, particularly in terms of technology, which will require more investment in IT capabilities, more cross-disciplinary workers to handle advanced machinery and equipment in yards and consists, and engineers and mechanics trained to use and service new positive train control (PTC) and locomotive technologies.

Addressing both retirements and a looming talent gap means that railroads (and other transportation industries) will need to develop a more strategic approach.

As a first step, it is useful to think of workforce planning being supported by four "pillars":

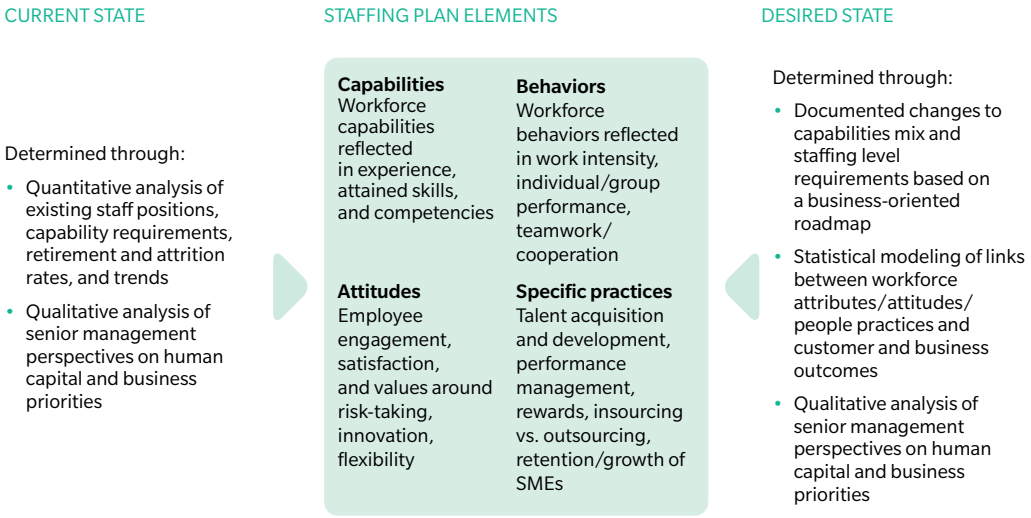
- External environment: The available labor pool and costs by geography – including skills gaps and training needs
- Current state of the workforce: The landscape of current staffing by geography, skills, costs, and expected retirement/attrition rates
- Projected future state: Expected future staffing needs, by skill and geography
- Projected service region/geography: where the service could be rendered remotely, if applicable

Understanding of the "gaps" between these four pillars determines the focus of workforce planning and can be used to develop a workforce roadmap, which identifies the expected evolution of the business environment and translates that evolution into workforce requirements. Comparing the current versus desired future state of the workforce then enables a company to define what gaps it must fill – both in terms of headcount and capability mix – on a go-forward basis (Exhibit 1).

Workforce assessment involves both top-down and bottom-up perspectives: The top-down view involves identifying and documenting the organization's current commercial, operating, and infrastructure strategy for the next 5-10 years, together with the critical path steps needed to achieve that strategy. Building the bottom-up view for each function/department includes:

- A workforce diagnostic and identification of current strategy, tools, and policies
- Current talent supply/demand analysis (geography, skills, costs, railroad impact)
- Determination of location for specific services or capabilities
- Determination of workforce future target state and gap analysis
- Development of the roadmap for the future state

EXHIBIT 1: WORKFORCE STAFFING PLAN DEVELOPMENT: IT EXAMPLE



CASE EXAMPLE: INFORMATION TECHNOLOGY

As an example, information technology (IT) is an area where railroads will likely need to focus more attention on workforce issues.

Initially, a workforce diagnostic would use data from human resources (HR) systems and interviews, together with customized analysis templates, to develop a structured fact base, which would then in turn be used to understand the current workforce's capabilities and characteristics across multiple dimensions, such as attrition rates by geography and tenure by role.

At the same time, the diagnostic would segment current IT capabilities by service location. Which capabilities must be provided on-site (in a specific location or geography) and which could potentially be provided off-site? For example, the need for non-strategic, commodity-based IT capabilities could leverage resources in other regions/geographies, if this would result in better availability and economic benefits.

Next, regional demographics and capabilities assessment could provide a perspective on the "supply" of IT resources for targeted on-site capabilities in the geographies where the railroad operates, versus current demand. Issues such an analysis might pursue for a given geography include availability and openings by role, competitive landscape, and education base numbers.

Current/supply demand, together with projected retirements and attrition, provides a jumping off point for defining future staffing needs. But here is where things get tricky, as future IT requirements for railroads are highly likely to change. A number of factors must be considered to accurately gauge future IT needs. What are the current IT systems and how do these relate to the projected future business requirement? How will the systems environment change going forward in terms of continued use of existing platforms, replacement of platforms, and development of new capabilities?

Railroads generally have a large number of interconnected, business-critical legacy IT systems, which require staff trained in their use. In addition, future IT capabilities, priorities, and timing must be identified. Advanced real-time concepts, such as shipment booking, reserved-basis capacity and revenue management, and PTC are likely to impact the future railroad IT landscape.

In addition to short-term (i.e., within five years) requirements, the railroad will also want to consider the longer-term directional trends that could impact their information systems (and talent) needs. These include:

- Customer-based planning and execution systems: IT systems are likely to expand in scope, because narrow systems create stovepipes. In addition, stronger focus on aligning operations with customer shipments and needs will be required.
- Seamless customer-facing transportation fulfillment systems: Customers will increasingly be partners in the fulfillment process, with roles in processing, execution tracking, and payment processes – all of which IT must support.
- Seamless operations planning and operations execution systems: Again, IT will trend toward eliminating costly, inefficient stovepipes. IT systems coverage will like expand to include block trains, large block bulk operations, intermodal, automotive, and local pickup and delivery.
- Integrated asset management systems: Railroads can improve return on assets

25%

Share of US rail workforce eligible to retire by 2015

by improving asset management and velocity, which will mean new and improved engineering systems for equipment and safety. Current management of many assets such as block train consists and intermodal equipment is not well supported by IT platforms.

Finally, timing will be critical, as the speed at which systems evolve will be a major determinant of future IT workforce capability requirements. In the future, railroads will look to rail planning and control systems to address an ever greater array of issues – encompassing supporting processes, inter-railroad coordination, and customer communication (Exhibit 2). The workforce roadmap must take a realistic and practical view of the likely pace of this evolution.

From a practical perspective, once the dimensions above are well understood, IT systems and projected initiatives can be compiled to determine projected resourcing needs by system, role, year-over-year, and geography. Potential offshoring/nearshoring opportunities can be evaluated to further refine requirements. Finally, gaps can be identified and prioritized (such as missing critical skills, or skills not present in a specific geography) and potential initiatives – aligned with company goals, culture, and resources – developed.

The last step, creating the roadmap, involves analyzing potential initiatives under the guise of various workforce optimization scenarios, using appropriate constraints such as organizational capacity, capital allocation, business priority, and time to delivery. Through scenario analysis, the highest-priority parameters (such as revenue optimization and innovation) can be identified, leading to a short list of recommended projects and optimal sequencing.

EXHIBIT 2: PROJECTED ROLES OF RAIL PLANNING AND CONTROL SYSTEMS

SUPPORTING RAILROAD PROCESSES

- Capacity management and yield management
- Intermodal shipment and ramp management systems
- Block train equipment cycle management
- Tactical decision support systems
- Optimized computer aided dispatching
- Automated equipment location detection systems

INTER-RAILROAD COORDINATION

- Car location and status messages
- Inter-railroad blocking instructions
- Inter-railroad advanced train consists
- Projected times of interchange
- Electronic tariffs and waybill transmission
- Car hire cost settlement
- Off-line car maintenance management

CUSTOMER COMMUNICATION

- Web-based shipment tracking and tracing
- Web-based car order placement
- Web-based price quotations
- Web-based product catalog with dock-to-dock shipment times

This process of course, can be applied to any business unit at the railroad, or to the railroad as a whole, to determine future workforce requirements, and thus where adjustments may need to be made to either keep workers longer and ensure knowledge transfer (such as through part-time/flex-time programs for those near or post-retirement), or to attract talent (such as through better alignment with universities and enhanced in-house training programs). For example, Oliver Wyman also has looked at railroad communication and signals workforce requirements, where evolving technology, geographic dispersion, labor agreements, and minimum staffing requirements mandate a tailored approach to understanding current and future workforce needs.

In conclusion, the process of strategic workforce planning is one that needs to be embraced by railroads, as well as other industries facing worker shortages, sooner rather than later. The tools and information exist now to identify workforce needs at a sophisticated level of detail – and thus avoid the risk of talent gaps that could have serious adverse impacts on the business in the near future.

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MARKETING

KNOWLEDGE IS POWER: MOBILITY MANAGEMENT 2020

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The time people spend in traveling and commuting is on the increase, the result of more active lifestyles, increased security concerns, and crowding due to a lack of infrastructure capacity, among other factors. Travel information is thus becoming more important as well, as people seek to streamline their travel time and minimize the impact of disruptions. In the next few years, active management of real-time, dynamic travel and trip information, or as we call it, "Mobility Management 2020," will transform the passenger experience and open up opportunities for new businesses and players along the mobility chain.

THE CHANGING FACE OF TRAVEL INFORMATION

Historically, passengers sought information at three steps in the travel chain: before they traveled, at the point of departure, and en route/at the destination. Typical information needs revolved around trip prices and times, basic services, departure information, and the impact of disruptions by route, as shown in Exhibit 1.

EXHIBIT 1: "BASELINE" PASSENGER TRAVEL INFORMATION NEEDS

STEPS IN THE TRAVEL CHAIN	BEFORE TRAVELING	AT THE STATION OR TERMINAL	EN ROUTE/ AT DESTINATION
NEEDS DURING NORMAL SERVICE – INFORMATION AND AFFIRMATION	• Connection and price information • Available offers (e.g., class of service) • Strength of demand • Service offerings on board	• Confirmation of departure/arrival • Departure platform/gate • Trains: assignment of track section for each class • How to get to the departure point, facilities, etc.	• Confirmation of connections • Details on changing planes/trains (gates, platforms) • Service offerings en route and at destination
NEEDS DURING DISRUPTIONS – ALTERNATIVES AND GUIDANCE	• What has happened • Affected routes • Expected duration • Alternative routes	• Updates on events • Affected routes • Expected duration • Alternative routes • Strength of demand • Adapted sign-posting	• Confirmation of connection changes • Alternative connections –for the entire travel route • Estimated time of arrival

Fast forward to today, when technology has put global information at the end of everyone's fingertips, anytime and anywhere. In tandem, expectations around travel information availability have grown by leaps and bounds, and the steps in the travel chain have grown more fluid. Passengers increasingly expect real-time and individualized travel information across diverse dimensions.

By 2020, we project that travel information demand will evolve even further, driven by shifting customer needs and technology trends:

- On the customer side, travel intensity can be expected to keep ratcheting up, amplifying a need for "door-to-door" information. Travel chains will become more complex and multi-modal. And customers will continue to push for more personalized and individualized travel options.
- On the technology side, the capabilities of mobile devices will continue to expand, with mobile-to-mobile leading to a dramatic increase in the availability of real-time information. Internet and "big data" technologies will play a much bigger role as well.

Some innovative enterprises already have recognized that travel information is an industry in transition and have built the infrastructure to cater to new customer demands. For example, Google offers complete trip scheduling, integrated convenience offers, individualized maps, and content creation and connectivity tools for travelers. The technology behind its travel information focuses on synchronization of data across all available channels, as well as "micro-increment" travel planning (rather than travelers needing large chunks of time to plan everything at once).

Uber is another example that demonstrates how mobile will change the customer experience. Already available in 45 countries worldwide, Uber provides users with ground transportation solutions that are tailored to exactly what they need: they can request and pay via mobile app for immediate pickup by the vehicle of their choice, such as a taxi, SUV, or luxury car. Similar mobile apps can be envisioned for hotel reservations, rental cars, and even for booking flight and train tickets.

EXPANDING MOBILITY MANAGEMENT

Realizing new business opportunities associated with travel information requires recognizing that there are three steps to get from the state of travel information today to a "Mobile 2020" platform that can provide a base for expanded value-added services (Exhibit 2):

- First, boost customer satisfaction, by increasing the quality and consistency of (real-time) information.
- Second, improve the customer experience, by discovering "what else" customers want to know, in detail, and making that information available. End-to-end travel chain management must also be easier for customers to negotiate.
- Third, develop new business capabilities that capitalize on the technology and consumer trends highlighted above, such as broadening offers beyond core transport services and developing new, customer-facing information business models.

Below we discuss briefly some of the necessary inputs and implications of each of these steps.

BOOSTING CUSTOMER SATISFACTION

While there are broad opportunities on the horizon, most travel operators still need to start at the first step: Oliver Wyman research and recent projects indicate that not even basic passenger information needs are being sufficiently fulfilled (Exhibit 3).

EXHIBIT 2: THE PATH TO MOBILITY MANAGEMENT 2020

EXHIBIT 3: ESTIMATED CURRENT PASSENGER SATISFACTION WITH TRAVEL INFORMATION

DEMAND	DESCRIPTION	CURRENT SATISFACTION LEVEL
SPEED	• Information communicated quickly • In case of disruption, should lead to quick analysis of the situation and proposed solutions	
RELIABILITY	• Information consistent with proposed solutions in cases of disruption, particularly regarding time, connections, strength of demand	
RELEVANCE	• Complete information, but as brief as possible • Information references relevant connections etc., ideally along the entire travel chain	
CONSISTENCY	• No discrepancy regarding timeliness and consistency of the information on different output channels	
DIFFERENTIATION	• Content satisfies customer demands appropriately for each respective step in the travel chain (at home, at the station/airport, en route)	

● Demand completely fulfilled ○ Demand not fulfilled

We have found that in many cases, poor information availability or flow is organizational in nature, reflecting the lack of a business model focused on information provision. Core requirements that must be met as part of step one include:

- Developing guidelines for prioritizing customer needs and solutions (versus focusing only on operational efficiency)
- Assigning responsibilities for information on the part of business units; creating decision/escalation mechanisms
- Developing standardized processes for recording, categorizing, and reporting disruptions as well as standardized procedures for resolving disruptions
- Creating a targeted management system; that is, an explicit, end-to-end responsibility for optimizing customer information. Key performance indicator (KPI) linkages must be built, a continuous improvement process put in place, and employees properly trained on all relevant processes.

