

# Innovation through Infrastructure Best Practices in Competitiveness Strategy



# 2015

#### Innovation through Infrastructure

Best Practices in Competitiveness Strategy

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Global Federation of Competitiveness Councils 900 17th Street, NW, Suite 700 Washington, DC 20006 USA

T 202 969 3409

www.thegfcc.org



# Innovation through Infrastructure Best Practices in Competitiveness Strategy

2015

#### **CHAIRMAN'S LETTER**



On behalf of the board of directors and members of the Global Federation of Competitiveness Councils (GFCC), I am pleased to present the 2015 report, *Innovation through Infrastructure: Best Practices in Competitiveness Strategy*.

When the GFCC was formed almost six years ago, it was predicated on the belief that the sharing of best practices among national competitiveness organization and among nations would provide benefit to all. With the release of this year's report, we have again put that belief into practice and created what we hope will be a useful tool for competitiveness organizations and initiatives around the world.

GFCC members understand more than anyone that the nexus between infrastructure, national competitiveness and economic prosperity can manifest into a higher standard of living for all. Investment in infrastructure is a way to address global economic, environmental and energy challenges; to invest in infrastructure is to invest in the future of global potential.

It is the mission of the GFCC to actively promote debate and dialogue, competition and collaboration, and innovation above all else. In this year's report we highlight outstanding examples of developing infrastructure for innovation from eight countries from all parts of the world—the United States, Ireland, The United Arab Emirates, Korea, Brazil and Russia.

*Best Practices in Competitiveness Strategy* is issued annually by the GFCC. I hope you enjoy the 2015 edition.

Sincerely,

Clindfalledy

**Charles O. Holliday, Jr.** Chairman, Bank of America Chairman, Global Federation of Competitiveness Councils

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#### **EXECUTIVE SUMMARY**

This edition of the GFCC *Best Practices in Competitiveness Strategy* report provides a broad overview of the issues related to infrastructure development, with important highlights on the possibilities for value creation. Infrastructure development is a key issue for competitiveness in developing nations as well as in advanced economies, as shown in the in the wide range of experiences included in this report.

In the United States, an estimated US\$3.6 trillion is needed to revamp and update the nation's infrastructure. That gap in needed investment is one of the key points of the case presented by the U.S. Council on Competitiveness, which has played a key role in raising awareness on the issue. Updating the national infrastructure is an essential part of the U.S. competitiveness agenda, as that case highlights.

Different infrastructure areas need to be addressed—from traditional physical infrastructures such as water, energy, sanitation and housing to modern infrastructures such as broadband and mobile access. In emerging countries, the lack of traditional infrastructure is commonly reputed as a source of competitiveness disadvantage. The emergence of new technologies has shown that traditional and 21st infrastructures can be linked—not just to fulfill existing gaps, but also to create value.

The case presented by the Eurasia Competitiveness Institute highlights the experience by Moscow in adapting new technologies for transportation. Minimizing wasted hours and improving efficiency in urban transportation can reduce economy-wide costs, while also creating opportunities for innovation, value creation and the promotion of entrepreneurship. In a similar fashion, the case presented by the Korea Economic Research Institute (KERI) highlights how investments in smart urban transportation are being developed in Korea to reduce wasted hours in urban transportation.

Korea is an example of how competitiveness strategies and infrastructure development can drive growth and prosperity. Building on infrastructure investment and manufacturing diversification, Korea has transitioned its economy towards an innovation-driven one—an achievement other countries are pursuing.

The Emirates Competitiveness Councils outlines the history of the United Arab Emirates' infrastructure-driven evolution to a knowledge-economy. The case highlights how the country is taking advantage of the investments historically made in infrastructure, the competitive advantage they created and using the assets generated to drive a new phase of its competitiveness strategy.

The Russia, Korean and Emirati cases highlight how infrastructure development is tied to societal cost structures and value structures. They also call our attention to the importance of cities and value creation through innovation. Those are the aspects covered by the remaining two cases in this report—the ones presented by the Irish National Competitiveness Council (NCC) and Brazil National Confederation of Industry (CNI). In the Irish case, city infrastructure is used as a tool for city competitiveness. More and more, cities have to compete among themselves for talent, for investment and for new businesses. The NCC has been benchmarking cities, trying to understand the factors that promote competitiveness and then promoting those findings across the country.

In Brazil, CNI is working in innovation promotion and addresses the development of the soft infrastructures needed to drive value creation, innovation and competitiveness. CNI has created and deployed the so-called Entrepreneurial Mobilization for Innovation (MEI), an initiative led by Brazilian CEOs and that has strong connections with Government, serving as a public-private dialogue and action structure that supports the design and implementation of innovation promotion strategies and initiatives.

In total, the cases included in this report cover the topics of the 2015 GFCC Annual Meeting, held in the King Abdullah Economic City, The Kingdom of Saudi Arabia. For cities, regions and nations to prosper, they need to not only invest in the physical infrastructures that promote the flow of goods, people, and services. Investments in soft infrastructure are also needed—from funding schemes and financial tools to talent pool development and public-private dialogues. The development of infrastructures is a competitiveness imperative, but within the challenge lies opportunity for growth and prosperity.

We hope you enjoy this report and that the lessons included can be meaningful for the competitiveness agendas around the globe.

