Through human history, transport has been the backbone of global growth and innovation. From the 18th-century railways that enabled US expansion out West, to Felix Baumgartner’s jump from the stratosphere, transport has fed humanity’s mission for expanding its boundaries. Insurance has been the means through which hazards could be addressed, enabling boundaries to be pushed, helping individuals and companies to risk travelling further and faster. In the 21st century, however, we are learning to accept that our boundaries cannot continue to expand indefinitely. We are confronted with physical limits in terms of resources, materials and water, driven by growth in global populations, changing demographics, increased demand from the middle classes and growing environmental challenges.

At Willis, as we analyse the transportation landscape, we see the risk dynamics of the global transport industry evolving at a rapid pace. The expansion of transport infrastructure has resulted in economic growth, connectivity and increased demand for mobility for the many. Sustained growth cannot be achieved, either internationally or domestically, without an effective transport infrastructure that connects people and goods in a timely fashion. Yet every country or region has a different state of mobility development, which results in different needs, and they must balance economic demands with environmental and sustainable priorities.

The question is how should we maintain a sustainable global transport infrastructure in a changing environment? Transport trends are likely to be shaped by the political environment and the popular trends of the time. If consumers decided to only eat in-season fruit, there would be an immediate and impactful decline in freight loads. Outside consumer trends, however, there is little political appetite for long-term planning which might prove unpopular. Few policymakers have the long-term vision to develop an integrated transport infrastructure that will be resilient to the increasing pressures of a post-carbon world. In the fast-growing markets of China and elsewhere in the East, where transport infrastructure and investment are scaling quickly, trends are more likely to be led by government decisions than consumer preferences.

We must recognise that the historical risks in transportation will not be the concerns of the future. Instead of worrying about technology, financial and political risk, we’re going to need to understand and compensate for the challenge of an increasingly wide array of risks. These will range from more environmental legislation, the impact of nature on infrastructure and the insidious threat of cyber hacking. What matters is the ongoing resilience of the global transportation network. That means we must assess the risks implications of future action on an economic, value, volume and even human health scale.

It’s not the first time that transport systems have had to overcome environmental issues. Levitt and Dubner, in their 2005 book *Freakonomics*, discuss how the advent of automotive technology at the turn of the 20th century was seen as hugely beneficial to the environment, ridding cities such as New York from the hundreds of thousands of working horses that drove the city’s economy. That meant more than 3,000 metric tonnes of manure a day, while sick horses were shot and left to rot in the street until they were sufficiently broken down to move — with horrendous environmental impact.

History teaches us that technological innovation can solve problems and, if it creates new problems, innovation can solve those too. We need to be aware of the risks we face, but we also need to be able to seize the opportunities that risks represent. Change doesn’t happen overnight; rather there is a gradual shift in the values we share and the choices we are offered. Those in the transport industry who have the foresight to see these changes and help to shape the future will prove to be the winners over time.

We trust that the insights contained within these pages will go some way to help you prepare for whatever the future holds.
Transportation Outlook

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The ability to move people, freight and information from one place to another is fundamental to economic activity and growth — it encourages networks to grow, and promotes trade and innovation. More and better networks mean more capacity, and more capacity means a greater number of people, goods and services that flow more easily. Lack of effective transport networks can constrain development, both domestically and internationally, and there is a strong relationship between the quality and quantity of transport infrastructure and levels of economic development. In developed countries, the direct impact of transport alone can account for between 6 and 12 per cent of gross domestic product (GDP). But it can be difficult to talk about “transport” as it has rarely been an integrated sector. Aviation has been segregated from road transport, while freight has been in a silo all of its own. However, we are now moving to a multi-modal world where journeys involve many different types of transport, which must be integrated with each other to be effective, in terms of efficiency and cost. Steve Doyle, executive director in Willis’s Transportation Industry, points out that the key decision for choice of transport mode is value, volume and time. How much can you carry, at what price and when will delivery take place? Increasingly, it appears that the particular mode of transport itself is less relevant — what matters is overall mobility, how a system of systems works for individuals, companies and economies.

The indirect impact of transport should not be forgotten, including the links with other sectors. Industry, such as insurance, supply, maintenance and repair, all benefit from transport growth. New businesses spring up around new transportation infrastructure, and the economic multiplier effect means that the price of available goods and services will either fall or the range of goods and services will increase. It can be one of the most effective investments in terms of wealth creation.

Investment planning is critical at the macro-economic level, but also at the micro-economic, localised, where effective transport is key to producer, consumer and production costs. Key to developing effective transport systems is obviously the capacity to deliver people and goods, but it also requires the ability to improve performance over time while maintaining levels of reliability. At an international level, the ability to access a wider market base enables businesses to affect economies of scale in production and distribution, which can have a direct impact on consumer prices. In the developed world, transport accounts for between 10 to 15 per cent of household expenditure and constitutes an average of 4 per cent of manufacturing output, although this level varies dramatically by sector.

The challenge is choosing the right development priorities, especially in a global market. Done right, investment in transport infrastructure can transform an economy, but poor technology choices, poor investment planning or availability of capital can mean that the true potential of transport projects is not achieved. In this new, multi-modal environment, transport projects can drain public funds, fail to generate extra wealth and additional economic opportunities. To be effective, each transport development project needs to be seen as part of a greater whole.

In a country like China, for example, connecting ports to remote parts of the country will help to develop the economy as a whole. The connection of sea ports to a nation’s interior is important for those countries still heavily dependent on resources and which wish to take advantage of the opportunities afforded by a globalised market. As their economies develop, however, they may need to think more carefully about how they develop their transport networks. It is likely that some areas will become more popular than others on the new network, for living and working, and the agglomeration of goods and services around these nodes means accessibility to them will play a significant role in economic development.

Transport plays a vital role in the economy as the backbone of trade and growth. The challenge is to choose the best development priorities to ensure transport infrastructure provides the mobility essential for economic prosperity and social wellbeing.

Transportation Outlook
As the world becomes increasingly urbanised, understanding the different requirements of transport systems matters even more. Stephen Chadwick, managing director of Dassault Systèmes, a 3D software company heavily involved in mobility and transport, says, “Transport ownership in cities is becoming more expensive and less desirable as public and shared transport improves. New ways of achieving transport are being introduced into cities with great success. It is no surprise to see pedal bikes, electric and other internet bookable vehicles almost as though they are self-owned, with convenience and flexibility but no ownership responsibility or fixed costs. A van one day, a minicab the next, and nothing the day after, is the ideal for many city dwellers. Prohibitive insurance prices for young motorists add to the attraction of non-ownership.”