IMPROVING THE CUSTOMER EXPERIENCE

With the proper organizational model in place to get high-quality, consistent data flowing, travel operators can then move on to step two, amplifying and complementing their existing information services to develop a stronger presence across different informational "clusters." Examples of possible offers for intercity rail and transit operators are shown in Exhibit 4.

EXHIBIT 4: POTENTIAL INFORMATION OFFERS IN PASSENGER RAIL/TRANSIT

INFORMATION "CLUSTER"	PASSENGER BENEFITS	EXAMPLES OF OFFERS NOT YET ESTABLISHED
 **INTEGRATED TOOLS FOR PLANNING**	• Simplicity • Information	• Cross-transportation planning tool • Mobility check – identification of "stable" connections • Commuter advisory, including traffic forecast • Inbound flight to connecting flight tool (e.g., fastest walking route, shuttle bus options at terminal)
 **INFORMATION BUNDLES THAT COMPLEMENT THE JOURNEY**	• Information • Improved comfort • Personalization	• Up-to-date news: weather, events, activities at the destination • "Point of interest" finder (public buildings, sights, etc.) • Orientation and navigation for boarding, changing, and alighting
 **SERVICE AND COMFORT**	• Information • Improved comfort • Personalization	• Alarm/text message prior to departure (taking current traffic situation into account) • Food and drink offers • Parking spot finder
 **SOCIAL FACTORS AND ENTERTAINMENT**	• Improved comfort	• Follow friends' journeys • On-board "friend finder" and chat • Games and audiobooks

And, in the same way that overall information is becoming more important, so will specific customer information in terms of customizing the travel experience. For example, an airline could make use of customer mobile/GPS data to track the location of a frequent traveler in the terminal who has arrived on a late flight, resulting in holding a connection for five minutes, or have an alert pop up on the computer in the club area when a member enters, so that staff can greet the customer by name.

DEVELOPING NEW BUSINESS CAPABILITIES

Once a travel operator ramps up its capabilities to deliver passenger information, particularly in real time, these skills can be the basis for a range of new business models, such as:

- **Traffic gateway:** Providing a multi-modal gateway for travel advice prior to the journey. This would include dynamic information on alternative travel options and the ability to compare travel alternatives along diverse dimensions (schedule, price, services, routing, etc.). All current and potential customers (including B2B) could be directed to the gateway as an information source.
- **Passenger assistance:** Providing customers and staff with dynamic information about the travel chain and any changes/alternatives prior to and during the journey. Functionality could include real-time route monitoring, travel alternatives (in cases of disruptions), and branded apps for infotainment and connecting travelers. In the case of irregular flight operations, it is becoming more important to give travelers options for what might work best for them. Information could even be made available onboard the plane so that flight attendants and even pilots can help passengers plan ahead for tight connections.
- **Mobility data:** Customer and real-time data can be combined to develop customized direct marketing offers that reflect an individual passenger's travel preferences. Partners (such as retailers) can be include in flagship programs to increase their scope.

The targeted usage of customer information can unlock additional opportunities, including increased profits from upselling (ticket upgrades, subscriptions) and cross-selling (ancillary services, tours, door-to-door, shopping), increased third-party income and investment, and direct profits from fee-based services (such as infotainment apps).

Finally, moving through the steps to achieve a Mobility Management 2020 information platform and building out the capabilities outlined above can enable travel operators to become true mobility services providers. This would mean expanding beyond "core" transport to offer door-to-door services, either on a drop-in basis or as across-the-board offers customized to the needs and preferences of each passenger. Such an offer might include home pickup, destination car or bike rental, accommodations, and tickets for events and scenic tours – with all necessary information communicated in real time to the traveler, each step of the way.

Mobility services will be the next big opportunity for travel operators

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CASE STUDY: THE NEW YORK MTA'S INFORMATION REVOLUTION

New York City's Metropolitan Transportation Authority, better known as the MTA, possesses one of the leading systems for travel and passenger information in the world. This system has been built through a series of evolutionary steps, and includes innovative, open-world concepts designed to involve technology developers as well as customers.

In 2007, the MTA found itself struggling in an age of open information, and facing trademark infringement lawsuits. By 2010, it had launched a premiere dynamic information website, including a developers' resource center that enabled free use of its data feeds for developers building mobile apps and websites. The MTA's "open data" initiative sought specific benefits from making travel information more widely available, including reducing call center and printing costs, improving the MTA brand image, increasing licensing, and improving customer service.

In 2011, MTA held its first App Quest Contest, designed to increase the diversity of apps while ensuring MTA maintains overall control of the process. MTA specifies the customer segments and customer needs which should be included and offers prizes totaling $50,000 to stimulate the development of relevant apps. In 2013, for example, the grand prize winner, Citymapper, uses real-time transit information to improve travel guides. Other prize winners include apps to connect riders with artists, to help the blind and visually impaired navigate the MTA system, and to enable riders to share their own experiences.

Other MTA projects to increase information availability and diversity include its "On the Go!" interactive travel kiosks, first piloted in 2011 at five stations and rolled out to a further 77 in 2013. The MTA Bus Time app provides real-time location tracking of buses, so passengers can determine exactly when a bus will arrive at their stop, minimizing wait times. Other examples from the MTA app-landscape include Notify Me NYC, which provides information on delays and disruptions, and MyCiti, which offers an interactive city map, with information on events, restaurants, and sights.

By increasing data availability and taking an active role in encouraging the development of mobile information options, the MTA has seen an 8 percent drop in call center volumes and costs, significant improvement in MTA's image (based on customer surveys), increased income from licensing fees, and the development of apps critical to niche groups that might otherwise not be served (such as the disabled). And through its Open Data Task Force, the MTA is continuing to seek new ways to broaden its connections with passengers.

CONNECTING WITH CUSTOMERS THROUGH EXPERIENCE INNOVATION

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Innovation efforts across many industries, including transportation and logistics, have a tendency to focus on products and services. It's an effort that's paid off in the past, as the persistent drive to add features, incorporate new technologies, and create niches has led to breakthrough innovations and created billions of dollars in economic value. Increasingly, however, companies are finding that growth from product innovation is becoming incremental and fleeting. Global competition and technology diffusion mean that competitors can quickly match most improvements. And the radical transparency of digital and social media prompts customers to switch allegiance with each new alluring offer.

For many of today's most innovative and up-and-coming brands, however, there is a new star (or an old star reborn) driving differentiation and growth: Customer experience. Companies are creating value and gaining brand loyalty not by focusing on specific product features or design, but by reimagining how customers use their products and services in the broadest possible terms:

- Car service Uber didn't change the vehicle or retrain the drivers; it fundamentally changed how customers order, meet, and pay for the service.
- Airbnb didn't redesign the travel portal or the hotel; it completely rethought how people can find the room they need.
- Tesla doesn't just sell an electric car; it delivers a vitally different customer experience through the use of e-commerce and remote technologies.

Each of these companies has mastered a discipline we call "experience innovation": taking a more comprehensive view of the lives of their customers and how they interact with the company's products/services and delivering new, unexpected "signature" moments. These experience innovators focus less on selling what they make and more on solving customer problems in a way unique to their brands – with a rich array of experiences that surround and connect to the core offer.

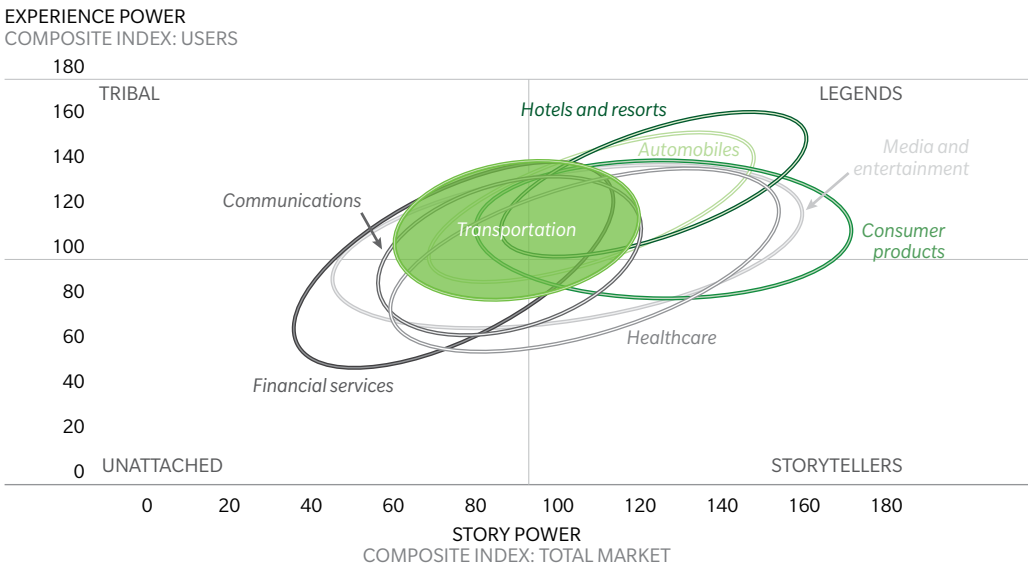
Experience innovation is not new, of course, as the long-term success of Virgin airport clubs, Starbucks cafes, and Disney theme parks can attest. These innovators have shown that experience isn't just about the planes, the coffee, or even the rides – it's about how we feel when we use the product or service. Many companies recognize this: in a recent Forrester study, more than 80 percent of senior business leaders say that their companies are focused on

Experience innovation can help brands keep customers' attention and affection

improving the customer experience. And yet, 85 percent of firms have no systematic approach to determine what a differentiated customer experience looks like, let alone create one.

The reality is that innovating the customer experience is becoming a competitive necessity. In today's digital world, with more brands and touch points than ever before, customers can quickly lose attention and affection. On the other hand, used creatively, mobile and social technologies can keep a brand in front of customers at any place and any time. Innovating the experience thus can be a source of differentiation, enhance loyalty, and strengthen brand presence. Exhibit 1 provides a snapshot of the customer experience innovation performance to date for transportation versus a number of other key industries.

EXHIBIT 1: CUSTOMER EXPERIENCE INNOVATION PERFORMANCE BY INDUSTRY



Source: The Lippincott Brand Study, 2014

THINKING WIDE

The catch is that, while it may offer greater opportunity than the same old product song-and-dance, experience innovation also is more challenging, for a variety of reasons. Within an organization, a product or service is typically managed by one owner, while an experience may need to involve dozens of masters. After a strategy is forged, changing an experience can require mobilizing and energizing thousands of employees. Finally, experience innovation requires thinking differently about the business and reimagining things that may be taken for granted. Experience innovation thus requires a new mindset and a new process, with several guiding principles:

CREATE DELIGHT

When companies focus on customer experience, they often fall into one of two traps: targeting specific touch points (such as customer call centers) instead of holistically addressing the end-to-end

customer experience; or thinking only in terms of operations and process efficiency. But experience innovation is as much about how to delight as how to deliver – how to identify the true emotional drivers of connection and loyalty. People remember the first time they are picked up by Virgin Airlines or rent a Zipcar for an hour. They remember because the experience was different and enjoyable, and made the product or service more appealing. These experiences are thus "emotional markers" for these brands.

EXPAND INTO THE ECOSYSTEM

Finding innovation opportunities often requires looking beyond a company's narrow product or service category. Consider Apple, which has focused on building a lucrative array of services to surround its products. The iTunes ecosystem envisioned the entire music experience: innovating how music content was purchased, organized, and managed. And taking a product company into the retail space allowed customers to engage with the product and its people – to feel the energy of the brand – while Apple captured retail margin. Thinking about customer needs in the spaces surrounding the core product or service offering can allow a company to expand its base and opportunities for growth.

GET AHEAD OF THE CUSTOMER

Experience innovators recognize that customers can't tell them about the things they need but haven't yet imagined, or how they might do things differently in the future. When Delta brought the lounge directly to the gate, it created a new experience among frequent travelers who had never thought of the gate as a café and social destination. Gate lounges have enabled Delta to deliver an experience in line with its focus on "21st century graciousness" – in a way customers might never have articulated in a focus group – while providing an opportunity for a new revenue stream.

CONNECT THE DOTS

Finally, great experience innovation doesn't involve coming up with a single "breakthrough" idea, but rather delivering a connected journey under one brand. Hyatt is innovating the all-inclusive resort category with the new Hyatt Zilara and Hyatt Ziva brands, which offer a tech-enabled resort experience: The website allows a potential customer to plan differently, a chip-enabled wristband serves as the key to a guest's room, and guests can order a drink or lunch by the pool using a smartphone or tablet. One distinct idea, even a big one, is usually not enough. Product innovation might rely on one-off improvement; experience innovation ties together multiple moments and experiences.

CREATING THE ROADMAP

The process of designing a truly innovative experience cannot rest on either the "process excellence" of classic customer experience improvement or the "creative brilliance" of the marketing team alone. Hard work, collaboration, and new tools and processes are required.

Successful customer experience innovation starts with a detailed exploration of the customer journey — and how it could be different. What makes customers frustrated, annoyed? What makes them feel respected and valued? Rather than asking customers what they need, companies do better to observe how they behave and react at every

8% PER YEAR

Difference in stock price appreciation per year for experience innovators

step in the product experience, as a starting point for imagining new opportunities.

The next step involves finding those points that make an emotional connection or change the game. Looking at a map of customers' most frequent touch points, what changes would they notice and remember? Are there big moves available: Is it possible to take entire steps out of the process, change the sequence, add new value in unexpected places? What about little moves – which can be surprisingly powerful emotional drivers: For example, Disney unexpectedly opens the park gates five minutes in advance, feeding off the "I'm about to be at Disney World" thrill. Focusing on defining signature experiences can deliver not just functional enhancements but emotional connections.

The third step on the roadmap involves creating a bold and forward-looking vision for the brand experience that will inspire internal teams and set a broad direction for innovation. A clear and proprietary set of guiding principles is important to ensure every moment tells the company's story and connects to its brand in a unique way. Think in terms of a portfolio approach for execution: balancing simple changes that build momentum with longer-term investments that require more work but deliver more value.