#### **UNITED STATES**

#### The U.S. Infrastructure Challenge: Raising Awareness of the Need to Invest Infrastructure Week From The Capitol to Coast-to-Coast

#### Infrastructure: A Vital Driver of U.S. Economic Growth and Competitiveness

The rapid rise of the United States as an industrial and economic powerhouse was launched on a platform of infrastructure built by businesses, entrepreneurs, financiers, innovators, and government. In the 19th century, rail barons laid tracks on which oil and steel traveled to fuel America's growing industrial enterprise and the rise of American cities. The pioneers of electricity generation and distribution lit and powered U.S. businesses and factories, a game-changing development in U.S. industrialization. In the mid-20th century, engineering feats of constructing colossal dams harnessed the force of American rivers, bringing hydropower to the West. Laying the 47,000-mile U.S. interstate highway system spedup and lowered the cost of moving people and goods across the country. And the rapid development of America's new digital nervous system and high-speed networks transformed business, commerce and society, unleashing a new age of communications and information mobility.

Today, infrastructure remains the bedrock of U.S. competitiveness, the circulatory system that efficiently moves the goods, ideas, and workers that are the lifeblood of the U.S. economy. The Council on Competitiveness's 2004 landmark *National Innovation Initiative* and *Innovate America Agenda*, the result of deliberations among 500 U.S. leaders, identified three core pillars of innovation and competitiveness. One of those pillars is infrastructure.



Council on Competitiveness



Infrastructure paves the way for economic opportunity, but failure to maintain it can accrue opportunity costs. For example, in today's global business environment, companies consider many factors in deciding where they will invest, expand and locate business facilities. Infrastructure is a major factor in that decision-making. The Council's *Global Manufacturing Competitiveness Index* surveys CEOs and top executives on the global drivers of manufacturing competitiveness. Of the top ten drivers, these executives rank physical infrastructure as the 6th most important driver of competitiveness, noting the cost and process efficiencies, and productivity improvements that directly result from access to quality infrastructure. This includes supporting basic logistics for moving physical goods, and the efficient movement of energy and information through technology-based infrastructure such as smart-grids, broadband and other networks.

Infrastructure is also vital to success in expanding a country's global trade. Mega markets and an expanding middle class are emerging around the world, a significant opportunity to capture economic gains made possible by globalization. But that requires the ability to move goods quickly, efficiently and cost-competitively by air, land, and sea.

Energy infrastructure has risen on the national agenda. The United States is in the midst of an energy revolution, a historic, game-changing shale oil and gas boom that needs infrastructure to move lower cost fuels to power the U.S. economy, and modern ports to export U.S. energy resources to global markets where demand for energy is soaring. Solar power is becoming more cost-competitive, but requires new infrastructure to move it from the solar resource-rich U.S. Southwest and Southeast to regions that need it. Grid modernization would bring the country more clean energy, more reliable power, and provide it more efficiently and securely.

Infrastructure also represents a golden opportunity for U.S. innovation. Meeting the need for modern infrastructure and sustainable environments requires a host of new and scalable innovations. In the emerging economies, some cities will be built from scratch, a whiteboard for new urban concepts, infrastructure and systems. Revitalizing domestic infrastructure can spur a broad portfolio of U.S. innovations to serve infrastructure markets around the world, innovations such as sensors, software, smart grids, security and safety systems, advanced materials, data and design tools, energy efficient buildings, intelligent highways and clean power generation. This could drive job creation and new growth in a wide range of U.S. manufacturing and service businesses.

#### The U.S. Infrastructure Challenge

While infrastructure is vital to U.S. competitiveness, productivity and innovation, the World Economic Forum's *Global Competitiveness Report* ranks the U.S. infrastructure at 12th worldwide, behind U.S. competitors such as Japan, Germany, France, Spain, the U.K. and Taiwan.

Since 2012, the Council on Competitiveness has published the *Clarion Call* annually, which highlights key emerging trends and ongoing U.S. competitiveness challenges, and lays out a competitiveness agenda for policymakers. In 2014, for the first time, the Council offered letter grades on policymakers' progress (or lack thereof) on its core recommendations. In 2014, the Council gave a grade of "C" for policymakers' efforts to deploy and update a modern and resilient infrastructure across the United States.

#### 2014 Clarion Call

#### INFRASTRUCTURE

Deploy modern and resilient energy, transportation, and cyber infrastructures to encourage investment and production in the United States, and to take full advantage of domestic energy supplies sustainably.



While recent congressional action granted the immediate solvency of the Highway Trust Fund keeping important transportation projects on track and construction workers on the job, the Fund shoots back into the red come the end of 2014, unless lawmakers come up with a long-term solution.

The average rate of investment in electricity infrastructure has increased over the last decade, but an investment gap remains. Current funding trends will lead to a \$107B gap by 2020 and almost \$732B by 2040, leading to increased electricity interruptions the nation cannot afford (ASCE).

Positively, between 2013 and 2014, the United Stated moved up two places to No. 7 on the World Economic Forum Network Readiness Index–a holistic measurement and ranking of the cyber infrastructure of more than 140 countries.

The U.S. infrastructure is aging and crumbling with worn out roads, run-down transit systems, broken bridges, washed-up water facilities, and electric power systems that can't bear the load, jeopardizing the American economy.