In an Urban Studies paper, Daniel Chatman and Robert Noland of Rutgers University, make the case that the deployment of public transit systems can produce significant agglomeration of services. Their research on the US market showed the hidden economic value of a transit system could be worth anywhere from $1.5 million to $1.8 billion a year, depending on the size of the city. Every time an urban area added about four seats to railways and buses per 1,000 residents, the central city ended up with 320 more employees per square mile, an increase of 19 per cent. Adding 85 rail miles delivered a 7 per cent increase. A 10 per cent expansion in transit service, by adding either rail and bus seats or rail miles, produced a wage increase of between $53 and $194 per worker a year in the city centre. The gross metropolitan product also rose between 1 and 2 per cent.

On average, across all the urban areas in the study, expanding transit services produced an economic benefit via agglomeration of roughly $45 million a year, with that figure ranging between $1.5 million and $1.8 billion based on the size of the city. Big cities stand to benefit more simply because they have more people sharing the transit infrastructure, as well as a tendency to suffer from the overwhelming traffic that cripples agglomeration in the absence of transit in places such as São Paulo in Brazil.

What makes mobility so much more important than transport are the advances that have taken place in the digital world. All effective transport developments must be supported by skills and expertise in management and software. Decisions must be made about how to most effectively use and optimise existing systems, while minimising costs and inconvenience. The ability to take advantage of new business models offered by the digital revolution could enable some countries to avoid the inflexibility of national hard networks, such as road and rail.

Economic development seems to have become more a facet of relations across space than dependent on resources. Economies with increased mobility, whether in terms of capital, commodities or labour, tend to fare better in the modern world. And that is something that the transport industry must embrace, if it is to survive the changes in expectation and behaviour of the global economy.
There is a fundamental connection between the quality and quantity of national and international transport infrastructure, wealth creation and economic growth. This has resulted in infrastructure becoming a central driver of development plans worldwide. As the world’s population grows, increasing demands are being placed on its transport infrastructure. As previously discussed, transport is an instrumental component of the economy and development. Trade and transport are intricately linked, connecting terms to cities and regions to nations. Transportation ensures the welfare of a society is bolstered. The importance of transport provides economic and social benefits by improving market accessibility and productivity, ensuring balanced regional development, and the creation and access to jobs.

Over the next four decades, the global transport market will face enormous change, but the biggest challenge will be to provide safer, affordable and cleaner transport for a burgeoning human population at the lowest social cost possible. During the global economic crisis and collapse of world trade in 2009, development of the transport sector was naturally affected. As international government debt grew, governments have sought to encourage private investment in infrastructure.

New methods of financing were formulated to help fund transport infrastructure developments, such as public-private partnership (PPP) agreements—where governments work with private-sector partners to finance projects at a flat cost with viable returns—road user charges or tolls for use of roads, tolls and congestion charges, institutional structures such as highway agencies, and bank loans. Initially negotiated as one-off deals, they have evolved to be part of everyday transport market function.

An example of a bank-funded integrated approach to improving public transport is the Lagos Urban Transport Project in Nigeria. Funded by the International Bank for Reconstruction and Development, the project has seen the development of a transport authority for the city and a bus rapid transport system, the first of its kind in Africa. Some 200,000 Lagos commuters now use the bus option each day.

In addition to safe and clean transport, passengers in Lagos have enjoyed a 30 per cent decrease in fares despite a rise in fuel costs. Transit times have decreased by 40 per cent and an average waiting time by 35 per cent. Time and money spent by poorer households was reduced from 90 minutes and 150 naira—about $1—in 2003, to 23 minutes and 100 naira by 2009. Nigeria has recently overtaken South Africa as Africa’s biggest contributor in terms of gross domestic product at $510 billion and, thanks to the success in Lagos, has a series of PPPs in place to continue to build infrastructure in the country.

While roads are the backbone of transportation, shipping which is largely used for freight transport, is once again increasing as international trade grows. An increase in “terminalisation of supply chains is unfolding, whereby seaport and inland terminals now have a more active role, and have radically changed the shipping sector,” says Professor Jean-Paul Rodrigue from Hofstra University in New York. This means that terminal operators are developing strategies to control larger parts of the supply chains.

The development of ports and marine infrastructure is a top priority for the Chinese government. A preference for shipping is understandable. It is cheaper—it costs up to 10 times less than air cargo, per unit weight, according to Beijing. China has now three of

**The biggest challenge will be to provide safer, affordable and cleaner transport for a burgeoning human population at the lowest social cost possible**
the ten largest container ports in the world and handles more than 40 per cent of the imports and exports through marine cargo. When Chinh’s Yangshan Deepwater Port in Shanghai is completed in 2020, with 30 berths and an annual handling capacity of 20 million 20-foot equivalent units, it will surpass Singapore’s status as the world’s largest port.

In Indonesia, airport expansion and development has taken precedence. As Indonesia is an archipelago country, the fastest, most convenient and cheapest mode of transport is by air. Earlier for this year, the Jakarta-Hatta airport was ranked the eighth busiest airport by the world’s trade representatives of airports, the Airport Council International, in terms of passenger numbers in 2013. Typically, the domestic aviation industry expands twice as fast as the overall economy and the airport’s 2013 ranking – up one level globally compared to the previous year – reflects the growth of the aviation industry in Indonesia. With 42 new airports being constructed across Indonesia, Cardia, operator of the country’s 17 biggest airports, expects passenger numbers to rise at twice the growth rate of the economy by 2019.

It is not just developing countries where the majority of infrastructure development occurs. Better connected and more efficient transport networks indicate higher levels of development and standards of living. But as more people have access to luxury and personalized vehicles, many roads are becoming more crowded. It is a constant battle to accommodate faster trains, and priorities for many developed countries including, Germany, France, Japan, South Korea and the UK.

The UK’s £40-billion High Speed 2 (HS2) rail link will see a new connection that intends to carry faster trains running at 225 miles (365km) between London and Birmingham from 2026, with branch trains to Manchester and Leeds via Sheffield planned by 2012. Train journeys from London to Birmingham will be reduced by 32 minutes, while journeys to Manchester should be reduced by an hour. Crossrail, another UK scheme fully owned by Transport for London and one of Europe’s largest railway and infrastructure projects, is scheduled to begin full operation in 2018, serving London by providing a new east-west route across Greater London. The World Bank says the distribution of major investment is in roads and highways at 57 per cent, with railways at 6 per cent, aviation at 3 per cent, ports and shipping at 5 per cent. It is still underlying economic and human factors that dictate the development of the mode of transport in each region and country. Until we see a disconnection between the benefits of transport infrastructure and growth, it will remain at the top of both national and international agendas.