Finally, when broad-based, interdisciplinary teams take these steps together, surprisingly powerful results can ensue. Drawing on expertise across functions is essential to push thinking on what is possible and to forge connections across operational silos. In addition, thoughtful organizational engagement is essential to execution, particularly when it comes to inspiring and training thousands of employees. The early involvement of leaders and frontline champions begins a process that should expand to inspire and transform the company.

WHAT'S THE PAYOFF?

Experience innovation may be more complex than product innovation, but the rewards can be significantly greater. Lippincott's 2013 study of more than 500 consumer-facing brands found that the stock price of experience innovation leaders appreciated by an average of 8 percent per year more than that of laggards between 2007 and 2012, significantly outperforming the S&P 500. Focusing on the experience can create returns regardless of an organization's degree of ambition:

- **Innovating the experience finds untapped sources of differentiation to drive loyalty, preference, and margin:** Behavioral science research shows that buying an experience, such as a vacation or a concert, is more rewarding than buying a product alone. And great experience innovations create meaningful switching barriers – witness Nespresso's capsule subscription model or Uber's automatic payment capability.
- **It's often easier to drive loyalty from an experience than a product:** For one of Lippincott's technology clients, we found that 50 percent of customer renewals were driven by the software's quality, ease of use, and functionality. But the other 50 percent were driven by the sales and needs identification process, contracting, education programs, and the ongoing service relationship. We determined that these experience elements could be improved almost two-fold through a broader view of the customer, whereas product improvement had a ceiling of 10-20 percent.

- **Experience innovation business models are more efficient:** Investing in experience innovation does not mean higher costs. Many innovators reduce the cost to serve customers as they create more immersive experiences. Healthcare innovators such as CareMore and Iora Health chose to spend a little money up front to hire wellness coaches, who can help patients head off health problems, but in return have seen major drops in much larger downstream acute care costs.
- **The opportunities for growth are more abundant:** Thinking about "end-to-end" customer ecosystems enlarges the sphere in which a company plays and creates significant adjacent opportunities for new growth, particularly as the activities and services associated with using a product are often 10 times the size of the market for the product itself. In the Apple example, ancillary services (iTunes, iCloud, Applecare) represent $12 billion a year in incremental revenue.

In summary, experience innovation should not be viewed as a creative exercise or a new marketing gimmick. Instead, it's a new approach to customers, one that involves understanding how customers' interactions with products and services are evolving, driven by changes in mobility, technology, and social media. Developing capabilities around experience innovation can enable any company to continuously and flexibly adapt its brand to ecosystem shifts and disruptions, offering fresh spaces for differentiation and growth.

Lippincott, part of the Oliver Wyman Group, is a global consultancy that provides integrated capabilities in brand strategy, design and expression, experience innovation, and organizational engagement. For more information, visit www.lippincott.com.

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FINANCE

THE HIGH-SPEED RAIL FUNDING PUZZLE

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How can high-speed rail (HSR) be made economically sustainable in the long run? It's a question that gets asked regularly by operators, investors, and government authorities. Oliver Wyman's research and recent project experience suggest, however, that this may be too simple of a question.

Defining a sustainable business model for HSR is a multi-dimensional process that requires a framework that captures all critical drivers – financial, operational, and strategic. Important dimensions that must be understood include the dynamics of the entire HSR ecosystem as well as core issues around stakeholders, addressable markets, investment costs, rolling stock life cycle economics, and operational costs.

A COMPLEX ECOSYSTEM

Defining the terms of HSR funding success first requires a detailed understanding of the stakeholder ecosystem, including context, objectives, and dynamics. This ecosystem typically includes:

- National and regional governments as well as regulators define mobility policies, transportation priorities, and competitive frameworks. Key trends that impact considerations of HSR include the continued growth of low-cost airlines, emerging intercity car-sharing models (such as Blablacar in France), and across the European Union, the opening up of regional/commuter rail to competition.
- Infrastructure managers, which may be government-owned (RFF in France), government-led (DB Netz in Germany), or a private entity (US and Canadian freight railroads) are concerned about cost/debt transparency, increasing safety/security requirements, and increasing capital costs to maintain and expand infrastructure, which in turn can lead to increased access charges for operators.
- Rolling stock integrators that build HSR equipment, together with their supply chains, benefit from growing demand, especially in emerging countries, but are dealing with multibillion dollar delays and cost escalations due to the increased complexity of rolling stock design and build projects, coupled with shorter lead times and fragile supply chains. (See *"Cost Down Strategies for Transportation Manufacturers,"* on page 41.)
- Homologation authorities are responsible for certifying the use of equipment on the network. In Europe, homologation bodies are becoming increasingly independent from infrastructure managers and national railways, leading to growing challenges and increased investment on the part of rail suppliers to meet agencies' standards.
- Other suppliers, in particular energy, rolling stock maintenance providers, and distribution intermediaries are facing trends such as rising energy costs (offset by lower distribution costs due to Internet-based sales channels) and the slow growth of maintenance outsourcing, especially in continental Europe.

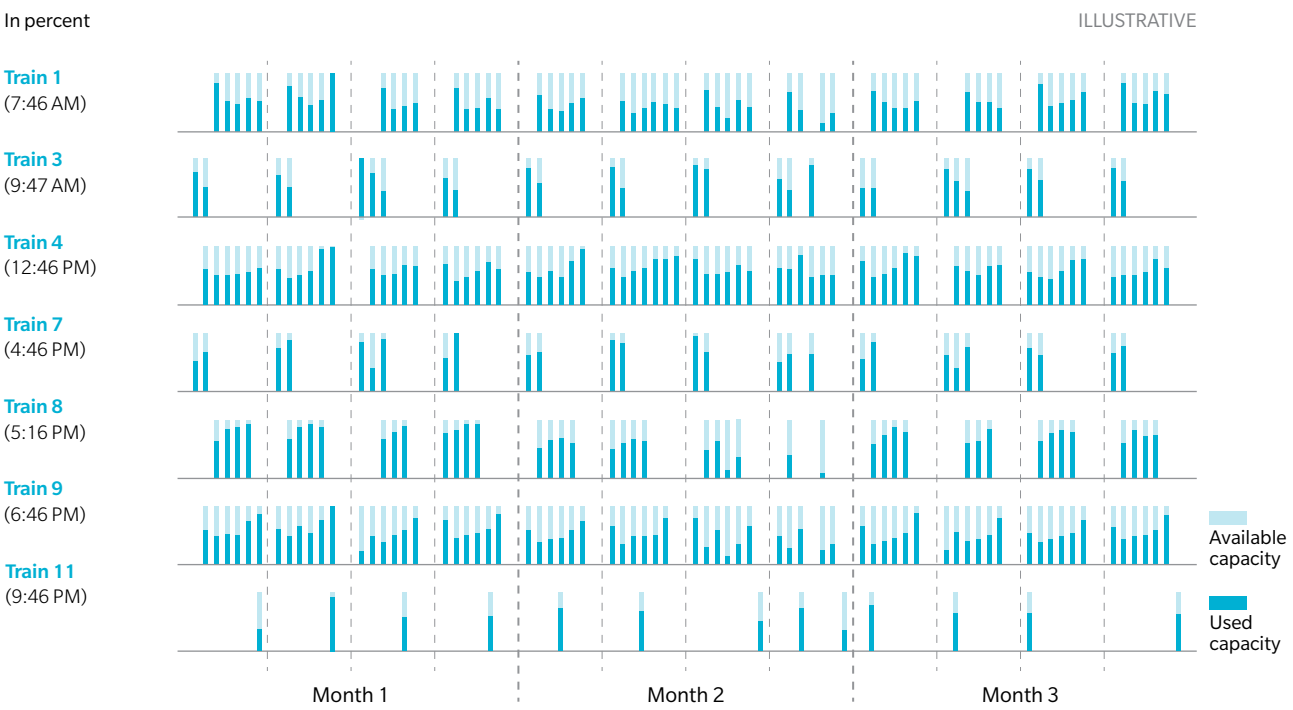
The influence, priorities, and underlying alliances or conflicts among this complex mosaic of stakeholders will vary for each region of the world and each country. A detailed understanding of stakeholder dynamics however is a necessary prerequisite to building a strategy that supports long-term HSR viability.

OPTIMIZING ROLLING STOCK ECONOMICS

Once the stakeholder environment is understood, the HSR business model must be consistently aligned with the investment timeframes typical of the rail industry, which vary by asset: 50+ years for infrastructure, 20-30 years for rolling stock, and anywhere from three to ten years for other rail products and services (such as distribution systems and on-board services). Ideally of course, the goal should be to optimize the deployment of operational assets over the timeframe of the fixed infrastructure investment.

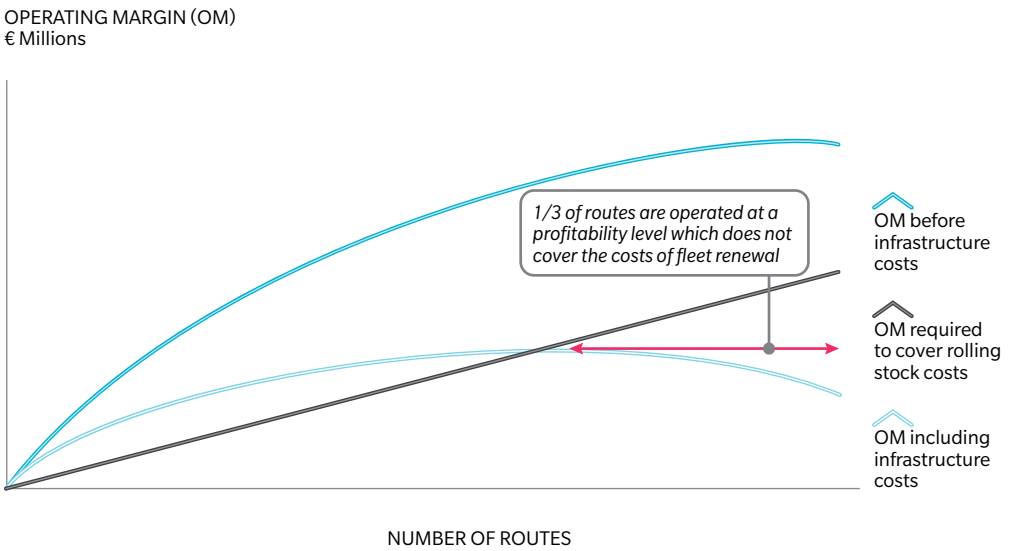
Given such a timeframe, the central question then becomes how to maximize the life cycle contribution of every piece of rolling stock within the fleet. Leading HSR operators have a detailed understanding of what economic value per trainset must be realized, based on the transportation plan, to ensure that funds will be available to reinvest in the fleet. Such an analysis lays bare the true source of value: matching the service plan and fleet size to traffic with the highest relative economic worth.

EXHIBIT 1: TYPICAL UTILIZATION BY TRAIN AND BY DAY ON A EUROPEAN HSR CORRIDOR



Note: Subset of total daily trains (selected examples)
Source: Oliver Wyman analysis

EXHIBIT 2: CUMULATIVE OPERATING MARGIN BY CORRIDOR, EXAMPLE EUROPEAN HSR NETWORK



Source: Oliver Wyman analysis

By analyzing the utilization of assets on a given corridor, an operator can determine where the service plan might be redesigned and the fleet rescaled to deliver better economics. Exhibit 1 shows an example of a sub-optimized service plan, where a significant number of trains have high available capacity, despite differentiated service levels during peak commuting hours versus off-peak hours and lighter travel days. The challenge for the operator, in such a case, is to redesign the transport plan to reduce overall fleet levels while preserving service levels consistent with ridership sources and stakeholder requirements (for example, public service transport levels mandated by government).

DETERMINING ADDRESSABLE MARKETS

This economic approach naturally leads to the definition of addressable markets for HSR. Oliver Wyman found that the most relevant HSR target markets, on an economic basis, are smaller than one might expect. For example, various analyses we have conducted on European HSR corridors have found that with an optimized service plan and a right-sized fleet, HSR operations can be profitable and sustainable on hub segments of the corridor, where ridership density and patterns result in a viable level of economic contribution per passenger. But beyond these core HSR routes, incremental contributions quickly become thin.

Exhibit 2 shows how the profitability of a European HSR network falls as the number of corridors expands to include routes on which the operating margin is well below the level required to cover fleet renewal costs – the result being that the whole network becomes financially unsustainable over the long term.

PROFITABILITY IMPROVEMENT LEVERS

The economic value of HSR can be further optimized by fine-tuning the rolling stock investment strategy, actively managing the cost of operations, and boosting revenue management activities.

As an example, Germany decided to moderate its investment in faster rolling stock, based on an analysis that determined that higher speeds were not economically justifiable given the specific size, shape, and density of Germany's intercity rail network and relevant markets.

Similarly, France's SNCF has seen HSR profitability erode over the past several years, the result of rising infrastructure charges and expansion of the network to include less desirable routes. SNCF recently began an transformation program aimed at optimizing HSR activities all along the value chain, from reducing the cost of operations (including maintenance, distribution, customer management) to adopting advanced pricing and revenue management techniques.

More globally, there are a number of "golden rules" for successful passenger rail service that must tailored and applied to HSR:

- Understand in detail ridership sources and passengers' motives for travel
- Micro-segment the market and apply tailored pricing strategies
- Once pricing strategy has been defined, optimize the revenue/capacity mix through advanced yield management technology
- Maximize feeder traffic revenue and contribution; minimize traffic losses due to train connecting points
- Develop a competitive transport plan, aligned with ridership, that maximizes asset utilization and that leverages, as much as possible, linkages between HSR and other networks (intercity and regional)
- Optimize operations expenditures: distribution, maintenance, energy, etc.
- Optimize rolling stock strategy through life cycle cost analysis, selective refurbishment, and life extension planning
- Regularly revisit the business model, given accelerating changes in demand dynamics

PUTTING THE PIECES TOGETHER

In this article, we've attempted to provide a quick snapshot of a framework for analyzing HSR operations and highlighted a few of the levers that can be pulled to generate more economic value from HSR services. Exhibit 3 provides an expanded list of topics that can be used by rail operators to assess their level of maturity in terms of managing HSR operations and determining where they need to focus to solve some of the complexities of the HSR funding puzzle.