According to the American Society of Civil Engineers (ASCE), much of the U.S. drinking water infrastructure is nearing the end of its useful life, with some 240,000 water main breaks per year. One in nine U.S. bridges are rated as structurally deficient, while the average age of more than 600,000 U.S. bridges is 42 years. The average age of the 84,000 U.S. dams is 52 years, the number of high-hazard dams is on the rise to nearly 14,000 in 2012, while the number of deficient dams is more than 4,000. Forty-two percent of America's major urban highways are congested, costing the economy an estimated \$100 billion in wasted time and fuel annually.

Every four years, ASCE publishes the U.S. infrastructure report card, modeled after the A to F school report card format, with grades based on



eight criteria: capacity, condition, funding, future need, operation and maintenance, public safety, resilience and innovation. Overall, it gives the U.S. infrastructure a grade of D+.

If not corrected, these infrastructure problems will lower productivity, raise the cost of business and trade, reduce the efficient production and consumption of goods and services, and lower returns on U.S. economic assets. This would result in long-term, serious consequences for America's economic prosperity, jobs and competitiveness.

#### ASCE U.S. infrastructure report card

Source: American Society of Civil Engineers



Each category was evaluated on the basis of capacity, condition, funding, future need, operation and maintenance, public safety, resilience, and innovation

In 2011, ASCE commissioned a series of reports estimating the economic consequences of America's crumbing infrastructure. Its Failure to Act reports estimated, for example, that deficiencies in the U.S. surface transportation system cost households and businesses nearly \$130 billion, including \$97 billion in vehicle operating costs, \$32 billion in travel time delays, \$1.2 billion in safety costs and \$590 million in environmental costs. If present trends continue, those costs could increase by 82 percent, rising to \$210 billion by 2020 and \$520 billion by 2040 (with cumulative costs mounting to \$912 billion and \$2.9 trillion by 2020 and 2040, respectively). If current trends continue, by 2020, the aging U.S. water infrastructure could cost businesses \$147 billion and U.S. households another \$59 billion, reducing the standard of living for U.S. families by almost \$900 per year by 2020. Failure to adequately invest in U.S. electricity generation, transmission and distribution could cost U.S. households \$71 billion by 2020 and \$354 billion by 2040, and cost businesses \$126 billion by 2020 and \$641 billion by 2040.

Overall, ASCE estimates that a total of \$2.75 trillion in investment is needed by 2020 but, with \$1.66 trillion in expected funding, that leaves a \$1.1 trillion investment gap. With out increased investment, infrastructure deficiencies could lead to increased costs of \$1.2 trillion to businesses and \$611 billion to households by 2020. But, by investing \$157 billion per year, the United States could protect \$3.1 trillion in GDP, \$1.1 trillion in U.S. trade value, 3.5 million jobs and \$2.4 trillion in consumer spending, as well as prevent an overall loss of more than \$3,100 per year through 2020 in disposable personal income, amounting to \$28,000 per household over ten years.



#### Infrastructure Week: A Full Court Press to Raise Awareness and Spur Action

At a time of budgetary constraint, securing large public investments in U.S. infrastructure has been challenging. However, despite fiscal pressures, the Council on Competitiveness advocates that these investments are critical to the future of U.S. competitiveness and economic growth. The Council seeks to raise awareness of the infrastructure imperative, and shift the infrastructure finance debate from one of cost to one of investment in the Nation's future.

#### Infrastructure Week 2014

To educate policy makers and the public, and urge action, the Council on Competitiveness led with Steering Committee partners—the U.S. Chamber of Commerce, the Brookings Institution's Metropolitan Policy Program, and the National Association of Manufacturers—the launch of *Infrastructure Week 2014*, an effort involving a bipartisan coalition of more than 30 organizations. The steering committee called for stakeholder groups to hold their own events during the week, collectively demonstrating that maintaining the status quo on infrastructure is not acceptable and to underscore ways to move forward.

*Infrastructure Week 2014* took place May 12-16, 2014. Business, labor, education, association, and non-profits groups organized, sponsored and hosted more than 20 events held during the week. Daily events focused on major infrastructure challenges, the consequences of inaction and the importance of interconnected infrastructure to provide a safe, secure, and competitive climate for business operations. Events also ex-



- 1. Modernize the Grid
- 2. Water is Your Business
- 3. U.S. Environmental Protection Agency
- 4. Texas A&M Transportation Institute, Urban Mobility Report
- Bureau of Labor Statistics as of March 2014
- 6. Department of Commerce
- 7. Federal Highway Administration, U.S. Department of Transportation
- 8. Cisco Virtual Networking Index
- 9. Progressive Policy Institute, "US Investment Heroes of 2013"
- 10. Sabine-Neches Navigation District
- 11. Federal Aviation Administration, NextGen
- 12. U.S. Energy Information Administration Edison Electric Institute

plored emerging solutions, innovative approaches, and best practices being developed nationwide to modernize aging infrastructure.