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Better connected and more efficient transport networks indicate higher levels of development and standards of living. Across the city of Curitiba, home to about 1.7 million people, and the city’s four-railway route, passengers can arrange travel with great ease. BRTs are not new in Brazil. The city of Curitiba, home to about 1.7 million people, built the world’s first BRT in 1974. This has targeted many aims – as of November 2013, more than 146 cities around the world have installed BRT networks.

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TOP TEN COUNTRIES BY TRANSPORT INFRASTRUCTURE INVESTMENT AND MAINTENANCE

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Source: Data extracted on 28 July 2014 from OECD.Stat

The World Cup in Brazil is over, regarded by many as one of the finest football tournaments ever staged. For its hosts, it is now on to the next massive project – The Rio 2016 Olympic Games.
Transportation systems are the arteries of the modern economy, carrying goods and people to the essential organs of the economic system. They also employ millions of people and create markets by using raw materials, products and services from other parts of the economy.

“A good transportation network is crucial to having a competitive nation and a functioning economy that can move people, goods and services effectively, and attract foreign direct investment because it is a good place to do business and live,” says Jeremy Blackburn, head of UK policy at the Royal Institution of Chartered Surveyors (RICS). In the United States in 2012, for example, transportation accounted for 8.7 per cent—more than $1.4 trillion—of GDP and employed over 11 million people, according to the US Bureau of Transportation Statistics.

Transportation schemes are important not just because they create a large number of jobs in their own right, but also because they enable the rest of the economy to function to its full potential, and grow through the networking effects of linking one location to another and increasing the potential market available to businesses. In addition, they increase productivity by giving companies access to a wider pool of labour, raw materials and energy sources.

“A high quality transportation network is vital to a top-performing economy,” according to a White House report on transportation infrastructure. “The economic benefits of smart infrastructure investment are long-term competitiveness, productivity, innovation, lower prices and higher incomes, while infrastructure investment also creates many thousands of American jobs in the near term.” The report added that for every $1 spent on transportation infrastructure, $3 in extra output is generated.

As a key driver of national economic growth, transport propels productivity, innovation, price cuts, long-term competition and employment.

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Gordon Wakeford, head of the mobility division at Siemens, explains: “Investing in transport brings welfare benefits to all countries. It’s about connecting people. If you don’t have a safe and reliable transport system, it puts people off visiting and living in your city. We talk to mayors all over the world. In emerging markets, after healthcare and clean water, transport is the main priority. In the developed world, where they have the healthcare and clean water, transport heads the list.”

Todd Litman, of the Victoria Transport Policy Institute in British Columbia, adds: “Transport policy and planning decisions often have significant economic development impacts by affecting government and consumer expenditures, employment opportunities, resource consumption, productivity, local environmental quality, property values, affordability and wealth accumulation.”

Sometimes it is easier to see the benefits by looking at the costs of not investing. A study by Lei Zhang, assistant professor in the Department of Civil and Environmental...
Transportation schemes increase productivity by giving companies access to a wider pool of labour, raw materials and energy sources.

Engineering at the University of Maryland, warns that US GDP will be $3.1 trillion lower by 2020 and 870,000 jobs will be lost in the US economy due to deteriorating transport infrastructure.

According to the World Bank, transport is a crucial driver of poverty reduction and achievement of the Millennium Development Goals. According to a spokesman: “Poverty reduction is more likely to occur when communities have ready access, all hours and in all weather, to essential services and to markets.”

The importance of access to transport is illustrated by the fact that, since 2002, the World Bank has supported 62,000 projects, of which 70% are tied to cargo operations. “The benefit of logistics clusters is the range of jobs they create, from more blue-collar work such as truck drivers. They also draw in other companies that need access to good transport infrastructure.”

Dubai, in particular, has turned itself into one of the world’s biggest logistics centre, taking advantage of its favourable location, which gives it easy access to Europe, Asia and Africa. “Logistics clusters create jobs that are difficult to move southwards due to economic growth in multiple sectors,” says Yossi Sheffi, director of the Center for Transportation and Logistics at the Massachusetts Institute of Technology.

Job creation is one of the strongest arguments for logistics clusters, he adds. “Logistics at the airport is responsible for 220,000 jobs in the local economy. This is due to the fact that these are jobs that are created by the fact that the airport has capacity to serve international passengers and serves more than 250 airlines flying people and cargo to more than 260 destinations across the continents.”

In 2009, Dubai’s then ruler Sheikh Rashid bin Saeed Al Maktoum ordered the building of Dubai International, a 1,800-metre stretch of compacted sand, a fire station and a small terminal building. By 1970, one million passengers were passing through its terminals, 16 years later passenger numbers had taken off to reach five million.

According to the Airport Company, DXB, as the airport is known, the net profit of the world’s best for international passengers and serves more than 250 airlines flying people and cargo to more than 260 destinations across the continents. Run by Dubai Airports, its capacity is currently 75 million passengers a year across three terminals.

In its Strategic Plan 2020, Dubai set out how it intends to achieve this. The project includes increasing the capacity of terminals from 22 to 280, the construction of additional terminal space and connecting areas, making it the first airport to connect terminals 1 and 2, the development of concourses 4, 5 and 6, introducing Concourse D, the development of Terminal 3, “the world’s first fully automated airport,” with the Berg system and the implementation of new automation technologies.

DUBAI INTERNATIONAL AIRPORT, DUBAI, UAE

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It’s some story, helped in part by its geographical position – the airport says that more than two thirds of the world’s population live within eight hours’ flight. But its rapid growth is also due to recognition by Dubai’s leaders that it needed to diversify its oil-dependent economy.

According to global research firm Oxford Economics, the aviation sector supports more than 250,000 jobs and contributes over $22 billion – 19 per cent of total employment and 8 per cent of UAE GDP. This includes 58 direct jobs that contribute $6.2 billion to GDP, 61 indirect jobs that generate $5.2 billion through purchases of goods and services from local businesses, and a further 20,300 jobs that contribute $13.7 billion through the spending of those directly and indirectly employed in the sector. In addition, there are the indirect benefits to the economy from visitors that fly to Dubai. Dubai Airports calculates that their spending supports nearly 134,000 jobs and contributes $2 billion through the spending of those directly and indirectly employed in the sector. In addition, there are the indirect benefits to the economy from visitors that fly to Dubai.
Major cities worldwide are set to grow at a fast pace putting transport systems under strain unless investment is increased.
EXTREME WEATHER IS CHANGING THE ECONOMIC CLIMATE OF TRANSPORT

While there is concern over transport emissions and resulting regulation, there is less discussion about the effect climate change and a changing environment is having on operations. Costs are increasing rapidly as industry faces a “new normal” in terms of drought, flooding and extreme weather.