EXHIBIT 3: POTENTIAL SOURCES OF HSR CONTRIBUTION

TOPICS	CONSIDERATIONS
ASSET COST	• What is the real cost of HSR assets, including acquisition, refurbishment, life extension, and financing? • Could this cost be optimized by considering different asset strategies?
ASSET ALLOCATION	• What is the allocation of assets per HSR corridor? • Is asset allocation consistent with the "economic value" of each corridor?
ASSET UTILIZATION	• What is the utilization rate of assets by corridor and by origin/destination? • What is the economic contribution of HSR operations on core versus non-core segments of the network?
TRAIN SERVICE ECONOMIC CONTRIBUTION	• What is the distribution of train service economic contribution? • Are there train services that are destroying value (generating negative economic contribution)? Why? Can this picture be improved by other means than cutting the unprofitable service? • More specifically, is it profitable from an ROCE perspective to serve demand during peak hours, considering the implications for fleet size, service plan impacts?
PRICING OPTIMIZATION	• Is the pricing strategy consistent with traffic patterns? • Is the pricing strategy capturing the full value from the market, in particular during peak hours for business travelers, who value flexibility?
TRAFFIC/NETWORK OPTIMIZATION	• Are there sources of profitable additional traffic that could be exploited by leveraging existing assets? • Is the business model for each corridor adapted to its specific market situation (traveler profiles, pricing levels, etc.)? • Are there other business models to consider for deployment, such as adapting assets to demand (capacity, speed), or changing operations and maintenance patterns?

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INCREASING PROFITABILTY IN GLOBAL LOGISTICS

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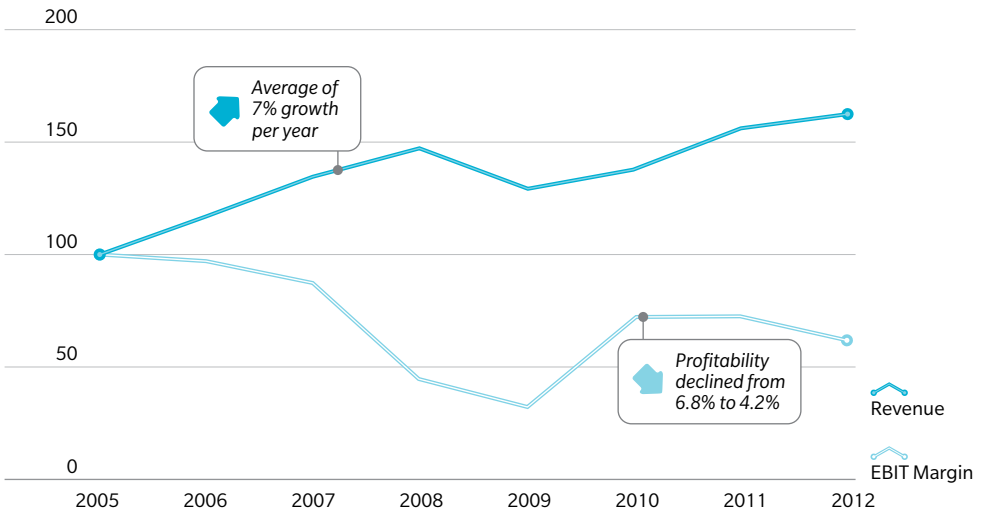
Despite increasing revenues, only a small number of logistics services providers are seeing increased profitability. Companies that want to grow their logistics businesses profitably must do more than just adjust a few small cost levers and hope to achieve scale or synergy effects by way of acquisitions. They must be willing to pursue fundamental change and challenge the way things have been done in the past. Oliver Wyman has identified six levers that can help logistics services providers unlock greater profits in a growth market.

An analysis of 100 leading global logistics companies – which has been ongoing since 2005 – found that these companies are achieving impressive revenue growth of 7 percent per year on average (Exhibit 1). At the same time, however, their profitability has significantly declined, from 6.8 to 4.2 percent EBIT during the 2005–2012 period. Thirty-seven of the 100 companies surveyed were able to maintain or increase their profitability, but only 35 enterprises managed to both grow and become more profitable. That general economic conditions were unfavorable over part of this period does not fully account for these numbers. Often, a company's growth (or lack of it) can be traced back to opportunity-driven activities that, in the long term, failed to achieve the desired effect on profits.

EXHIBIT 1: INDEXED AGGREGATE REVENUES AND EBIT MARGIN FOR THE TOP 100 GLOBAL LOGISTICS PROVIDERS



Source: Oliver Wyman analysis

MARGIN PRESSURE DESPITE GROWTH

A good example for margin pressure despite growth is European road transportation. This market segment is highly fragmented, and even leading players can only claim a market share in the range of 0.5 to 2.5 percent. Increasingly, financiers and parent companies are asking themselves whether it still makes sense for them to invest their money in European road transportation, or whether it might not be better to channel funds into more attractive logistics segments, such as contract logistics, or into emerging markets, such as Brazil, Central Asia, India, and China.

Since 2005, many logistics services providers have built up extensive geographic coverage in Europe's core countries by means of organic growth and acquisitions, and now call themselves "network services providers." But a closer look reveals that they are not so much road transportation networks as independently operated subsidiaries that seek to realize synergies within the group and jointly develop individual customer solutions. Network thinking is often not well developed: Traditional mindsets with a focus on legacy business and "silo" thinking at the regional management level are more typical.

What's more, the fact that profit and loss are usually measured at the local subsidiary level means that, in day-to-day business, every subsidiary in the network will strive to optimize itself at the expense of the others. In these cases, the oft-praised "local entrepreneur" philosophy may actually have a detrimental effect on the organization as a whole. More often than not, it prevents companies from realizing scale effects, professionalizing their core functions, subcontracting appropriately, and optimizing their networks. In addition, complex matrix structures, which complicate decision-making, as well as the duplication of functions and responsibilities, will amplify these effects.

MORE PROFIT IN GROWING MARKETS

In recent years, the logistics industry has optimized existing business models down to the smallest cost lever. As a result, in road transportation, logistics services providers are increasingly using route optimization systems, relocating truck fleets to regions with lower labor costs, selecting network-compatible shipment typologies, and extending their truck capacity utilization rates. There's a little room left in terms of the potential of traditional cost levers – such as implementing lightweight construction, improving aerodynamics, and increasing the efficiency of engines – but not much. The situation in other logistics segments is more or less the same.

Achieving profitable growth in the future will thus require logistics services providers to undertake a thorough overhaul of their traditional business designs. Oliver Wyman has identified six levers that can help them to achieve this goal.

1. BALANCING THE BUSINESS PORTFOLIO

The activities of logistics services providers today often encompass a broad combination of transportation, forwarding, and supply chain management, while at the same time these firms are becoming more international. Market and profit potential and risk profiles diverge considerably, depending on an individual company's lines of business, products/solutions, and geographic coverage. For example,

ONLY 35%

of the top global 100 logistics companies have grown profitably since 2005

spare parts logistics for industrial goods generates higher returns than many businesses in the automotive industry, but has less market potential. When developing a growth strategy, it is thus important to use targeted investments and activities to create a portfolio that balances profitability and risk.

2. SPECIALIZING AND STANDARDIZING SOLUTIONS

In recent years, customers' logistics requirements have undergone substantial change. Customers are prepared to pay more and commit themselves longer to one supplier if that supplier can offer innovative, industry-specific solutions that can have a major impact on final product costs. Solutions development should be backed, however, by standardized processes and systems, including a modular approach to existing assets and networks and elimination of multiple types of solution components, such as warehouse management systems.

3. PROFESSIONALIZING TENDER MANAGEMENT

In recent years, shippers have considerably improved the professionalism of their logistics purchasing, and the cost structures, prices, and services of individual logistics services providers have become much more transparent. But many logistics services providers have no clear view of what it costs them to render their services at the subsidiary or dispatcher level, and tender management is often a last-minute affair. Professional tender management, on the other hand, comes into play right after an inquiry is received, is closely integrated into key accounting and solutions deployment, and is grounded on deep industry expertise and sophisticated IT tools.

4. THINKING AND ACTING "NETWORKS"

Currently, it is typical in the logistics industry for individual subsidiaries to dispatch and control traffic. As a result, it is impossible to optimize the utilization of the entire network, and parts of the network often become destabilized. The aim of "thinking and acting networks" is to significantly increase both network efficiency and productivity, thus delivering high levels of service quality and customer satisfaction. To meet this goal, logistics services providers must, above all, install centralized network management, including corridor and trade lane management, and define a core network with fixed routes and timetables, whereby line planning can be adapted on a rolling basis to account for market and origin/destination changes.

5. IMPLEMENTING DYNAMIC CAPACITY MANAGEMENT

In the face of rising volatility among customers and capacity providers, it

is becoming increasingly difficult for logistics companies to assess capacity needs. They often lack a detailed understanding of the economic drivers of traffic volumes or an early warning system that could enable them to spot market changes. Simulation-based optimization models that explicitly incorporate economic drivers, such as demand-based capacity growth or cargo rates, enable estimation of basic capacity and peak ranges. These estimates can then be used to plan capacities on a rolling basis and redefine capacity needs accordingly. The logistics services provider can then choose a suitable combination of different contract durations and define the appropriate hedging strategy, e.g., for cargo rates.

In addition, employees of logistics services providers are widely scattered, meaning that they interact closely with diverse individual markets. This access to market information is a hidden asset that can be systematically exploited as an early warning system for market changes and as input for capacity planning.

6. STREAMLINING ORGANIZATION AND GOVERNANCE

Processes and structures across subsidiaries often are not harmonized – a situation that can be improved through the sharing of best practices. In addition, logistics companies should determine if there are functions/activities (e.g., accounting, customer service, IT, HR) that could be aggregated at some level – whether at headquarters, by country/region, or through shared services centers.

It is also important for providers to seek ways to simplify and speed up decision making, in order to respond more quickly to customer demands or market changes. Too many input levels or committee rounds can greatly slow down time-to-market – particularly at large logistics services providers. At the same time, industrializing and standardizing production can improve transparency and serve as a basis for establishing a governance system that measures the performance of individual locations using comparable key performance indicators (KPIs). This opens up the opportunity to install professional, cross-regional benchmarking and subsidiary optimization teams, for example, which can be an effective tool for ensuring continuous improvement.

RECALIBRATING THE VALUE COMPASS

Standardizing and streamlining structures and processes, developing an industry and innovation orientation, thinking and acting in terms of networks, as well as professionalizing certain functions are all means to one end: improving future logistics services business designs. The traditional "local entrepreneur" culture of focusing on transactions and making "gut decisions" will no longer suffice to produce profitable growth. While strong, vital subsidiaries are important, there also must be an overall perspective on the business, greater systematization, and stronger team orientation. Last but not least, it is important for logistics companies to align their individual employees' value systems and targets with this perspective.

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COST DOWN STRATEGIES FOR TRANSPORTATION MANUFACTURERS

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Manufacturers of aircraft and passenger rail rolling stock are experiencing ongoing delivery delay problems that have set the industry back $20 billion over the past several years. On the aviation side, costs and delays have been the price for developing game-changing aircraft programs that will transform the economic profile of the airline industry (Exhibit 1). On the rail side, rail integrators (which turn component assemblies into complete trainsets) are facing higher costs and penalties due to setbacks in high speed and regional passenger train projects across Europe.

Keeping the development and production planning of new products within budget and on schedule is a challenge for any manufacturer. But recently, the costs associated with setbacks have risen to new heights. Aviation and rolling stock development programs are experiencing delays of as much as four years, costing manufacturers significant additional engineering hours and hundreds of millions of dollars in cost overruns. At the same time, the contractual penalties that manufacturers must pay their customers, especially in the aviation industry, are soaring, reaching billions of dollars (Exhibit 2).

EXHIBIT 1: RECENT AIRCRAFT PROGRAM DEVELOPMENT COSTS, FROM PRELIMINARY DESIGN TO 2014

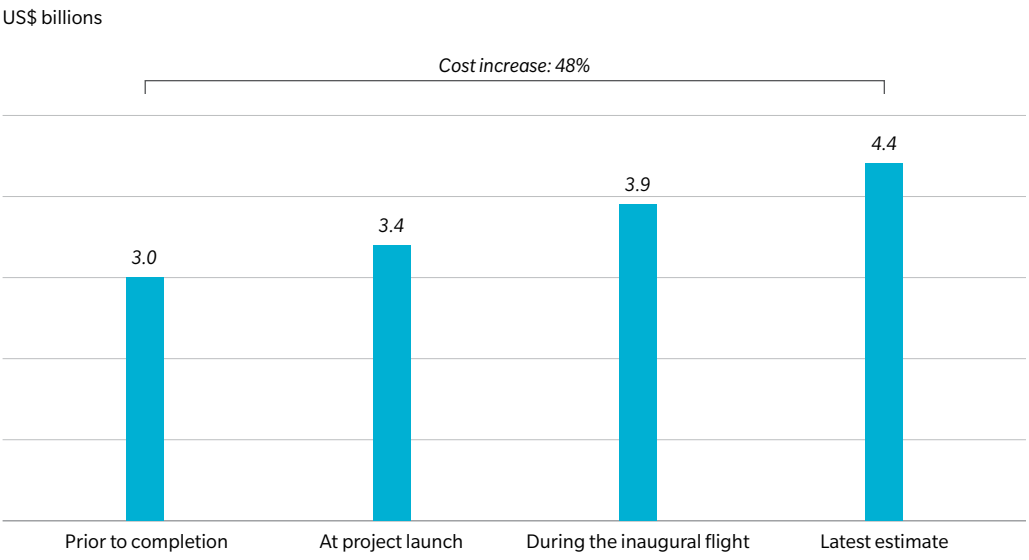
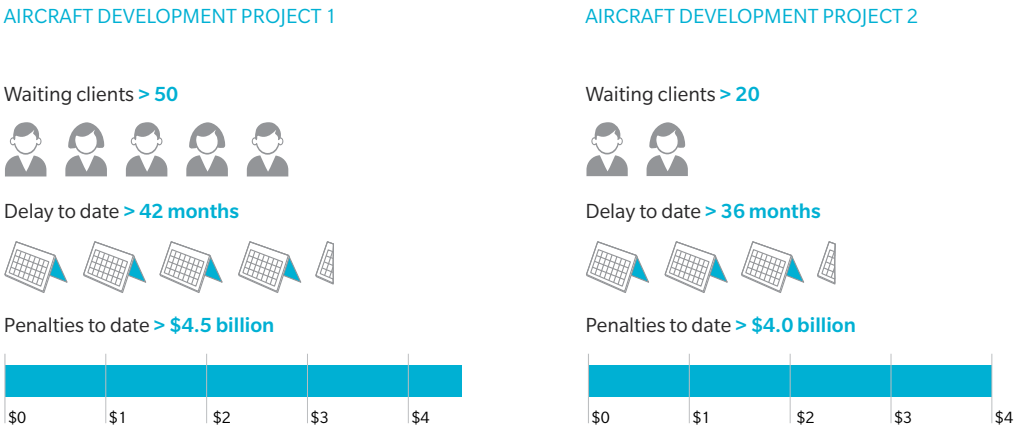


EXHIBIT 2: EXAMPLE AIRCRAFT DEVELOPMENT DELAYS AND PENALTIES



COLLABORATION, NOT COMPLICATION

Rising demand for transport worldwide, coupled with an aging installed equipment base, will drive a large number of new projects. In the next 20 years, we estimate that there will be demand for 20 percent more aircraft globally – or approximately 36,800 units – compared with the orders received in the past decade. Orders for rail equipment, too, are expected to jump by 20 percent worldwide over the next two years, to $213 billion, up from $180 billion during 2007-2009.