#### **Infrastructure Week 2015**

With the inaugural *Infrastructure Week*, the Council and its partners established a new platform for advocacy, drew many organizations into the effort, and catalyzed events across the country. With surging momentum driven by the 2014 success, Infrastructure Week 2015, held on May 11-15, was an even bigger, more highly visible endeavor. Additional organizations joined the Steering Committee including the AFL-CIO, American Society of Civil Engineers, and Building America's Future. With both top-down national leadership, and bottom-up local and regional efforts, Steering Committee organizations and affiliated stakeholder groups hosted a diverse and creative set of events in Washington, DC and in more than 15 U.S. states coast-to-coast.

*High Level Advocacy.* Drawing support from America's top leadership, Vice President Joe Biden and U.S. Transportation Secretary Anthony Foxx kicked-off the week, speaking at a live webcast event. Later in the week, during Infrastructure Advocacy Day, infrastructure advocates, mayors, state legislators, labor and manufacturing leaders converged on Capitol Hill for a full day of meetings with Members of Congress and Congressional committees. They gathered in front of the U.S. Capitol Building for a press conference, demanding that Congress take action on a longterm sustainable infrastructure bill. At a briefing held at the White House, business leaders from across the country met with senior Obama Administration officials to discuss how transportation infrastructure policies affect business.

Many of the messages heard during Infrastructure Week 2015 spoke to the link between infrastructure and economic issues. "Cities and their metros are expected to account for 92 percent of the nation's future economic growth and attract 66 million more people over the next three decades," said Oklahoma City Mayor Mick Cornett. "This growth will bring dramatic and increasing pressures on our transportation systems." Anaheim, California Mayor Tom Tait noted that two-hour commutes have become increasingly endemic to American lives, hurting productivity, pocketbooks, and guality of life. They echoed comments from Laborers' International Union of North America General President Terry O'Sullivan, and National Association of Manufacturers President and CEO Jay Timmons that the 33 consecutive short-term patches on federal infrastructure funding have hurt American manufacturers and workers competing in the global economy.

**Some Fun.** During the week, 16 of the world's most promising startups revolutionizing transportation and cities faced off in the 1776 Challenge Cup Cities and Transportation Semi-finals, competing for two \$50,000 prizes and a chance to compete in the "Elite Eight" at the Challenge Cup Global Finals. Each startup got three minutes to pitch their business, followed by another three

#### Hitting the Media

New York City Mayor Bill de Blasio and Oklahoma City Mayor Mick Cornett wrote in *The New York Times* that, "Our transportation system, once the envy of the world, is in jeopardy. Right now, congressional leaders and the Obama administration are debating the size of the Highway Trust Fund and the direction of the federal surface-transportation program. Some are content with business as usual: a short-term extension and lurching from crisis to crisis. This would fail to provide the long-term certainty needed to plan and carry out multiyear transportation projects." Both mayors carried this message to MS-NBC's Morning Joe television program.

minutes of questioning by investor and industry expert judges. They were judged on how big their potential market is, how much traction they had gotten so far, and other factors that evaluated whether the entrepreneurs had the idea and the team to scale globally.

Celebrating the two semifinalist winners, the 1776 Challenge Festival held a rooftop gala for the movers, shakers, and thought leaders of the transportation and cities world. The 1776 Challenge Festival also featured a conference on cities, transportation, and "civic tech" on the rise. It featured panels on the impact of smart cities on "have-nots," the role of CIOs in building smarter cities, and autonomous vehicles and drones.

Use of the Internet and Social Media. The Infrastructure Week 2015 coalition took significant advantage of the Internet and social media to spread the message. For example, sponsored webinars covered topics such as cost-effective steel bridge design, strategies for water and sewer utilities to communicate the value of infrastructure investments to consumers, local broadband initiatives, innovative approaches to infrastructure funding, and understanding coastal vulnerability through the lens of post-Hurricane Sandy New Jersey.

The coalition and Stand Up 4 Transportation invited cities to make their voices heard at the Rally to Rebuild America virtual town hall. Participants were invited to post their infrastructure advocacy "selfies" and messages on the Rally to Rebuild America Facebook page: https://www.facebook. com/events/1414566552197510/



About two dozen graphics were developed for sharing on social media, as well as several infographics.

Significant Success. In all, Infrastructure Week 2015 mobilized 92 affiliate participating organizations and convened 47 events held in Washington, DC and around the country. Most events were open to the public and free, and some offered light meals and beverages to encourage busy decision-makers and others to attend.

Eighty mayors from around the United States participated in their home district, while 27 mayors—including Mayors Bill De Blasio of New York City and Mick Cornett of Oklahoma City—flew to Washington to deliver their message. Throughout the week, infrastructure advocates, mayors, and state legislators held more than 300 meetings with congressional offices and the Obama Administration about the need for long-term infrastructure investment and to deliver the message that investing in infrastructure is investing in America's economy.

In addition, *Infrastructure Week 2015* received significant media attention, earning coverage from major outlets such as CNN, National Public Radio, MSNBC, and U.S. News & World Report. And with help from affiliates, engagement on twitter established 41 million impressions using #Rebuil-dRenew and #InfrastructureWeek.



The hard work of Steering Committee and affiliate organizations made for a robust and nationally recognized week of events. U.S. leaders, decisionmakers, and the public learned about the need to invest in U.S. infrastructure, about innovative and replicable approaches to infrastructure improvement, about securing infrastructure investment, and they shared best practices and lessons learned.