It took 100 workers more than two months, at a cost of £120 million, to repair the effects of two nights of rains at its more hostile. Such extreme weather picked up for storm-damaged coastal railway lines, left hanging in mid-air earlier this year, in Dorset, west England.

The environmental disaster hit with it many lessons. London’s sustainable development commissioner Shaun McCarthy, questions how many of these lessons have actually been learnt. “Last winter in the UK was a wake-up call on climate change and extreme events. There clearly needs to be better resilience planning. We are seeing massive investment in rail infrastructure, but it is very long term. Better short-term contingency is needed,” he says. The authority responsible for the UK railway network, Network Rail, will publish climate change adaptation plans for all routes by September 2014, listing specific and critical works to be better resilience planning. We are seeing massive investment in rail infrastructure, but it is very long term. Better short-term contingency is needed,” he says. The authority responsible for the UK railway network, Network Rail, will publish climate change adaptation plans for all routes by September 2014, listing specific and critical works to be better resilience planning.

“New environmental change and extreme weather is having more frequent and severe costs. The economic impact of extreme events is becoming the new normal. On the road, the definition of ‘normal’ is expanding to allow for not just more, but different impacts, according to head of external communications at the RAC Foundation Philip Green. “Not that long ago, harsh conditions meant snow and ice, but now you have to throw in flooding, and not just in winter. When nature turns against us, there are at least three issues to deal with: disruption to essential transport, damage caused to infrastructure, and just what level of mobility road users should reasonably expect. Part of the problem is the growing backlog of road maintenance,” he says.

For road transport and travel, however, arguably the key issue of public and policy concern, plus associated commercial risk, is not so much the impact of climate and extreme weather on highways and vehicles, but the impact of vehicle emissions on the environment. “Not all emissions are the same though,” says Green. “There is a straightforward and understandable link between carbon emissions and fuel consumption. The more petrol and diesel you use, the more harm you do the environment. With local air pollution things are harder to disentangle,” he says.

Unlike tackling the particulate matter (PM) and nitrogen oxides (NOx) common to local pollution, carbon reduction is already a straightforward and understandable goal. The aviation industry is particularly sensitive to climate trends and meteorological events. Analysis has shown nearly 20 per cent of accidents are weather related. In addition to safety concerns, services are impacted by things such as de-icing delays. Disruption potential is particularly critical for major airport hubs, such as London Heathrow, which works to full capacity. Impacts are inevitable, says Rui Zhao, chief economist at Airports Council International (ACI). “If the aviation industry is to continue to grow, and to do so sustainably, it needs a more efficient approach to carbon reduction,” he says.

According to Acit, carbon emissions from aviation have increased by 5 per cent a year, or 8 per cent a year by 2050, at a cost of $108bn.

Top six most expensive natural disasters 2013

1 - Flooding, central Europe - May
2 - Earthquake, Lacien, China - April
3 - Super Typhoon Haiyan, South-East Asia - November
4 - Typhoon Hai, China and Japan - November
5 - Drought in China - January to September
6 - Drought in Brazil - January to May

Source: IBT Times

Again though, industry trends are driven by a mix of financial imperatives and climate change regulation. Mr Kirchner adds “in the air, sustainability and efficiency have always already become key market drivers. With fuel price being a major cost factor for airlines, a ‘greener’ and more environmentally friendly aircraft is automatically also of economic advantage. In addition, programmes are targeted at making air traffic management systems more efficient. In Europe alone, up to 40% of CO2 could be saved per flight.”

For transport, environmental impacts remain a double-edged sword, carrying both a responsibility and a threat. No matter the issue, be it operational impacts, liability or increased regulation, the environment is a matter for the transport industry as a whole.}

The aviation industry is particularly sensitive to climate trends and meteorological events.
The UK is going to have to bring in tolls to start to raise revenues, but also to ration the roads.

The impact of that is they will go outside political control,” he says. “The idea is that they can budget over a longer period of time. I would look for them to use more innovative means of financing.”

The most obvious means of paying for new roads is tolls. Mr Prior says UK politicians aren’t yet ready to start imposing tolls, although they will become necessary in the future. “At some point in time, the UK is going to have to bring in tolls to start to raise revenues, but also to ration the roads. The country doesn’t have the capacity or space to build more roads,” he says.

Another option would be to increase levies on petrol and diesel. In the UK, for example, petrol is currently taxed at 58p a litre, plus VAT, which is expected to cost £4.5 billion, plus £2.5 billion for the trains, using the revenues the line generates to pay back interest and capital. Interest rates would be lower because the bonds would be a relatively safe investment. But there are problems with this approach as well. As Marcus Fiskin, senior lecturer in transport studies at the UK’s Loughborough University, points out, the problem with bonds is they add to public debt, which every finance minister, including George Osborne, wants to avoid when managing public finances.

Another option is to use the uplift in land values around a new infrastructure development to fund its construction. For example, a company could buy land in an area a new railway is due to be built. As the railway is built, land around the station could be sold to developers. Dr Fiskin explains: “When you open a new railway line, you improve accessibility and the value of the land rises.” This type of arrangement was used for building the Docklands Light Railway in London. But the scheme was scuppered when land values dropped during the recession, just when the land was due to be sold.

While most major transport infrastructure in the UK is funded straight out of the public purse, there are some innovative schemes in place. One is the so-called Community Infrastructure Levy. Under this scheme, local authorities can make developers pay a certain amount of money per house they build, which is used to improve transport to that site. In Milton Keynes, for example, developers have agreed to make a standard contribution of £4,500 per residential dwelling. This scheme, says Dr Fiskin, has attracted the attention of foreign academics. What policy-makers need to be aware of is PFI comes with a number of significant risks and that effective alternatives do exist.
A combination of robust regulatory and financial planning is necessary to help reach investment-grade status

**TOTAL PUBLIC-PRIVATE PARTNERSHIP PROJECTS REGION**

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<th>Region</th>
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**RISKS AND BENEFITS OF REGULATION**

The concern with regulation is often with the risk factors it introduces. Yet the right regulation is also a means of improving operational safety, reforming investment opportunities and providing a strong framework for growth.