In addition, customers expect new equipment to reflect the latest available technologies, creating an even higher hurdle for manufacturers. The good news is that in our consulting, we are seeing a growing awareness on the part of manufacturers of the critical need for a more collaborative approach – one that can halt today's runaway costs.

In our view, the fundamental problem is that most manufacturers try to prevent product delays by improving their own product development and manufacturing processes in isolation. Instead, manufacturers must take a broader view to produce planes and trains that are becoming more complicated and thus more difficult to deliver on time and in budget. Manufacturers must re-evaluate how they manage everything – from product development and the supply chain to production ramp-up – in a comprehensive manner, involving their contractors, suppliers, and other third parties.

Tomorrow's industry leaders will be those companies that develop the capability to involve a wide group of stakeholders, ranging from start-ups and academics to their customers' and suppliers' engineering teams globally. Today, many manufacturers rely on siloed, opaque product development processes and incomplete assessment metrics. To end product development and delivery delays and improve quality, manufacturers must develop farther-reaching, transparent processes, as this will allow them to tap into the expertise of a wider group of stakeholders. This approach will help manufacturers not only generate more innovative concepts, but also better estimate the maturity of these

concepts before including them in the scope of new projects. They will also be able to better anticipate major risks and assess the feasibility of new product planning and budget – from the moment an aircraft or train is merely a concept to when it rolls off the assembly line.

A DEMANDING ENVIRONMENT

Of course, the first step in solving a problem is properly defining it. Why are aviation and rolling stock manufacturers experiencing rising delays and costs? The primary reason: a more demanding environment. Remaining competitive requires developing ever more innovative planes and trains, at a faster pace, and at an equivalent, or lower, price.

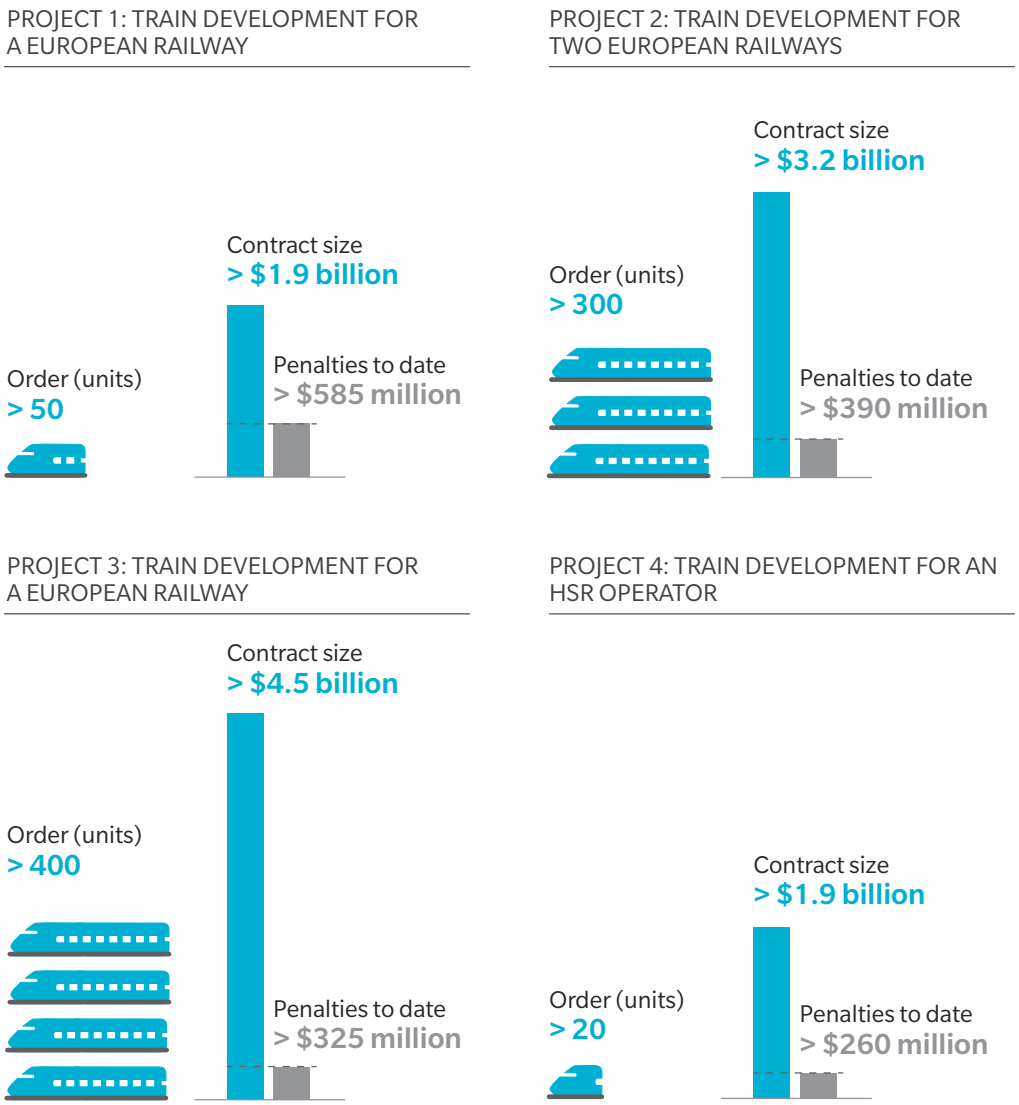
Customers' expectations are rising, especially for details that increase comfort, infotainment, and connectivity for passengers. In addition, environmental and safety standards are becoming more restrictive. Approval processes for both aircraft and rolling stock are tightening, with longer testing periods and more required documentation. At the same time, building planes and trains packed with new technological innovations requires sophisticated engineering – in fact, many new technologies require hundreds of thousands of engineering hours before they are sufficiently stabilized to endure the gauntlet of the approval process.

Manufacturers are trying to meet these mounting demands with a global and often fragile patchwork of component and assembly suppliers. Most rely on hundreds of small and financially stretched firms that offer limited visibility into their operations. Moreover, manufacturers often engage suppliers without a robust audit of their ramp-up capacity and quality and may devote insufficient resources to follow up on action plans.

Some manufacturers even inadvertently introduce contractual risk into their supply chains by failing to include back-to-back terms and conditions in supplier agreements (which ensure a supplier passes on its obligations and liabilities through to its subcontractors). As a result, these manufacturers may discover discrepancies between their needs and their suppliers' purchasing strategies too late, leading to a scramble to secure needed components on time and in budget, while ensuring a reliable product.

Making matters worse, customers are asking for more robust contracts, with added clauses to protect them from potential deviations. Customers also are enforcing penalty clauses more often than in the past and have equipped themselves with significant claims management departments (Exhibit 3).

EXHIBIT 3: EXAMPLE TRAIN DEVELOPMENT PROJECT CONTRACT SIZES AND PENALTIES



NINE BEST PRACTICE FLASH POINTS

In our experience, securing an on-time, on-budget product rollout involves best practices at nine "flash points" that occur throughout the product development cycle. Just as hitting the flash point of a fuel will cause a fire, each of these points can suddenly trigger a delay or significant cost overrun if mismanaged.

1. CAST A WIDER NET FOR CONCEPTS

Before deciding on a new product concept, hold an "open innovation" competition to attract the best ideas. Open innovation initiatives that invite suppliers, customers, and even outsiders such as academics to participate can significantly improve the pool of choices for innovative concepts and accelerate the shift into development. In addition, collaborating with equipment operators

(current or potential clients) during the drafting of specifications can help avoid overloads, anticipate operational costs, and test the feasibility of deadlines.

2. STANDARDIZE ENGINEERING

Reduce development costs by standardizing engineering processes, and then focus on the development of standardized and modularized components and assemblies. Such systems can be more easily and speedily adapted for customers and projects in different geographies.

3. ANTICIPATE AND MITIGATE RISKS

Establish an efficient alert process early on to gain more control over product quality. By tightening the management of so-called "maturity gates" associated with a "V-model" development life cycle, a manufacturer can better anticipate risks and launch mitigation initiatives more effectively. Establishing key milestones, or "maturity gates" assists with validating each relevant step of a product's design at each stage of its development.

4. IMPLEMENT A STRONG DESIGN AUTHORITY AND REINFORCE SYSTEM ENGINEERING

Build a functional architecture to manage interfaces, particularly as systems are becoming increasingly interlinked. To start, a company should improve its ability to track configuration evolutions by agreeing on a detailed description of objectives and expected performance at the various stages of development, using so-called "baselines." Another critical, high-impact step is creating a "design authority" comprising senior experts to monitor engineering teams' progress. Such an authority can ensure teams remain focused on quality, cost, and delivery requirements as well as that the design is finalized at the appropriate juncture.

5. REVAMP TESTING STRATEGIES

A product's development time can be significantly cut by increasing the number of upfront digital simulations and reducing the number of physical tests. Designs can be tested more rapidly with the use of simulation tools and 3D-printed prototypes.

6. RAMP UP PROJECT GOVERNANCE

Project management processes and skills must be able to handle increasingly complex production runs. Ensure key performance indicators are focused on process control and are predictive, so risks can be better anticipated. Track progress weekly on design maturity, software development, test completion, and documentation. Project governance also must be flexible enough to evolve as product development progresses.

7. STRENGTHEN THE SUPPLY CHAIN

Innovation and collaboration can help strengthen what is often a fragmented

supply chain. Facilitating faster maturation of the supply base and supplier consolidation can reduce the risk of small suppliers defaulting. At the same time, treating key suppliers as partners in the process can improve the reliability and performance of the product under development, with less likelihood of cost and time inflation.

"Back-to-back" contracts can ensure a supplier's obligations and liabilities to the manufacturer flow through the entire supply chain. Other ways that we have observed manufacturers assisting suppliers include helping them develop their engineering capabilities and expand their manufacturing capacity, locating subcontractors for them, and, at times, financing supplier initiatives.

8. ENSURE MANUFACTURING EXCELLENCE

To ensure an efficient process and a high quality product, embrace excellence. Practices such as lean manufacturing and Six Sigma are key to cost effective assembly. Awareness on the part of operators (customers) must be raised as well, with regard to what constitutes operations excellence, to ensure they put in place standards and a culture that encourages employees to send alerts at the first sign that something may go amiss. In addition, reinforce external and internal quality control processes such as design reviews and First Article Inspection Reports that assess the effectiveness of the manufacturing process.

9. REGULARLY AUDIT THE ENTIRE PROGRAM

Program management teams often underestimate risks and overestimate their mitigation plans. Check points often prove insufficient for large programs that involve a multitude of interrelated risks, including new technologies, technical issues, suppliers, partnerships, changing client requirements, ramp-up challenges, resource availability, and certifications. For these reasons, it is critical to perform an independent audit of the program at each key milestone, so as to challenge the program management's perspective on every potential risk.

BETTER NOW THAN NEVER

Some aerospace and rolling stock manufacturers already have started implementing a wider range of best practices to reduce their project delays and cost overruns. But the startling rate at which the costs and penalties for producing planes and trains continues to climb shows that much more should – and can – be done.

In our view, the surest and quickest path to reigning in soaring costs is for manufacturers to cast a wider net and work collaboratively with clients, contractors, and suppliers. Companies that move quickly to address the pitfalls and complexities of these large development programs are the ones most likely to thrive in an increasingly hypercompetitive environment.

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OPERATIONS

AVIATION MRO SURVEY 2014: SIGNS OF NEW LIFE

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Oliver Wyman conducts a survey of airlines, original equipment manufacturers (OEMs), and independent maintenance, repair, and overhaul providers (MROs) to determine the state of the aviation MRO market each year. Previous versions of this survey noted the emerging dominance of OEMs in high-value, aftermarket aviation services, and this year confirms that OEMs have won this market. This leaves independent MROs scouting for paths to evolve and grow. At the same time, operators still want to preserve material and service alternatives for their fleets. Other trends worth noting in this year's survey include fresh hiring in the US for airframe maintenance and stirrings of interest in three-dimensional (3-D) printing for parts.

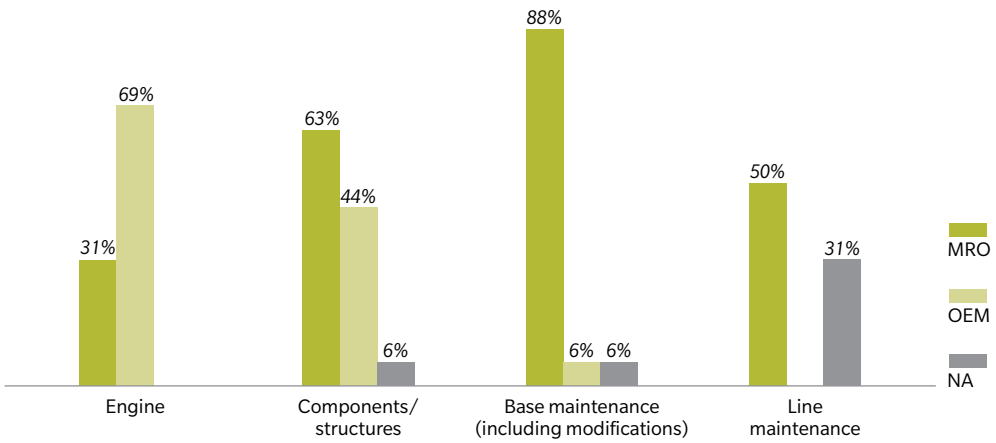
OPERATORS SEEK REDUCED COSTS

For airlines seeking engine and component maintenance for next-generation aircraft, OEMs have largely emerged as the only choice. In particular, engine and large systems manufacturers have designed and deployed effective strategies to restrict alternative material and repair development by third-party MROs (Exhibit 1). And there is limited expectation among airlines that the current state of maintenance placement for either old or new aircraft will change in the near future.