#### About

Founded in 1986, the Council on Competitiveness is a non-partisan leadership organization of corporate CEOs, university presidents, labor leaders and national laboratory directors committed to advancing U.S. competitiveness in the global economy and a rising standard of living for all Americans.

#### Infrastructure Week 2015 Events

In addition to webinars, workshops, panels, briefings, and advocacy missions were held in Washington, DC and coast to coast.

#### Sample of National Events

- Bridging the Infrastructure Funding Gap
- Financing 21st Century Infrastructure
- Solving the Infrastructure Crisis Through Public Private Partnerships
- Congressional Briefing: Investing in America's Flood Infrastructure
- · Rethinking Infrastructure Approvals
- Public Private Partnerships: Building on 20 Years of Experience
- National Infrastructure Challenges, State and Local Solutions
- Linking Communities Together Through Innovative Regional Transportation Planning
- Metropolitan Washington Infrastructure Financing Workshop
- Economic Competitiveness: Transit's High Value in the Knowledge Economy
- Transportation Funding and the Future of the Highway Trust Fund
- The Next Infrastructure Challenge: Connecting to a Clean, Reliable and Affordable Energy Future
- Thinking Beyond the Runway: A Look at How Airports Help Our Economy Take Off
- Long-Term Transportation Funding: Imperative to U.S. Competitiveness and Leadership in the Global Marketplace
- Building Resilience Through New Financing Vehicles

#### Sample of Events Across the United States

- New York, NY: A Vital Link: Expanding Transportation Capacity Across the Hudson
- Harrisburg, PA: Pennsylvania Infrastructure Day at the State Legislature
- Cleveland, OH: Follow the Flow: Celebrating Clean Water Investments in the Cleveland Metro
- Boston, MA: Engineers and Land Surveyors Day at the Massachusetts State House
- Chicago, IL: Broke, Broken, and Out of Time
- Pittsburgh, PA: Pittsburgh on the Move
- Sacramento, CA: 2015 American Society for Civil Engineers California Legislative Day
- New Orleans, LA: Infrastructure Delivers More Than You Think: Tour Port NOLA
- New York, NY: NationSwell Council Luncheon: Rebuilding America's Infrastructure
- Philadelphia, PA: What is the Value of Water? The Pennsylvania Story
- San Francisco, CA: 9th Annual San Francisco Public Utilities Commission Construction Contractors Breakfast
- Los Angeles, CA: Complete Streets/Competing Priorities: The 8th Annual UCLA Downtown Los Angeles Forum on Transportation, Land Use and the Environment
- Minneapolis, MN: Riding the Wave of Water Innovation
- New Windsor, NY: Hudson Valley Pattern for Progress Presents: Let's Talk Infrastructure

#### UNITED ARAB EMIRATES

## From Retail to Rockets: UAE's Infrastructure-Driven Evolution to a Knowledge-Economy

"No matter how many buildings, foundations, schools and hospitals we build, or how many bridges we raise, all these are material entities. The real spirit behind the progress is the human spirit, the able man with his intellect and capabilities."

H.H. (Late) Sheikh Zayed Founder of the United Arab Emirates

#### Abstract

Innovation and competitiveness are closely related concepts. The most competitive countries are often also the most innovative. This paper describes the United Arab Emirates' efforts to use investment in infrastructure to spur economic growth, attract and develop human capital, raise the living standards of its citizens and establish a foundation for the country to develop its innovative capacity, all of which will enable it to transition to a diversified knowledge-based economy in the coming decades.

## The UAE's Infrastructure-Focused Growth Trajectory

Over the past four decades, since its founding in 1971, the UAE has propelled itself on the world stage as one of the most dynamic economies in the world. The critical success factor that enabled the UAE's economic development has been the strategic use of oil revenues, which the country's visionary leadership has invested to create a world leading physical and social infrastructure base that will serve as a catalyst for the future develop-



Emirates Competitiveness Council

ment of the country.<sup>1</sup> In so doing, it has been able to navigate the challenge of being an exclusively natural resource economy based on oil.<sup>2</sup>

This article explores how UAE's construction of world-class infrastructure—seaports, airports and a network of expressways—enabled the movement of goods and people to and from the UAE, linking the country to the global economy. The core of the strategic policy planning by the UAE government has been to both rapidly develop the capacity of its economic and governance institutions, and build world-class physical and social infrastructure and leverage this to attract people. This approach has allowed the country to fast-

The UAE is ranked 3rd in the world for the quality of its overall infrastructure. Particular strengths include air transport, roads and ports infrastructure. Source: "Global Competitiveness Report," World Economic Forum, WEF, 2015. Web. 2015.

<sup>2</sup> Strong economic reliance on natural resources is sometimes referred to as the "natural resource curse" wherein an abundance of natural resources can serve as a hindrance rather than a facilitator for development by diminishing incentives for institutional development, and for individuals to engage in activities marked by risk-taking, innovation and entrepreneurship.