With macroeconomic gains in the MINT (Mexico, Indonesia, Nigeria and Turkey) countries, billions are being thrown at infrastructure development. While transport across a global industry to readily regulated, the need for investment is driving significant infrastructure development. Public and private investment for highways, expected to require more than $106 billion in need for investment is driving significant infrastructure development. While transport regulatory and financial opportunities and providing a strong framework for growth.

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There have been huge advances in recent years in the cars we drive, from stop-start technology and electric motors that can harvest energy from braking, to the latest lightweight materials which increase fuel efficiency. But we’re also seeing changes in how we drive as well as our wider driving environment.

“Intelligent mobility is the future of transport,” says Stephen Hart, leader of the Intelligent Transport Systems and Services Innovation Platform at the Technology Strategy Board, the UK’s innovation agency. “It’s all about getting emerging technologies to make journeys more efficient, more connected and smarter.”

He estimates the market for intelligent mobility is set to grow to £700 billion by 2035, creating huge opportunities for businesses to help shape the ways we travel in future. These opportunities range from systems that manage traffic flows to reduce congestion and emissions, to technologies which allow trucks or cars to drive autonomously. There will even be roads that generate energy, he says.

The case for taking action is clear - eliminating existing road congestion would add £7 billion to £8 billion to UK GDP each year, as well as reducing the impact of transport on CO2 emissions. The sector currently contributes about 24 per cent of the UK’s total CO2 footprint. While it is easy to see that cars have advanced in the last few decades, it is not so obvious what has changed on the roads they drive on. But, according to Gordon Wakeford, head of mobility at Siemens: “Lots has happened that you cannot see.”

The world has become increasingly connected, and vehicles and the transportation system are no exception. Inrix, a provider of traffic information, says 100 million vehicles around the world are already providing so-called smart data, while roads and traffic signals are among the products that are increasingly being embedded with sensors as part of the “internet of things”. There are also now large numbers of traffic-monitoring cameras and induction loops in roads to increase communication and connectivity. From a traffic perspective, this means that there is more data available to help drivers control their journeys and municipalities can control the wider flow of traffic.

Collection and analysis of that data is also improving, allowing real-time traffic-flow mapping, providing an accurate picture of the actual situation on the road and enabling appropriate decision-making. Many new cars now have SIM cards fitted that work like mobile phones, allowing them to “talk” to each other and the transport infrastructure. “If a car skids on an icy road, it can convey that information to other vehicles to warn them of the conditions, to traffic-control systems which could change signals to slow traffic and, if necessary, contact the emergency services,” says Mr Hart.

Such technology also works in less dramatic circumstances, simply providing a picture of the state of the traffic at any particular time. This kind of data has been available for some time to traffic managers, but with the connected car it can be made available to drivers, too, giving them more control over what to do. Studies show that simply giving drivers access to traffic data can cut congestion by 10 per cent. “Sitting in a traffic jam in future will largely be a matter of choice,” predicts Mr Wakeford. Given that around 8 billion litres of fuel are wasted through jams every year, the benefits are potentially significant.

Bryan Mistele, Inrix chief executive, told an International Transport Federation summit: “The information [generated by such technology] could be broadcast into millions of vehicles and devices so people can make better decisions based upon that data, and freight companies could optimise their schedules and deliveries based on real-time and predictive data, knowing what traffic will look like in not just one hour, but even one week.”

Much of the development in road transport in the last decade has focused on improving fuel consumption, light-weighting and emissions management. The advent of smart data, however, is likely to transform not simply vehicles and roads, but the management of traffic altogether.

WHAT’S AROUND THE CORNER FOR ROAD TRANSPORT?

If a car skids on an icy road, it can convey that information to other vehicles to warn them of the conditions, to traffic control systems which could change signals to slow traffic and, if necessary, contact the emergency services.
There is even the possibility of comparing cities and countries, and using the data to make more informed decisions about what to build—whether to expand road capacity or focus on mass-transit systems.

Technology could also help make better use of existing road capacity, reducing the need for new roads. The growing use of sensors will allow highway authorities to track degradation rates for roads and bridges, allowing them to deal with any problems early, potentially saving large amounts of time and money in repairs.

A promising technique that is now possible because of increased connectivity is “platooning.” Companies such as Volvo are working on the practice, which allows a line of vehicles to be linked electronically and controlled by one driver. Platoons of vehicles can travel closer together and travel at a uniform speed, reducing fuel consumption and congestion. There will also be a huge safety benefit, too. Most road traffic accidents are caused by human error, so increased autonomy will increase safety as well as reduce the time and money lost to congestion,” says Mr Hart. Volvo says platooning could be on the roads and money lost to congestion,” says Mr Hart. Volvo says platooning could be on the roads in five years.

There are even plans to use roads to generate energy. Solar Roadways has created a modular system of solar panels that can withstand even the heaviest of trucks. The company, which has raised $2.2 million from crowdfunding site Indiegogo, against an initial target of $1 million, hopes to install them on roads, car parks, driveways, pavements and cycle paths. “They pay for themselves primarily through the generation of electricity, which can power homes and businesses connected to driveways and parking lots,” the company says. There are other possibilities, including installing heating elements to keep roads snow and ice-free, built-in LEDs to create road lines and signs on the road, as well as installing electronic gates to control access to driveways, pavements and cycle paths.

In short, according to the World Economic Forum, “Technology is not the hindrance.” It adds, in a report entitled The Connected World: “In the face of rising urbanization and a lack of space to expand road networks, it is important to find new ways to use existing infrastructure, such as by changing traffic lights, for instance — to take a count of changes in traffic patterns and smooth busy journeys.” According to the World Bank, this has cut the number of traffic and road accidents as well as pollution. Serious road crashes and emissions have also fallen significantly, while the speed of public transport flows increased.

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MICHEL ADANANDO
World Bank Country Director for the
Transportation and Urban Development
Operations, Washington, DC
03/04

Either we should build to demand or manage demand in a very different question. Quite honestly, we need to do both. However, how much emphasis should be laid on each will vary depending on the level of urbanisation. When the strategy for reducing demand will vary depending on how far a city has grown.

In the developing world, where current levels of urbanisation are low, cities are expected to grow at much faster rates than the developed world. In such cases, it is important to build to meet the projected demand over the next few years. As more people move in, the travel demand will grow even if very stringent demand management measures are adopted and it is essential to build to meet a basic level of demand.