EXHIBIT 1: DESTINATION OF FUTURE MAINTENANCE

Who do you expect to predominantly hire for new aircraft maintenance in the future?
Percent of airline responses for types of vendor, by platform (multiple selections possible per category)

POSITIVE RESPONSES

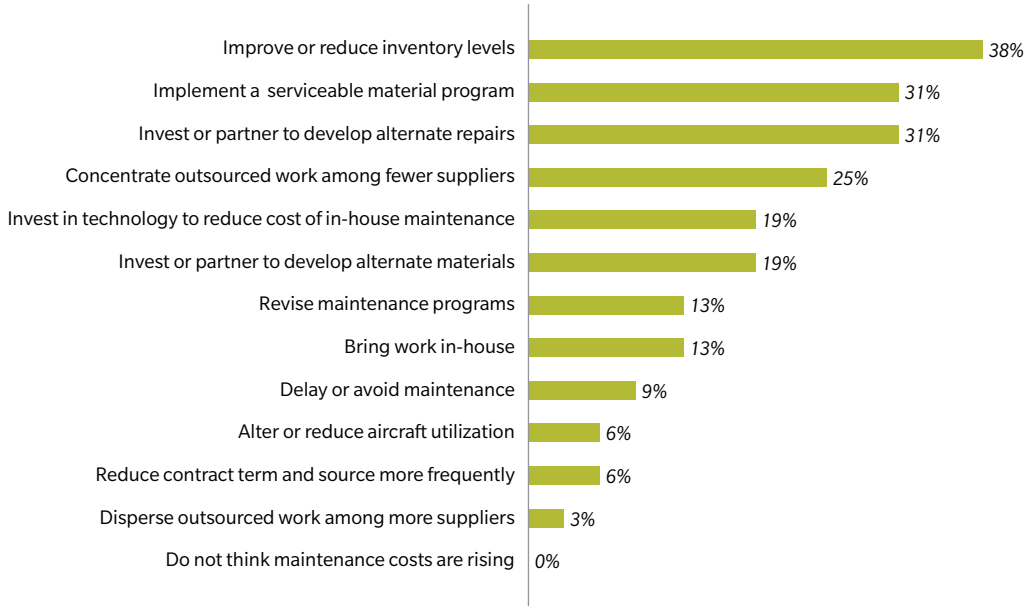


Source: Oliver Wyman 2014 MRO Survey
Note: NA = no response

EXHIBIT 2: COST REDUCTION STRATEGIES, COMPONENT/ENGINE COMBINED

What strategies have you considered or adopted to combat rising outsourced engine or component maintenance costs?

PERCENT OF RESPONSES BY STRATEGY



Source: Oliver Wyman 2014 MRO Survey

Airline responses to our survey, however, also show that operators intend to sustain maintenance cost reduction efforts throughout the aircraft life cycle, suggesting operators will continue to seek OEM alternatives where possible. When asked about reducing the costs of engine and component maintenance overall, airline respondents highlighted strategies that MROs are well positioned to address: reducing inventory levels, developing serviceable material programs, and developing alternative repairs to reduce part replacement costs (Exhibit 2).

OEMs of course are by nature opposed to these options, as each reduces demand for high-margin new parts. If MROs continue to hone and expand these capabilities, perhaps in deeper partnership with airlines to gain access to necessary operational and technical data, they may yet successfully stem OEM momentum and defend their remaining market share.

ENGINE AND COMPONENT MRO STRATEGIES

In the search for new avenues of growth, many engine and component MROs are turning to new forms of collaboration. They are moving beyond simple licensing agreements with OEMs, while entering into a variety of partnership arrangements with aircraft lessors. As we discussed in last year's survey, given that OEMs have overwhelmingly limited aftermarket alternatives for new aircraft types, airlines now must exploit new equipment selection

as their primary source of leverage (that is, pitting manufacturers against each other). By partnering with lessors, MROs offering comprehensive labor, technical, program, and logistics services might be better able to penetrate these transactions and gain a foothold in the massive market for new aircraft maintenance, rather than ceding further ground to OEMs. And a third of MROs indicated on this year's survey that they are partnering with lessors or have plans to do so.

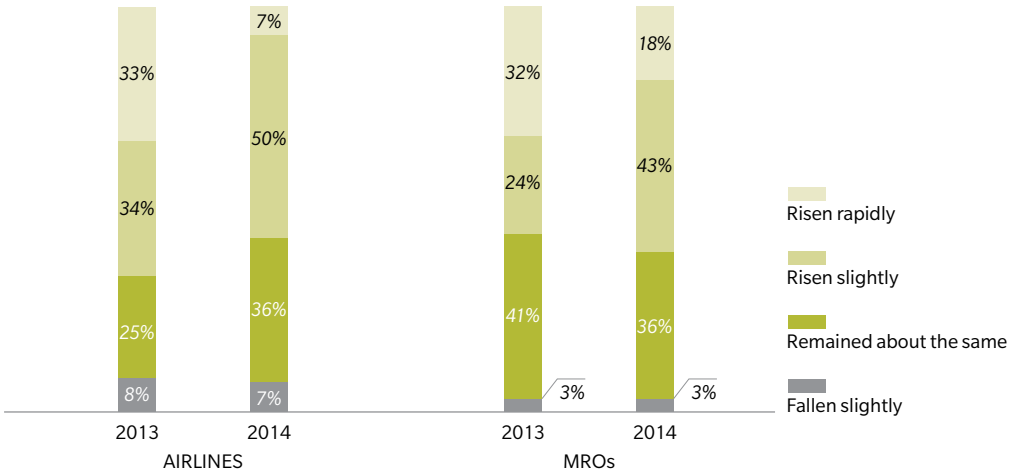
Another area with high potential for MROs is serviceable materials (refurbishment of used parts). These materials are becoming more openly available as popular modern aircraft types retire. We found a vast majority of airlines (86 percent) have adopted an active serviceable materials strategy since OEM emergence, and MROs have responded to this growth in demand with programs of their own (79 percent). Usage of such materials has risen among both airlines and MROs (Exhibit 3).

The ability of MROs to identify, source, and harvest serviceable material provides an edge against OEM counterparts seeking to serve mature aircraft. Only a quarter of OEM respondents report an active serviceable materials strategy, which is consistent with their focus on selling high-margin new material. Indeed, we believe that MROs could expand their serviceable materials programs further, as our survey found that they tend to overstate the obstacles to acceptance; lessors and operators are fairly relaxed about using serviceable materials in systems outside of the power plant.

EXHIBIT 3: USE OF SERVICEABLE MATERIALS, AIRLINES AND MROs

How has your use of serviceable parts changed during the past three years?

PERCENT OF RESPONSES



Source: Oliver Wyman 2014 MRO Survey

THE AIRFRAME OPPORTUNITY

Airframe MROs do not face the same competitive challenges as engine and component MROs. Instead, the market appears to be turning in their favor, at least in the United States.

Rising labor rates in emerging economies, combined with sustained sentiments about repatriating base maintenance, has slowed the multi-year pattern of sending aircraft overseas from developed markets. Stateside repair stations do have a mild to moderate price disadvantage, but 60 percent of airline survey respondents said that they were willing to absorb up to a 5 percent cost deficit relative to overseas alternatives in order to use a domestic provider, and 20 percent indicated a willingness to accept up to a 15 percent deficit.

In the US, mounting investment in domestic hangar capacity may in fact suggest that the repatriation trend is accelerating, suggesting keen future demand for technical labor. Hiring is gaining momentum, and our survey does not support conventional wisdom that the supply of skilled labor in the US has weakened. Still, airframe MROs face the challenge of not only hiring to handle this growth, but also to replace a graying workforce – more than a third of the North American technical workforce is 46 to 55 years old.

M&A COMES TO MRO

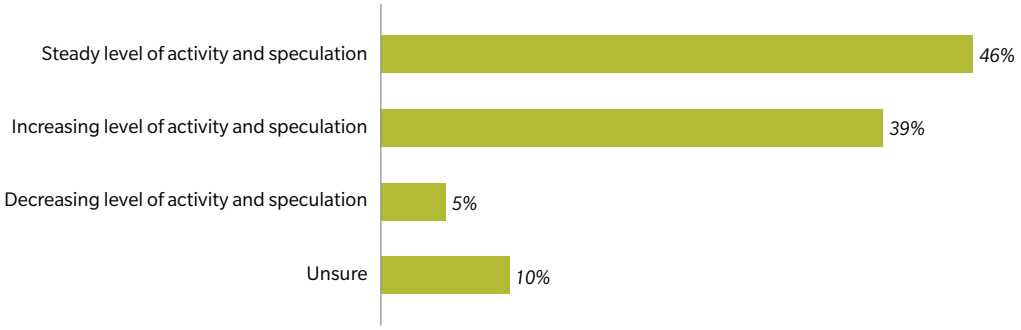
With the post-2008 crisis in the rearview mirror and airline financial performance stabilizing, the aviation sector appears to be emerging as a more attractive play for some investors. Financial investors are intrigued by the industry's macro growth story (long-term global fleet growth and renewal fueled by emerging markets and new technology), while strategic players are seeking safer ground in a shifting landscape.

MRO and OEM respondents report that M&A activity in the maintenance aftermarket is beginning to heat up, with 39 percent noting that the level of activity and speculation has increased during the past three years (Exhibit 4). Our respondents also report significant activity within their respective organizations during this period – two-thirds of the MROs and OEMs surveyed report that their organization has completed or contemplated some form of M&A activity recently.

EXHIBIT 4: DIRECTION OF M&A ACTIVITY, COMBINED

How would you characterize the current merger and acquisition climate in the airline MRO industry compared with three years ago?

PERCENT OF RESPONDENTS



Source: Oliver Wyman 2014 MRO Survey

Where is the interest coming from? Seemingly, everywhere, including MROs themselves, private equity investors with both concentrated aviation and diversified holdings, and OEMs. In particular, 49 percent of respondents cited MROs as strategic buyers, which may indicate maneuvering on the part of these providers to capitalize on the opportunities highlighted above or to better brace themselves for the OEM onslaught.

3-D PRINTING: A LONG-TERM TREND?

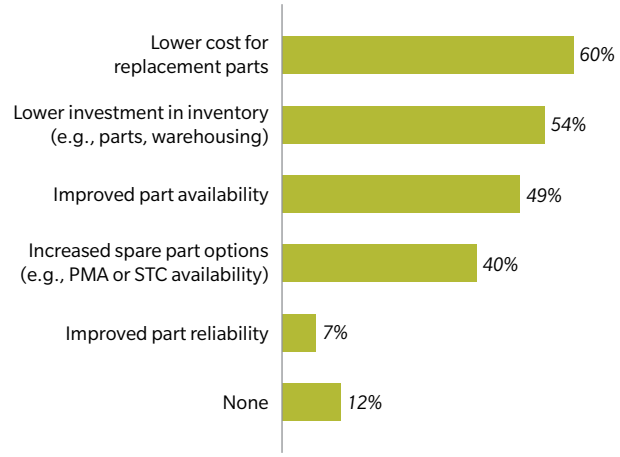
Finally, looking further out, we asked our survey respondents about how a headline-grabbing technology, additive manufacturing, also known as 3-D printing, might affect the aviation maintenance market. Our respondents loosely agreed that expendable parts could be the most likely target for 3-D printing in the next five years. They had lower expectations for the likelihood of proprietary materials being manufactured this way, suggesting that industry participants expect OEMs to protect their technology from adaptive manufacturing by others.

While our respondents had no consensus on whether 3-D printing might become a practical part of the maintenance supply chain, they did agree that it could bring benefits to operators, including lowering the cost of replacement parts and inventory investment requirements, while improving part availability (Exhibit 5).

EXHIBIT 5: EXPECTED BENEFITS TO AIRLINES, COMBINED

What benefits might the successful deployment of 3-D printing technology bring to airlines?

PERCENT OF RESPONDENTS



Source: Oliver Wyman 2014 MRO Survey

FINDING ROOM IN THE SKY

Right now, MROs are finding ways to sustain themselves, chiefly by serving older aircraft, developing value-adding capabilities, and expanding service offerings through partnering and acquisition activity. But the worldwide fleet is shifting increasingly toward newer aircraft, where OEM's control the lion's share of aftermarket spend. This means that MROs must continue to hunt aggressively at the competitive edges, where market share is still up for grabs.

We believe that creative and proactive MROs can solidify their relationships with airline customers by responding to operators' desires to combat rising costs and maintain choice in the aftermarket. By developing value-added services in niches left unprotected by smaller manufacturers, employing cost-reduction options ignored by larger OEMs, and partnering smartly to alleviate operators' new pain points, independent providers can continue to fill a critical role in the ever- evolving MRO landscape.

For a copy of the complete MRO survey, please visit: http://www.oliverwyman.com/mrosurvey2014.html.