## Box 1: The Development of World-Class Seaports, Roads, Railways and Logistics Infrastructure

Beginning in 1972, the development of ports marked an important stage in the economic development of the UAE.<sup>3</sup> Against the skepticism of foreign advisors, who didn't believe that a port of the size envisioned could be constructed, or that ships would come, the late founder and ruler of Dubai, His Highness Sheikh Rashid Bin Saeed Al Maktoum, forged ahead with his plans to build Port Rashid.<sup>4</sup> The port quickly became oversubscribed, and its success paved the way for the construction of an even more ambitious port, Port Jebel Ali, which today stands as the world's largest man-made harbor, the biggest container port in the Middle East and the world's sixth largest container terminal port. Another example is the port at Fujairah that has 48 bunkering barges.<sup>5,6</sup>

Together with investments in seaports, the development of airports and a network of roads and expressways formed the backbone of trade facilitation. Today, the UAE is one of the world's preferred trade and logistics hubs. In 2015, the *World Bank Doing Business Report* ranked the UAE 8th for the ease of *Trading Across Borders*.<sup>7</sup> The UAE has become a world standard bearer for the speed and cost of importing and exporting.

Home to nearly 12,000 kilometers of roadways, road infrastructure in the UAE links each of the emirates and provides access to new development zones.<sup>8</sup> The UAE has also developed public transportation options such as the Dubai Metro and Tram systems to respond to population growth. The development of the first railway in the region is also under process. The *Etihad Railway* network will be built in phases to link the UAE's principal centers of population and industry. It will also form a vital part of the planned GCC railway network linking the UAE to Saudi Arabia in the west and to Oman in the East, eventually forming a vital part of the greater GCC railway network.<sup>9</sup>

In addition to infrastructure for land transport, the UAE is home to more than ten airports. There are ongoing developments to accommodate increasing passenger numbers and cargo volumes at airports throughout the country. According to the Airport Council International, "Dubai is the sixth busiest airport in the world in overall passenger traffic, [and has] become the world's busiest in terms of international passenger traffic ahead of London-Heathrow in 2014."<sup>10</sup>

- 3 Global rankings put the UAE 3rd for the quality of its port infrastructure and 1st for the quality of its roads. Source: "Global Competitiveness Report," World Economic Forum, WEF, 2015. Web. 2015.
- 4 ECC on opportunities Expo Bulletin: An Eye for Opportunities, Emirates Competitiveness Council, Internal Memorandum.
- 5 "Port of Fujairah Authority," Port of Fujairah, 2011. Web. 2015.
- 6 Recently, Jebel Ali won an award for the best seaport in the Middle East for the 21st year in a row at the prestigious Asian Freight, Logistics and Supply Chain Awards, AFLAS, 2015, in Hong Kong, "Jebel Ali Retains Crown as Best Seaport in the Middle East," Emirates News Agency-WAM, 15 Sept. 2015; n. pag. Print.
- 7 "Doing Business in United Arab Emirates," Doing Business in United Arab Emirates, World Bank Group, 2015. Web. 09 Sept. 2015.
- 8 "Emirates Road Named after Mohammad Bin Zayed," Gulf News, 1 Jan. 2013. Web. 09 Sept. 2015.
- 9 Dossier Expo 2020 Dubai, UAE (2014).
- 10 ACI World Releases Preliminary World Airport Traffic and Rankings for 2014–DXB Becomes Busiest Airport for International Passenger Traffic, N.p., 26 Mar. 2015. Web. 09 Sept. 2015

track its development by accessing international talent from across the skill spectrum, while upgrading the know-how of its younger generations. In this way, the UAE has overcome the challenge of being a hydrocarbon-led economy to one that is diversified with greater reliance on its knowledge resources for its development and prosperity.

#### Fast-Tracking UAE's Development

Using the World Economic Forum's (WEF) framework of economic development (Figure 1), we explore UAE's rapid development along the three stages of development.<sup>13</sup> Through its competitiveness policies, investments and infrastructure-focused evolution of its development, the UAE transformed itself from an agrarian, trading, pearl-fishing economy in the country's early years, to one poised to become one of the world's leading knowledgebased economies in the coming decades.

#### **Box 2: Infrastructure Financing**

According to the Global Infrastructure Investment Index 2014 (GIII),<sup>11</sup> Gulf countries—especially the UAE, Saudi Arabia and Qatar—are home to the most dynamic infrastructure investment markets in the Middle East. The UAE's growth and investment in economic infrastructure is ranked third globally in the GIII 2014. Economic infrastructure comprises the infrastructure that makes business activities possible such as transportation, communication, distribution and energy assets.

Oil and other government revenues contributed to the initial capital for infrastructure investment. In recent years, alternative financing mechanisms such as bond issuance (Islamic or

11 ARCADIS is a publisher of The Global Infrastructure Investment Index 2014 (GIII). GIII ranks the world's 41 most dynamic countries with the greatest potential for growth and investment in their economic infrastructure. The indicators selected are those most pertinent to investors when making an investment in infrastructure. non-Islamic) have become more prominent.<sup>12</sup> With ambitious and iconic mega projects like *Expo 2020 Dubai UAE*, private sector finance and collaboration is expected to play an increasingly important role. However, Public-Private-Partnerships (PPP) are quite common in the energy sector, especially in Abu Dhabi where they are called Independent Power Producers (IPP). In the energy sector and, more specifically oil, they are referred to as Production Sharing Agreements (PSA).

The clear vision, sound regulatory framework, maturity of the capital market, strong credit ratings and enviable taxation regimes are factors behind the success of the UAE in attracting infrastructure investments and boosting investors' confidence.