For Transportation and Development Policy (ITDP) Enviro Public Policy executive “An advanced country in not only the types of people, but also the values that it values, the motivations and distribution of technology, such as the 3D printing, open-source manufacturing and small-scale energy generation, are enabling small businesses and communities to respond to new needs by reducing the scale at which it is economically viable to carry out what were previously industrial activities – a trend recently labelled by the Economist magazine as the “Third Industrial Revolution.”

While these business models contribute to social mobility by creating business and employment opportunities, they also increase demand for travel. The future of mobility does not focus on convenience, reliability, comfort, attractiveness, affordability, flexibility, or as part of a regional regeneration plan. Just as developments in the use of technology play a role in creating this challenge, they will play a role in addressing it: through reducing the impact of existing modes of transport by switching to electric or hydrogen power for vehicles, by producing and optimising the behaviour of travel systems to prevent congestion, by optimising public transport, or as part of a regional regeneration plan. Four opinion leaders answer questions at the crossroads of transport.

**Should you build roads to satisfy demand or manage demand to address congestion, and are we beginning to see a trend towards mobility rather than transport as an end in itself?**

**What is the best approach to infrastructure investment in achieving economic growth, and are there approaches to making inroads in public transport?**

**How can we encourage cities to leverage the need for intermodality, underpinning the possibility of shaping mixed-use, compact neighbourhoods with high-quality public space. In the long-term, mobility management coupled with land-use planning has more previously accessible only to much larger organisations with international sales and distribution networks. More recent developments in the use and monetisation of technology, such as the 3D printing, open-source manufacturing and small-scale energy generation, are enabling small businesses and communities to respond to new needs by reducing the scale at which it is economically viable to carry out what were previously industrial activities – a trend recently labelled by the Economist magazine as the “Third Industrial Revolution.”

While these business models contribute to social mobility by creating business and employment opportunities, they also increase demand for travel. The future of mobility does not focus on convenience, reliability, comfort, attractiveness, affordability, flexibility, and social aspects that are central to this new paradigm is commitment to the design of new business models. The future travel solutions will still be a vital service, but mobility will be the defining driver of socioeconomic growth.

**FURTHER ON DOWN THE ROAD**

Despite the deepening tensions in economic development has been brought on by the economic and financial crisis, is emblematic of the fundamental need to break down financial channels worldwide and explore new flexible financial options for infrastructure investment. Instead, new trends are already proving that challenging institutions and some of these institutions are losing favor. Information economics can be an important tool for, for example, have motivated citizens to rebuild their perception of their infrastructure asset ownership and public goods through the use of crowdfunding and peer-to-peer financing. In a perceptual shift in relation to infrastructure also looming on the horizon? Recent advances in driving technologies, for example, suggest that a new infrastructure
Global trade flows are changing as the world economy develops and trading patterns shift to the East.
Rail could be described as the dinosaur of transportation. Even when the trains themselves are upgraded, there are millions of miles of ageing track, which cannot be easily renewed. But, when it comes to the large-scale movement of people and cargo, there is very little that can compete. The advent of the digital revolution and its application to railways could be transformational for the industry.

Rail transport is used far more for freight in larger countries such as the United States, Russia and China. In the US, for example, passenger transport accounts for less than 1 per cent of rail traffic. In Europe and Scandinavia, by comparison, only in Sweden is there more rail freight than passenger transport.

But even in the lumbering field of freight, large rises in traffic are possible. Rail traffic has doubled in Mexico since reforms began in 1995, compared to a GDP increase of around 56 per cent over the same period. Mexico’s railways now carry more freight than any railway in the European Union except Germany. The opportunity to transform the way railways in these growing markets are managed could have a significant impact in an industry which, for many, is stuck back in the 20th century.

Turning railways’ mechanical efficiency to the advantage of passenger transport and shorter-haul freight is not as straightforward as moving wagons of uncomplaining goods. Half-empty passenger trains are still less efficient than cars, as the network needs to be managed effectively. Similarly, freight trains are by and large less efficient than a fleet of efficiently operated lorries for delivering to distances of under 100 miles (160km). For large-scale and very long distances, however, rail still comes out on top. What it needs to be is smarter.

GE is making great strides in the development of what chief executive Jeff Immelt calls the “industrial internet”, an industry interpretation of the consumer “internet of things”. The principle is the same, however; it’s about using digital technology to monitor, measure and manage railways and what they carry. It’s understood that, with the millions of trains already out on the world’s tracks, transformation of the railways and trains themselves is unlikely. Any change in the sector may prove to be incremental, but in an industry as widespread as rail, productivity improvements of only 1 per cent for US haulers could translate into operational savings of $2.8 billion.

Cisco has also recognised the opportunity to use data analytics to address the challenges in rail. The combination of large-scale data analysis and industrial engineering could offer a wide range of industrial and efficiency improvements. Ian Foddering, UK chief technology officer of Cisco, says: “Connected devices in substations will be able to interact with other sensors on the network, in a standardised way. Environmental sensors will measure water-table levels, in-ground sensors will detect potential landslips – all of which will provide real-time information on the network to improve safety and rail operating efficiency. New rolling stock will be fitted with sensors on individual components, such as wheels, doors, locks, cameras, bolts and fastenings. For example, a sensor on a brake can notify crews that the brake is wearing out so they can take it out of service before it causes problems and delays.”

The problem with a failure in a train is that if it breaks down miles from anywhere, it can be a struggle to reach it, get it off the track and repair it. In the UK, the average speed of a freight train is only 20 to 25mph and even an increase of 1mph can make hundreds of millions of pounds worth of operating improvement over time. Part of the challenge is an inability to run the network smoothly – congestion in the tracks, in the yards and breakdowns can have a major impact. Operationally too, optimisation of the journey, through understanding location, weight, fuel burn, speed and so on could enable operators to save significantly on fuel costs. The challenges will be to move the rail industry into an understanding that it “is selling locomotion, not locomotives”, as GE’S Brad Surak, general manager for industrial internet programmes at the GE Software Center, says.
ENHANCING RAIL

FUTURE OF NORTH AMERICAN RAIL: CONFLICT AND HARMONY

High speed rail is no longer the challenge in the United States, as many regimes have abandoned the technology. The central debate is how to manage freight and passengers on a congested rail network, with high-risk shipments of oil and toxic chemicals now heavily regulated, says Daniel Bancroft, senior vice president at Willis in New York.