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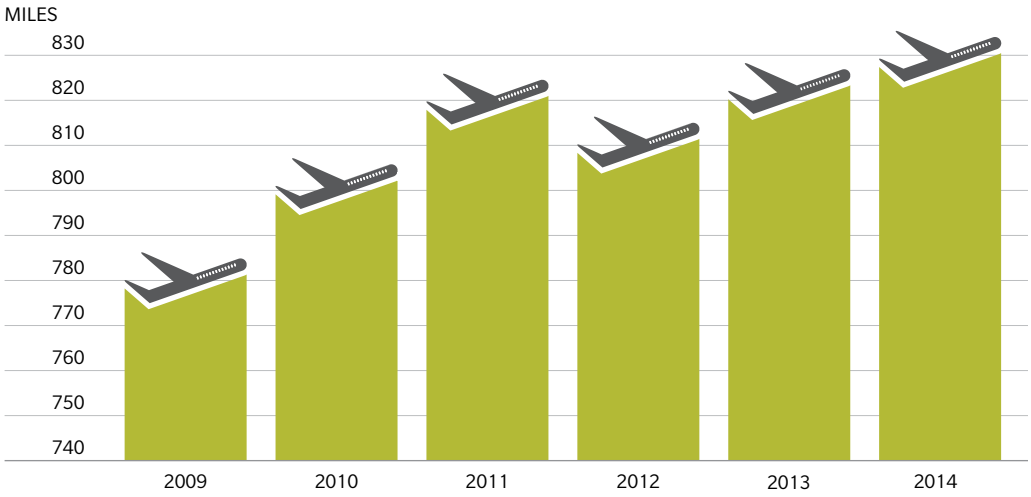
NEW AIRCRAFT CAN TAKE THE LONG WAY ROUND

Oliver Wyman tracks a wide variety of information on the airline industry (at PlaneStats.com) and we have recently noted a trend of airlines turning to newer narrow-body planes for long-haul routes. Narrow-body aircraft like the A320 family and the 737-NG offer better fuel efficiency and have greater ranges than older aircraft such as the 737-Classic or MD-80.

Most new technology narrow-body aircraft fly on routes shorter than 1,500 miles, with older (but less fuel efficient) 757's flying longer routes. Some airlines, however, are using the new aircraft to open up longhaul markets at lower densities: As shown in Exhibit 1, the average stage length for the 737-NG has increased by nearly 7 percent since 2009. Although the new aircraft have a practical range limitation of about 3,000 miles, multiple routes longer than this are being operated using payload restrictions and technical stops. For example, some 40 nonstop route segments are being operated on routes greater than 3,000 miles using the 737-NG, primarily by Copa out of Panama City and Turkish Airlines out of Istanbul, while the A320 family are flying to/from Europe on five non-stop routes greater than 3,000 miles (Exhibits 2 and 3).

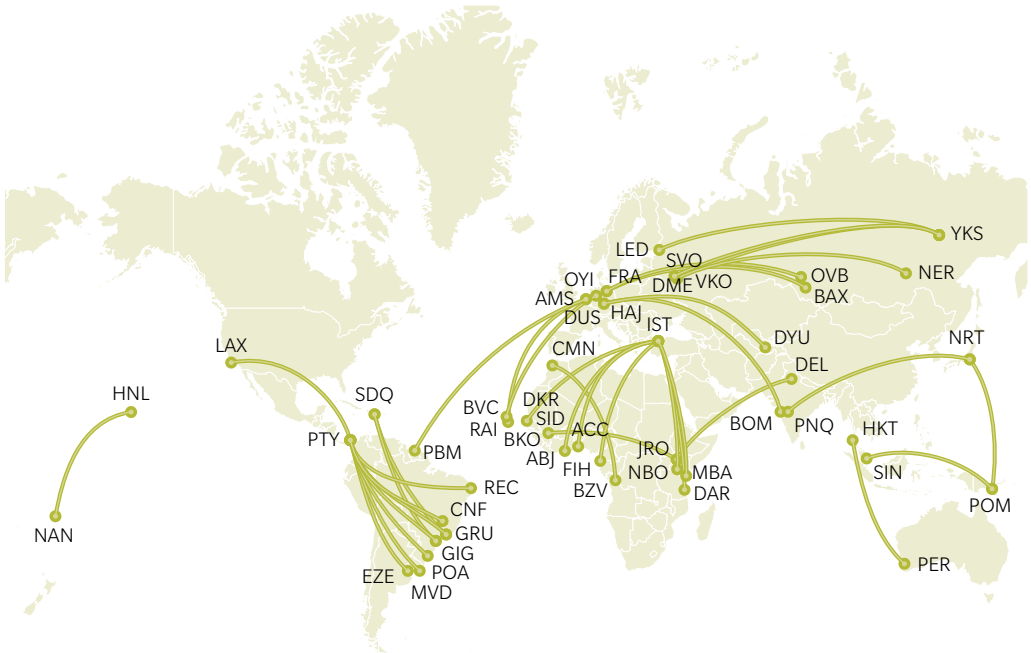
A prime example of the shift to narrow-body aircraft on longer routes is New York JFK to Los Angeles (Exhibit 4). This nearly 2,500 mile route has traditionally been the province of wide-body aircraft. Value carriers JetBlue and Virgin America only operate A320s in the market, however, and American Airlines this year shifted all of its capacity on the route from wide-body 767s to narrow-body A321s.

EXHIBIT 1: AVERAGE 737-NG AIRCRAFT STAGE LENGTH, 2009-2014



Source: PlaneStats.com

EXHIBIT 2: 737-NG AIRCRAFT ROUTES >3,000 MILES

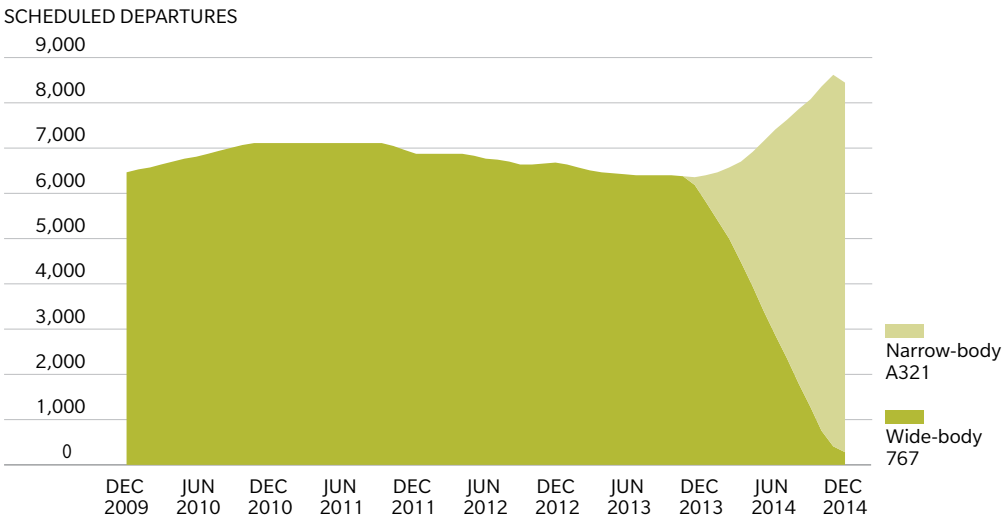


Source: PlaneStats.com

EXHIBIT 3: A320 FAMILY OF AIRCRAFT ROUTES >3,000 MILES

Source: PlaneStats.com

EXHIBIT 4: THE SHIFT FROM WIDE TO NARROW: AMERICAN AIRLINES JFK-LAX ROUTE EXAMPLE



Source: PlaneStats.com

ENGAGING MANAGERS IN OPERATIONAL EXCELLENCE

AUTHORS
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Kevan Jones

When it comes to achieving operational excellence, employee engagement is an often overlooked but critical component. Engaged employees are enthusiastic about their work and workplace, highly productive, willing to improve and to act to further the organization's interests. The organization's customers enjoy higher levels of service and the organization benefits from improved staff retention and attracting more talented candidates when it needs to hire.

Through a series of workshops and thought leadership/discussion forums conducted over the past two years with major transportation, energy, and manufacturing companies – we have collaboratively explored practical approaches and techniques for increasing employee engagement. One key finding has been that a more focused approach to engagement may be needed for mid-level managers and supervisors, who play a key role as conductors of change, and thus have the power to drive operational excellence initiatives more broadly across an organization.

CO-CREATING CHANGE

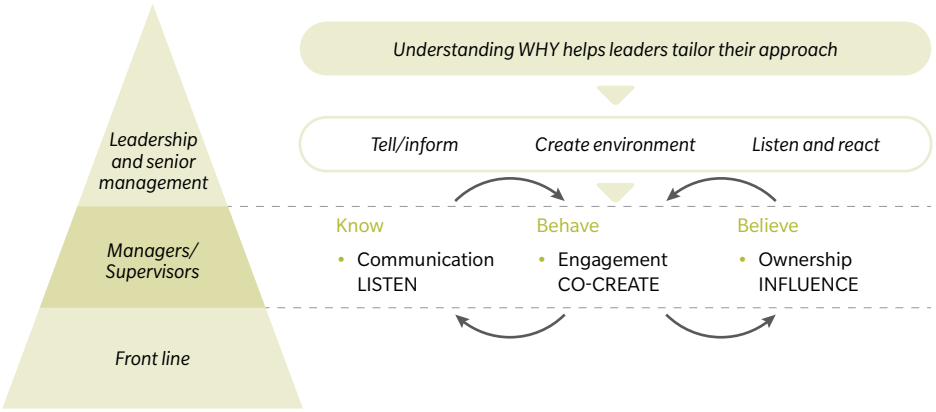
Many companies focus on making managers aware of the relevant tools and techniques for achieving operational excellence in their units or departments, but miss out on a way to amplify these benefits; namely, by ensuring managers (and their teams) know why they are seeking operational excellence.

It's clear when managers "get it," as they look to actively improve operations and encourage and support the efforts of others to do so as well.

Simply knowing why operational excellence is a goal won't likely be sufficient to change behavior, but providing this information is important to remove uncertainty and ensure expectations are understood: that "business as usual" is not an option. Some of the ideas our workshops have surfaced for communicating operational excellence goals in a way that gets managers engaged include:

- Make "what's in it for me" meaningful and personal: link the message to objectives and measures; don't assume that financial rewards alone will drive appropriate behaviors.
- Simplify the message: For example, one airline chose to focus its baggage handling managers on the customer experience, and designed metrics around this dimension.
- Include emotion: For example, one automaker uses scenarios and stories to make managers and employees aware of the potential impacts on end customers when they don't experience excellence.
- Create a burning platform: Make clear what the consequences could be – both for the individual manager/team and the company – if nothing changes. Get managers involved in solving the problem and volunteering ideas for how they could make a difference.

EXHIBIT 1: STAGES OF MANAGER ENGAGEMENT



The final point above leads naturally into the idea of "co-creation" – where managers believe in and own the situation, as well as the actions of themselves and their teams. This is where we tend to see the most effective engagement emerge.

In addition, to make engagement stick, executive leadership and senior management most play an ongoing role and treat engagement as a two-way relationship. To develop ownership for operational excellence, mid-level managers must feel that their opinions are listened to and that their actions are noted; the communication process then functions as an iterative means for executives to assess and refine engagement expectations based on manager feedback (Exhibit 1).

PERCEPTION VERSUS REALITY

It's also important to understand the situational factors and individual beliefs that may lead to managers failing to engage. Some of those include:

- "Old school" values, in which operational excellence was not a priority
- Do not understand or do not have the capability to lead (as opposed to capabilities to manage)
- Cannot see the relevance of operational excellence to their work, or that it will lead to change for the better
- Have too many targets or misaligned targets, and can't see how to meet them all
- Not wanting to reduce team size, as this is viewed as an indicator of success and worth
- Assume that if they don't do it, someone else will
- Believe their team is already doing a great job and that there is little, if any, room for improvement

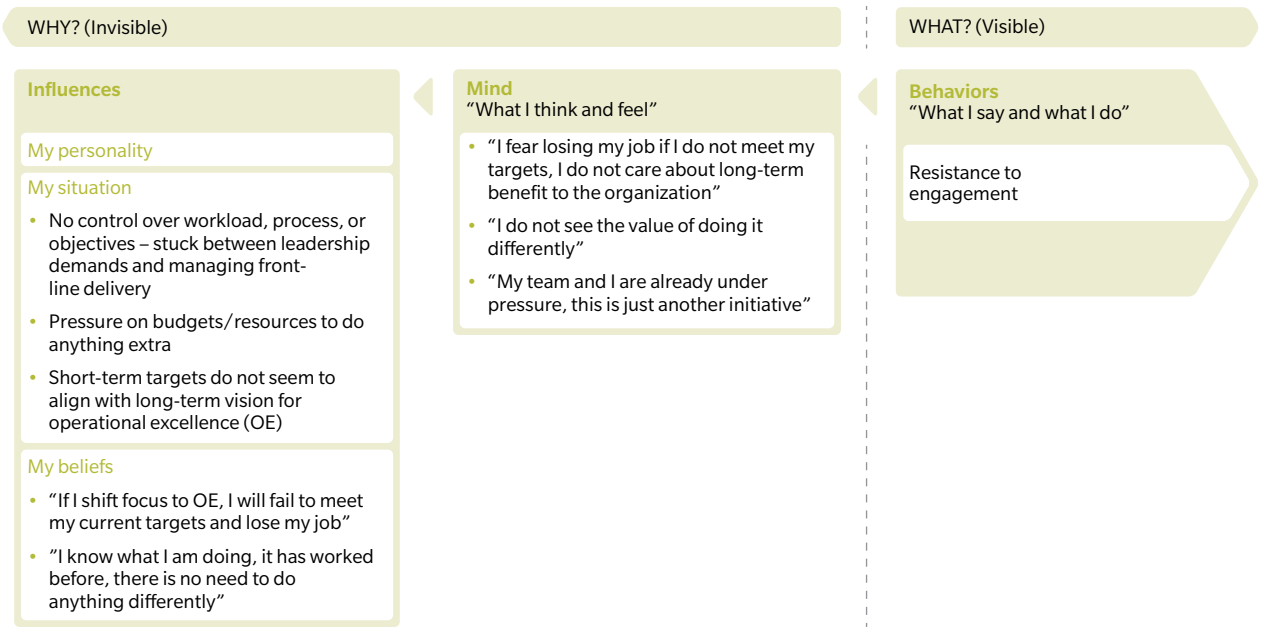
In any organization, these issues are likely to be a mix of perception and reality. Those in charge of promoting operational excellence must sort out which is which, replacing misperceptions with facts, while working to change realities that might be getting in the way of achieving operational excellence goals. As shown in Exhibit 2, it's important to understand how a manager's personality, beliefs, and perceptions of his or her situation can translate into fears that lead to passive or active resistance to engagement.