<sup>12</sup> Middle East Capital Projects & Infrastructure Survey, PWC, June 2014, and "Building Beyond Ambition," (n.d.): n. pag. 2014. Web. 2015.

<sup>13 &</sup>quot;Global Competitiveness Report," World Economic Forum, WEF, 2015. Web. 2015.



#### Figure 1: WEF's Stages of Economic Development and Relevant Policy Levers (Pillars)<sup>14</sup>

14 "Global Competitiveness Report," World Economic Forum, WEF, 2015. Web. 2015.





## Section 1: Factor-Driven Economic Development (1971–1990)

#### Investing Oil Revenue to Lay the Infrastructure Groundwork

Prior to the discovery of oil in the 1950s,<sup>16</sup> the region's economy "depended mainly on subsistence agriculture, nomadic animal husbandry, the extracting of pearls and the trade in pearls, fishing, and seafaring."<sup>17,18</sup> This period "reflected the country's limited natural resources, and resulted in a simple subsistence economy."<sup>19</sup> The discovery of oil and subsequent rise in oil prices

in the early 1970s "enabled the UAE to short-cut the usually difficult and lengthy process of saving and capital accumulation necessary for economic development."<sup>20</sup> In an effort to diversify away from an oil-based economy, oil revenues were invested in world-class roads, ports and built infrastructure that connected the seven emirates internally and the UAE to the global economy. This enabled the UAE to capitalize on its strategic geographical location, and make it a dynamic hub for the movement of goods and people from around the world.

Concurrently, steps were taken to develop the country's political, social and economic institutions, to create a stable macroeconomic environment, and invest in health, primary education and other growth-enhancing initiatives for the social wellbeing of the population. This period was characterized by a significant demand for workers to fill blue- and white-collar jobs, attracting

20 Shihab, Mohammed, "Legal Developments in the UAE." Arab Law Quarterly 7.3 (1992): 199-204. UAE Interact, 2015. Web. 2015.

<sup>15</sup> Emirates Competitiveness Council, 2015.

<sup>16</sup> By some accounts, oil was first discovered in the region what is now the UAE around 1953 (see: "The Story of UAE," Zayed University, 2015. Web. 2015), and the first cargo of crude was exported from Abu Dhabi in 1962 (see: "History," Embassy of United Arab Emirates, 2015. Web. 09 Sept. 2015 (see: http://www. uae-embassy.org/uae/history accessed 9 September 2015).

<sup>17</sup> Shihab, Mohammed, "Legal Developments in the UAE," Arab Law Quarterly 7.3 (1992): 199-204. UAE Interact, 2015. Web. 2015.

<sup>18</sup> The UAE was founded in 1971.

<sup>19</sup> Shihab, Mohammed, "Legal Developments in the UAE," Arab Law Quarterly 7.3 (1992): 199-204. UAE Interact, 2015. Web. 2015.

migrants mainly from South Asia and the greater MENA region. This rapid increase in the country's resident population, along with the investments to establish the UAE as a center for retail, tourism and trade, laid the groundwork for the country's subsequent shift into a more diversified and "efficiency-driven" economy.

## Section 2: Efficiency Driven Economic Development (1990–2010)

#### Developing the Services Sector and Launching UAE as a Hub for Trade and Talent

The second wave of investments was aimed at expanding and adapting the initial stock of infrastructure assets to accommodate the rapid growth in the resident population, and develop hubs for retail, hospitality and tourism (see Box 3). This wave also facilitated increased connectivity between the emirates and established the UAE as a key trading hub in the MENA region. At the same time, efforts were directed at upgrading the country's higher education and research institutes, creating efficiencies in goods and labor markets, modernizing the domestic financial market, and enabling the rapid adoption of technology to boost productivity, creating both a trade-oriented and domestic consumption-driven economy.<sup>21</sup>

In keeping with the government's commitment to provide first-rate social services for the wellbeing of its citizens, this period was also characterized by large-scale investments in social infrastructure, in particular schools, universities, hospitals and public housing. These investments had immediate benefits in terms of their impact on indicators of human development (see Box 4).

## Box 3: An Evolving Retail and Hospitality Sector

Dubai has one of the fastest-growing tourism sectors in the world. In the 2014 MasterCard Global Destination Cities Index, Dubai ranked 5th for the number of overnight international visitors worldwide, outranking cities such as New York, Beijing and others. Investment in retail and hospitality infrastructure has grown with the rapid increase in tourism in the UAE. Dubai alone has more than 70 malls. The WEF Travel and Tourism report ranks the UAE 34th globally for the availability of hotel rooms per 100 of the population. More than 100 hotels will be inaugurated for the upcoming Expo 2020 Dubai UAE. The world's first fully solarpowered hotel, Hotel Indigo in Sustainable City, the luxurious urban resort by Mandarin Oriental and the Bulgari Luxury Hotel are all due to debut in the emirate by 2017.22

In the category of retail infrastructure, the planned 'Mall of the World' is projected to be the world's largest mall and will have an indoor park, cultural theaters and wellness resorts with a capacity to host more than 180 million visitors annually. Also, establishing integrated retail and hospitality services is an emerging trend. For instance, the UAE has pioneered a model whereby neighborhoods are brought into malls as a way to deal with the extreme climate in the UAE. Malls such as Abu Dhabi's Galleria Mall and the Dubai Mall are examples of urban concentrations that allow people to shop, stay and pursue various 'outdoor' activities such as skiing and skating within the mall.