Case study

High-speed rail will be “on track” after the recession. This led to congestion and was further increased by changes in the last few years that transformed the majority of US rail transport was freight, to 100 times cheaper than using trucks. In the US, the freight railroad often owns the railroads and shippers. Shippers and network connections raised the profile of the passenger industry and gradually began increasing the number of passengers carried.

In 2012, Amtrak recorded its highest year of ridership with 31.2 million passengers, almost doubling numbers since 2001, with growth anticipated to continue. While primarily focused on US freight has increased in remaining competitive and profitable, public entities running passenger services have struggled. Experts are divided on whether to continue the use of high-speed rail as it requires significant investments and can be frustrated by parallel plans for expanding road projects. The American Society of Civil Engineers estimates that the rail industry requires $200 billion in investment by 2035 to meet projected future demand. A joint project for commuter services is planned and many are focusing on private operators such as Amtrak, a French transportation contract operator which runs and maintains the Boston and northern Virginia commuter rail services.

Knowledge, efficiency and safe operation of the transportation service will be required in the future. Finally, it is not just the challenges of congestion and demand that arise from the question of who will take on liability. Risk-assumption practices are changing and not just in the context of transportation risks. For example, a commuter service requires a high degree of rail and track maintenance to avoid accidents and high costs. Railroads and shippers and network connections raised the profile of the passenger industry and gradually began increasing the number of passengers carried. In 2012, Amtrak recorded its highest year of ridership with 31.2 million passengers, almost doubling numbers since 2001, with growth anticipated to continue. While primarily focused on US freight has increased in remaining competitive and profitable, public entities running passenger services have struggled. Experts are divided on whether to continue the use of high-speed rail as it requires significant investments and can be frustrated by parallel plans for expanding road projects. The American Society of Civil Engineers estimates that the rail industry requires $200 billion in investment by 2035 to meet projected future demand. A joint project for commuter services is planned and many are focusing on private operators such as Amtrak, a French transportation contract operator which runs and maintains the Boston and northern Virginia commuter rail services.

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Knowledge, efficiency and safe operation of the transportation service will be required in the future. Finally, it is not just the challenges of congestion and demand that arise from the question of who will take on liability. Risk-assumption practices are changing and not just in the context of transportation risks. For example, a commuter service requires a high degree of rail and track maintenance to avoid accidents and high costs. Railroads and shippers and network connections raised the profile of the passenger industry and gradually began increasing the number of passengers carried. In 2012, Amtrak recorded its highest year of ridership with 31.2 million passengers, almost doubling numbers since 2001, with growth anticipated to continue. While primarily focused on US freight has increased in remaining competitive and profitable, public entities running passenger services have struggled. Experts are divided on whether to continue the use of high-speed rail as it requires significant investments and can be frustrated by parallel plans for expanding road projects. The American Society of Civil Engineers estimates that the rail industry requires $200 billion in investment by 2035 to meet projected future demand. A joint project for commuter services is planned and many are focusing on private operators such as Amtrak, a French transportation contract operator which runs and maintains the Boston and northern Virginia commuter rail services.
The aviation industry is being driven by an urgent need to accommodate growth in demand, cope with high fuel prices and meet increasingly stringent expectations for environmental performance. Increasing air passenger numbers are being driven strongly by development in Asia and the Middle East. Between them, China and India are expected to make up 40 per cent of global economic growth by 2040.

Meanwhile, the International Civil Aviation Authority (ICAO) is under mounting pressure to agree a deal to reduce carbon dioxide emissions from aviation. It has been suggested that failure to reach agreement by its next assembly in Montreal in 2016 could see the European Union (EU) reintroduce its plan to impose emissions limits on foreign carriers.

“E-Thrust” concept, being studied seriously by the aircraft maker with partners including Rolls-Royce, represents the radical end of an innovation push, aircraft such as A350 Airbus and 787-9 Dreamliner are the immediate and practicable end of the spectrum.

Both Airbus and Boeing have been taking record orders with their combined backlog rising steadily, despite the financial crisis, to more than 11,500 units. According to market analyst Flightglobal Ascend, fewer than half of deliveries in the past five years have been to replace existing aircraft. But demand growth is only part of the equation. Flightglobal Ascend’s head of market research Bill Ineich says it is new aircraft types promising large fuel-burn reductions that have generated record orders.

One of the drivers behind this is the A350 and 787-9 which have between them a backlog of nearly 1,700 aircraft. It is smaller aircraft, though, that best highlight the drive for fuel economy and the limits of existing technology. Both Airbus and Boeing are in the process of updating their existing A320 and 737 short-haul models with a new generation of more fuel-efficient engines and some aerodynamic and electronics enhancements. Both promise to cut fuel consumption by about 15 per cent and airlines have piled in with more than 7,000 orders.

Short of something as radical as E-Thrust, those re-engineering programmes are probably the last gasp before we have to look for improved aircraft. As the industry’s Air Transport Action Group points out, jet aircraft are already 70 per cent more fuel efficient than in the 1960s.

Putting the problem in perspective, the EU’s Clean Sky aviation technology research initiative conceives that aviation accounts for 2 per cent of global greenhouse gas emissions and 6 per cent of transport emissions. But European goals set in 2000, to halve aviation CO2 emissions by 2020, within 20 per cent would come from engines. That part of the target may be in sight, but the rest has to come from “efficient aircraft” (20 to 25 per cent) and air traffic management (5 to 10 per cent).

Some savings will come by replacing the oldest aircraft, but upgrading on-board systems can also help. Honeywell and Airbus have, for example, developed a “green” taxiing system that claims it could cut fuel burn on a typical short-haul flight by 15 per cent. By putting electric, direct-drive motors in the wheels to end the inefficient use of main engines on the ground. "E-Thrust" concept, being studied seriously by the aircraft maker with partners including Rolls-Royce, represents the radical end of an innovation push, aircraft such as A350 Airbus and 787-9 Dreamliner are the immediate and practicable end of the spectrum.

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In the developing world, airport construction continues apace in order to drive trade and economic networks. In the developed world, however, the race is between the ambitions of airport operators to expand, and environmental campaigners to limit growth.

"As part of the UK’s Climate Change Act," says Mr Johnson, "we will have to reduce emissions by at least 20% per passenger in 2050 from 1990 levels. For the aviation industry this will mean, zero, we can build a new runway in the South East, but that won’t allow for any aviation growth, anymore, anywhere in the UK."

While Western politics may bear against predict and provide airport expansion policies, elsewhere runways and terminals are being built at an unprecedented rate.