While beliefs are not easy to change, open communication around specifics and the development of what are perceived to be "fair" metrics and rewards can help motivate managers to view operational excellence programs with less distrust and understand that there is value – both for themselves and the organization – in engaging with operational excellence.

In summary, some of the "best practices" to motivate and engage managers include:

- Be clear on objectives – think "SMART": specific, measurable, achievable, realistic, and timed
- Provide clarity on roles and expectations and how these contribute to operational excellence
- Clearly communicate the relationship between short-term objectives and long-term vision
- Invite managers to share their own practical experiences in managing operational excellence within their situational constraints
- Empower managers to lead by example, by putting them into a leadership role (e.g., specific operational excellence project lead) and then asking them to identify efficiency opportunities and resource requirements
- Provide incentives for innovation (with consideration of personal motivations) and demonstrate the value/rewards of innovation (that is, ensure the impacts of achievements are broadly visible)

EXHIBIT 2: UNDERSTANDING ENGAGEMENT RESISTANCE



OEM MANAGER ENGAGEMENT EXAMPLE

One workshop participant, an original equipment manufacturer with operations in some 60 countries, instituted an operational excellence program for its new product manufacturing stream. Early on in the program, the senior executive in charge identified that Technical General (TG) Managers had been told of the need for operational excellence but were thus far lukewarm in their support. The involvement of these managers, however, was vital to engaging engineers and shop floor workers.

Through discussions with other forum/workshop participants, the operational excellence manager identified three principles to guide efforts to engage these managers: treat engagement as a "contact sport," use a common language and maintain high energy, and connect with managers' agendas. These principles meant that the operational excellence manager and his team needed to be constantly in touch with the TG Managers – communicating with them face-to-face to build a groundswell of people who would accept and support operational excellence. In addition, rather than telling the managers what to achieve, the team asked each manager what he or she wanted to achieve and then worked to assist them (within the scope of the team's mandate) to realize these goals.

After a yearlong process, the operational excellence manager believes that the TG Managers are in a better place: They've accepted operational excellence and have taken on championship roles for their own teams. Anticipated next steps include training managers in operational excellence techniques, benchmarking progress to date, and then iterating the engagement process to both deepen and broaden commitment across a larger number of employees.

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COLLABORATION CAN IMPROVE CRUDE-BY-RAIL SAFETY

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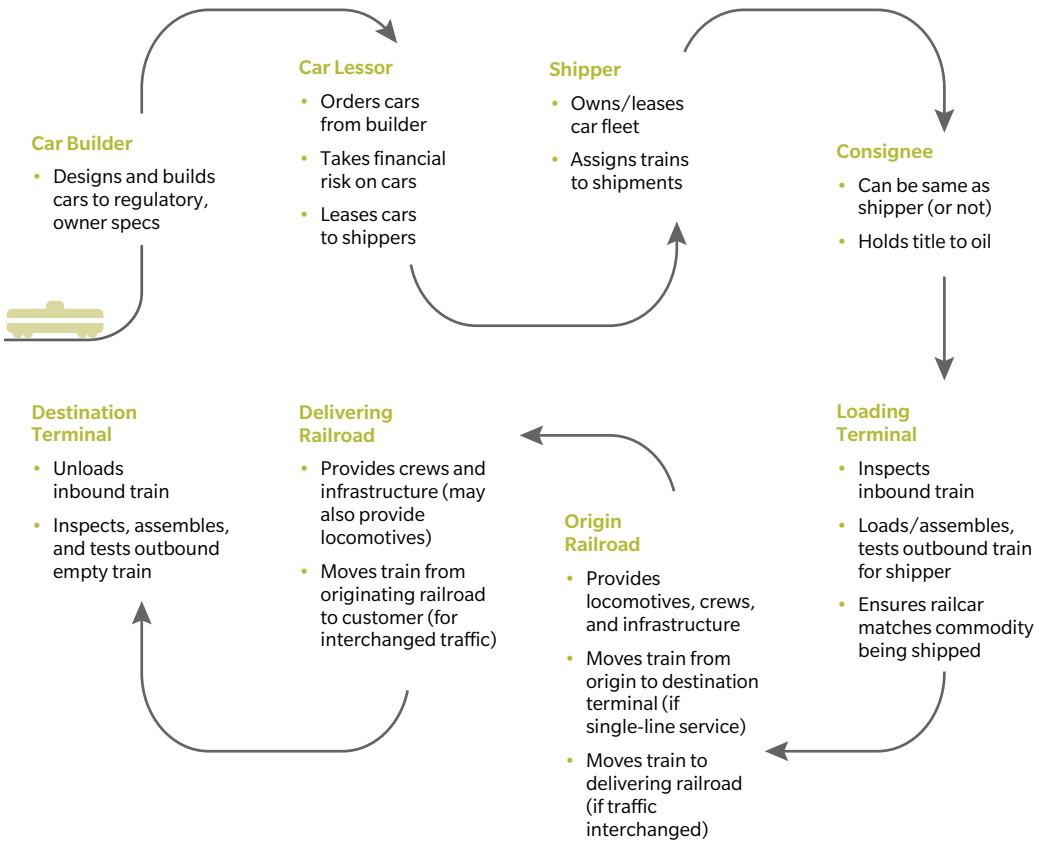
Despite the relative safety of crude oil rail transport, when incidents do occur, they can have catastrophic consequences. As a result, over the past several months, regulators in the United States and Canada have introduced a raft of new regulations and standards designed to improve the safety of transporting crude oil by rail. Encouraging greater focus on routings, inspections, and equipment are a good start to addressing safety challenges, but we believe that a more holistic approach is warranted – one that involves better coordination and planning to manage risks across all stakeholders in the crude-by-rail "supply chain" (Exhibit 1).

EXHIBIT 1: THE CRUDE-BY-RAIL SUPPLY CHAIN



BARRIER THINKING AND BOWTIES

Other industries, such as oil refining and power generation, have faced similar safety challenges and reinvented their approaches to mitigating risk. One organizing principle commonly used for safety management in high-risk industries is called the "bowtie" methodology – this tool can be used to comprehensively identify the potential hazards of shipping crude by rail, consequences, and safety barriers that can prevent or mitigate threats (Exhibit 2). This understanding can then be used to guide the collective development of a risk management strategy for the entire supply chain – from organizational and structural activities to addressing public and regulatory perceptions.

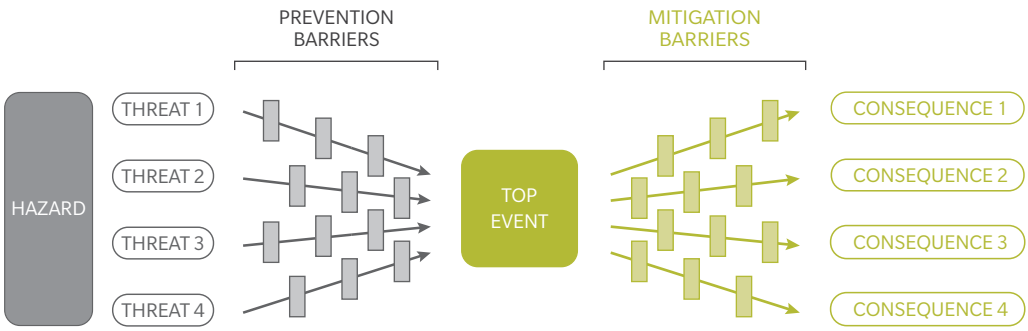
The bowtie is built up by understanding how a "top event" – such as a tank car explosion – relates to specific hazards (such as the flammable nature of crude oil), the threats that might lead to the event (such as a broken rail that causes a derailment), and the consequences of the event (uncontrolled fire, harm to people and property). Barriers can then be identified that would either prevent the threat from materializing, or that would mitigate the event and reduce the consequences.

Potential barriers could include operational, design, or behavior and process changes. In the case of a broken rail, for example, track inspection and proper maintenance would serve as a barrier to derailment. On the mitigation side, proper placard display does nothing to prevent an incident, but could help firefighters respond and mitigate consequences. Once barriers are known, they can be highlighted as "safety critical" to ensure sufficient focus. The "bowtie" represents the culmination of the process and provides a roadmap for collective action.

SAFETY ALONG THE SUPPLY CHAIN

A number of recent actions have been taken to strengthen the safety of crude-by-rail movements, including a voluntary increase in track inspections, new hazmat routing assessments, better crude testing, and enhanced tank car specifications. Minimizing the sum total risk of crude-by-rail and the subsequent impacts of that risk (from a public safety, regulatory, and industry reputation standpoint), however, requires consideration of stakeholder roles and the potential for collective action. Given how grave the consequences of an accident can be, no party can afford to be the weak link.

EXHIBIT 2: THE BOWTIE METHOD FOR IDENTIFYING RISKS



400,000

Number of carloads of crude oil moved in the US last year

Although a complete "bowtie" assessment will consider many more factors, an initial assessment suggests that there are additional safety barriers that only collaboration can raise across the supply chain (in addition to participants' discrete activities). A few examples follow.

ASSIGN TANK CARS BASED ON RISK

A principle of process safety used in high-risk industries is "design integrity," which means that the fundamental build of equipment will be suitable for the hazards expected. In a refinery, equipment is designed for the temperature, pressure, and corrosive nature of the hydrocarbon it will contain. Rail tank cars similarly must match the hydrocarbons they carry. For example, the US Department of Transportation issued a warning in January regarding the flammability of Bakken crude oil. Utilizing appropriate tank cars (e.g., the FRA-111 and CPC-1232) that can safely handle this oil makes sense, as would reassigning other types of tank cars to less volatile cargos.

From a supply chain perspective, one approach might be to rank all hazardous commodities currently carried in FRA-111 tank cars. Then, based on this ranking, as newer, stronger CPC-1232/P-1577 tank cars come online (29,000 of which exist today, projected to grow to 55,000 cars by the end of 2015), these could be prioritized, through a pooling approach by fleet owners, to ensure they are used for the most hazardous commodities. Once cars were prioritized and assigned, the railroad and shipper could ensure that a unit train hauling Bakken crude, for example, was composed entirely of these stronger tank cars. This approach would require collaboration across the supply chain:

- Shippers would need to test the crude and request CPC-1232 tank cars for loadings prioritized to these cars.
- Car owners would have to agree to pool the cars so the best cars could be applied to the most hazardous shipments.
- Railroads would have to work with shippers to coordinate the flows of empty trains to the right loading locations, etc.

Particularly as all crude oil is not the same, it would take coordination across stakeholders to ensure the best possible handling for the most hazardous commodities.

ASSESS THE LAST MILE PROACTIVELY

Final mile analysis ensures that the rail lines have the required structural integrity and safety practices in place to manage the hazards that will be transported over them. In many cases, the Class II and Class III railroads in a supply chain function as contractors for a Class I carrier, handling "last mile" pickup and delivery. While the regulatory system does monitor track condition for Class II and III railroads, increased risk may stretch regulators and be more difficult for these small railroads to address on their own. Shippers and Class I carriers could consider conducting proactive risk and safety audits in conjunction with their Class II and Class III partners to ensure consistent safety practices and conditions across all portions of the routes used for crude rail transport.

MAXIMIZE SAFETY TECHNOLOGY

Another potential area of crude-by-rail supply chain focus could be support for

targeted R&D and the adoption of advanced safety technologies. With so many new cars being introduced onto the rail network, and given that most crude oil is being targeted for unit train operations, this may raise opportunities for step changes in fleet safety and performance.

One example would be replacing 150 year-old compressed air braking technology with electronically controlled pneumatic (ECP) braking on the new tank cars now coming online. This would enable braking to be applied faster and more consistently in a unit train in the event of an incident (and allow electronic confirmation of braking capabilities).

A total supply chain review, however, would be needed to address the investment and operational complexity issues involved in the use of electronic brakes:

- Parts suppliers would have to ensure they had the capability to supply ECP components in sufficient quantities.
- Car builders would have to add the parts to new cars.
- Car owners would have to pay the small premium for this technology and schedule retrofitting on existing CPC-1232 tank cars.
- Railroads would have to ensure locomotives were equipped with ECP technology and crews trained to properly handle ECP trains.
- Terminal operators would have to be trained to properly set up and test the system when the trains are assembled.
- Any shortlines involved in "last-mile" services would have to ensure their infrastructure could accommodate the through operation of ECP equipped locomotives from the Class I carrier.

Newer, proven technologies could also be used to harden elements of the system – other heavy industries use tech that provides shippers and carriers with immediate data to notify them in real time of variances in standards. Locomotives are now equipped with GPS technology and fault reporting; these systems could be used to immediately report emergency brake applications and notify emergency personnel to accelerate the response to incidents.

With electronic train lines from ECP braking systems, it might also make sense to equip the trucks on tank cars with sensors that could detect the kind of rough sudden motion that indicates a derailed wheel set and immediately apply the brakes on the train. Seconds count in a derailment event, and this would stop a train far more quickly than waiting for the derailment to progress to the point that the train line was severed or a problem was detected in the cab. Such a system could notify the train crew of exactly which car triggered the braking event – enabling an immediate inspection of the problem rather than having to check along the entire train – thus minimizing the time lost by false events. Used properly, such technology could strengthen barriers and ensure inspection/maintenance activities focus on the most immediate and highest risks.

DEVELOP CROSS-INDUSTRY BEST PRACTICES

The petrochemicals industry has developed comprehensive safety practices and Dow, DuPont, and other chemical companies have been brought in by the rail industry to share those best practices in the past. Given the risk profile of crude-by-rail – a risk that is jointly borne by all parts of the supply chain – it may be worth reinvigorating this collaborative model to optimize cross-industry safety with regard to crude. This model could even be extended to communities and first responders to ensure that critical safety issues on both sides of the bow tie – prevention and mitigation – are fully addressed.

A TIME TO BUILD

An estimated 400,000 carloads of crude oil moved by rail in the United States over the past year, and that number is likely to continue to climb for the foreseeable future. Clearly, the safety of crude-by-rail shipping will ultimately depend on the strength of the barriers to risk that get built. Each participant in crude-by-rail movements certainly can work to improve its own practices and try to convince regulators, investors, and other stakeholders that it is leading the charge. But the best results, i.e., identification and implementation of all best practices that can lead to the safest crude-by-rail supply chain possible – are likely to come about only if all parties come together to develop a comprehensive understanding and mitigation strategy for crude-by-rail risks.

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