Outside Europe and North America there is an aviation boom under way, as many rapidly developing economies work to house aviation, rather than road and rail, as the backbone of national transport networks.

Between 2010 and 2015, China started work on 55 new airports and some of these are huge. Beijing/Daxing International Airport is scheduled to open in 2018 and will eventually handle up to 200 million passengers a year. Indra will build up to 50 new airports by 2025. In Turkey and the Middle-East several new hubs are being built to cater for transfer traffic which, until recently, was the preserve of northern-European capital-city airports.

The study “points to Europe being bypassed as an aviation hub as well as falling behind the top expander in America and Japan,” says ACI Europe president Arnaud Feist. “These findings are alarming and they should serve as a wake-up call to our governments and EU institutions.”

Europe’s politicians are being increasingly squashed between the demands for economic growth, which promote aviation’s expansion, and the commitment to cut noise and greenhouse gases. New and older voters seem to have a fairly negative view of aviation, for many the perception is more positive. “Air is now viewed as cheaper, simpler to book and more fun than rail by the emerging ‘EasyJet generation’, so rail has a fight on its hands to become the people’s choice of transport,” says Mr Lowen, director of transport infrastructure advisors Intrata, concludes.

Other factors of air travel are gradually being more significant to the world’s top climate scientists. The Kyoto Protocol, which entered into force on February 16, 2005, has developed into something more concrete. It is a binding, legally enforceable treaty that sets binding limits on greenhouse gas emissions for industrialised countries. This means that the aviation industry is becoming subject to the same laws and regulations as any other industry.

"The aviation industry is heading east," says Henry Dent, chief executive of Climate Strategies. "The dynamic centre of the aviation industry is heading east. Boeing recently predicted about 32% of all airplane deliveries over the next 20 years will be made in Asia-Pacific, overtaking North America and Europe. The world’s fastest growing airports are now Dubai, Istanbul and Kuala Lumpur. Beijing Capital now handles 10 million more passengers a year than London Heathrow."

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Climate policy is certainly not the only strategic factor for transport choices, but it would be a high-risk approach to ignore it, says Henry Dent, chief executive of Climate Strategies.

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Shipping has been stuck in a quagmire since freight rates plummeted in late-2008. There is now a general, albeit begrudging, acceptance that record high freights before the recession will not make a comeback – and ship operators have been forced to rethink the status quo.

But shipping lines have had more to deal with than commercial risk during the latest downturn. Operational risks have multiplied over the last decade with increased piracy, a threat that had previously been remote, such as off the coast of Somalia. Dealing with the threat has also raised some questions out of the-box thinking. Tom Middle, Stenhouse Marine, senior maritime analyst, says ships that have implemented comprehensive counter-piracy measures have greatly reduced their vulnerabilities and limited the chances of being attacked. "Maritime security is a multi-dimensional and therefore should be addressed in multitude of ways, where the security during transit and operations are key concern. While suffer stakeholders to share responsibility," he says. "Correctly implemented, security plans can provide a layered response in order to facilitate intelligent route planning, detection, deterrence and defence."

Such anti-piracy strategies have been one of the great success stories of this downturn, and have become more popular than ever. Lines deploying 13,000-ton ships or more on a regular basis, or joint services, are now a common and growing strategy which has a number of positive outcomes, says Neil Dekker, former Maersk chief executive and senior maritime analyst, says ships that have implemented comprehensive counter-piracy measures have greatly reduced their vulnerabilities and limited the chances of being attacked. "Maritime security is a multi-dimensional and therefore should be addressed in multitude of ways, where the security during transit and operations are key concern. While suffer stakeholders to share responsibility," he says. "Correctly implemented, security plans can provide a layered response in order to facilitate intelligent route planning, detection, deterrence and defence."

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Strong competition is expected to come from Asia and the need to cut costs to stay competitive will lead to new alliances between suppliers to enable growth in emerging markets.
Technology has the power to drive a convergence of models to manage last-mile delivery, digital e-commerce now constitutes a large part of the evolution of the logistics market. While he says, "There is a strong movement towards collaboration and co-operation, and companies in storage and distribution networks. There is likely to be an increase in multi-modal approaches, as logistics companies will need to cover domestic and international users and stakeholders.

There are significant opportunities within the logistics industry, however. Perhaps one of the greatest is the role for logistics to play in a closed-loop, sustainable economy of the future. In the developed world, despite strong efforts to develop recycling and reuse, there is a need for innovation and new thinking. In the digital world, there is a need for new ways of thinking about how data is collected, stored, and used. A new data-driven economy could provide the infrastructure for a closed-loop economy.

In the air freight market, for example, IAG Cargo – the British Airways and Iberia cargo business – is exploring the possibilities of e-freight. This is an industry-wide programme that aims to build a paperless, end-to-end transportation process for air cargo, involving the entire air-cargo supply chain. The International Air Transport Association (IATA) has set a target for the industry to move towards 100 per cent e-freight, starting with adoption of the e-AWB or electronic air way bill. For IAG Cargo, e-freight boosts operational efficiency and reduces the cost of paper purchase, destruction and recycling, and reduces storage costs as well as freezing space.

Weinghaus expects to see a shift from Asia and the need to cut costs to stay competitive and focus on environmental impacts. While the benefits of e-freight are clear, there are challenges to overcome. The costs of transitioning to e-freight can be significant, and there are also concerns about the security of digital data.

The growth in Sino-African trade has been propelled by a surge in trade in the 2000s. Now it is well established, with China buying minerals from Africa, and Africa buying TVs, sound equipment, Sectional machinery, nuclear reactors, and much more from the Chinese. This has, in turn, fostered Chinese investment in African transportation infrastructure, such as building roads to modernise ports, roads and railways across the continent.

Africa has been one of the regions to benefit most. The Tanzanian government commissioned a report by China Mawei Engineering Holdings to build a port, special economic zone and rail network at Bagamoyo, just 70km from the commercial capital Dar es Salaam. Furthermore, China has agreed to support a $3.8-billion railway link between Kenya’s capital and the ports of Mombasa and Malindi, the first step of a line that will eventually link neighbouring Uganda, Tanzania, Burundi and South Sudan.

The deal is seen as significant not only because of the size. The line incorporates a narrow-gauge track built more than 100 years ago during British colonial rule. Then, British engineers built railway lines from the coast to the hinterland, using miles of track built more than 100 years ago during British colonial rule. The Chinese are planning to modernise the line, using heights to transport minerals and other natural resources to fuel their industrial powerhouse.

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