21 Adapted from: World Economic Forum, Stages of Economic Development / *Emirates Competitiveness Council* analysis, 2015.

<sup>22</sup> Maceda, Cleofe, "Dubai to Have 100,000 Hotel Rooms by Expo 2020," Gulf News, 28 June 2015. Web. 09 Sept. 2015.

#### Box 4: Social Infrastructure and Human Development

Ensuring happiness and wellbeing are central tenets of Vision 2021, the National Agenda and the Dubai Plan 2021. The UAE's global ranking for happiness and wellbeing is on an upward trend. The Earth Institute and the Legatum Prosperity Index respectively rank the UAE as the 20th and 28th happiest country globally, and the happiest and most prosperous among MENA countries. The Human Development Index ranks the UAE among countries with "very high human development."23 These rankings are, in large part, the consequence of a consistent investment by the UAE to develop world- class social infrastructure and implement innovative solutions for the delivery of government services to ensure the wellbeing of its citizens.24

Housing is considered to be the right of every UAE citizen. The UAE offers its citizens three types of housing assistance: home loans and grants to citizens who own a piece of land, interest-free long-loans for citizens who can repay them and free housing for low-income citizens.<sup>25</sup>

Education has long been a priority for the UAE. The UAE offers free secondary school education to all citizens and residents, and free tertiary education for UAE nationals. Schools are not only built by the government but also the private sector and cater to the needs of the country's residents. The UAE has the highest number of international schools of any country in the world.<sup>26</sup> According to Knowledge and Human Development Authority (KHDA), there are 13 different types of curriculum offered in Dubai's private schools, of which many are international schools accredited by international bodies.<sup>27</sup> The government has invested significantly in its health infrastructure. Investments in this sector include hospitals, health-care centers, clinics and school health centers. Health-care free zones in Dubai are the results of combined government and private investments. The UAE now boasts advanced healthcare infrastructure made up of well-equipped hospitals, specialist clinics and primary care centers. In recent times, Dubai has also focused on becoming a hub for medical tourism.

<sup>23 &</sup>quot;Human Development Reports, Global Launch of HDR, UNDP, 2014. Web. 09 Sept. 2015; and "Human Development Index Trends, 1980-2013," UNDP Open Data, UNDP, 2013. Web. 09 Sept. 2015.

<sup>24</sup> The UAE government places great emphasis on the use of ICT to deliver public services. Select rankings of the UAE according to the 2015 World Economic Forum's Global Information Technology Report are as follows: ICT use and government efficiency (1), impact of ICTs on access to basic services (1), government success in ICT promotion (2), importance of ICTs to government vision (1).

<sup>25 &</sup>quot;United Arab Emirates: Country Note," (n.d.): n. pag. https://www.mofa.gov. ae/ Ministry of Foreign Affairs, 2013. Web. 2015.

<sup>26</sup> The UAE Has the Highest Number of International Schools Globally, Gulf News, 9 Sept. 2015. Web. 09 Sept. 2015.

<sup>27 &</sup>quot;United Arab Emirates: Country Note." (n.d.): n. pag. https://www.mofa.gov. ae/ Ministry of Foreign Affairs, 2013. Web. 2015.

## Section 3: Innovation-driven Economic Development (2010-present)

#### From Retail to Rockets

His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the United Arab Emirates and Ruler of Dubai, has emphasized that "[w]e have to start work immediately on the third phase of development... and boost the UAE economy to enable it to enter a new era in which it will become the capital of entrepreneurship, arts, culture, and family tourism for over 2 billion people...We have a vision and high aspirations. The future does not wait for those who are hesitant. We do not anticipate the future. We build it."<sup>28</sup>

As the UAE transitions to a knowledge-based economy in the coming years, it will continue to translate its natural resource base—its "inherited prosperity"—into innovation-driven "created prosperity."<sup>29</sup> Future spending on infrastructure will be directed both at further expanding, adapting and maintaining the base of existing physical infrastructure assets, and also investing in new initiatives that will further the UAE's vision to create a knowledge-based, sustainable, highly productive and diversified economy.

Continued growth in retail, cultural and medical tourism along with mega-events such as the *Expo 2020* will motivate further infrastructure spending to expand existing and establish new retail, hospitality and health-care hubs as well as transport and logistics networks. The UAE's Vision for the year 2021 provides further impetus for large-scale investments in both physical, and telecommunications and ICT infrastructure.<sup>30</sup> These investments will enable the country to meet a set of ambitious environmental targets, and rank among the top countries in terms of the quality of its seaports

and air transport infrastructure and the performance of its logistics and telecommunications networks. The investments will also spur scientific discovery and technological advancement. In 2015 the Government of Dubai inaugurated the Mohammed Bin Rashid Space Agency which has already launched two satellites—*DubaiSat 1* and *DubaiSat 2*—is working toward completing the *KhalifaSat* in 2017 and a mission to Mars in 2021, the first such endeavor in the Arab and Islamic world.<sup>31,32</sup>

In the world's most successful and dynamic economies, competitiveness and innovation are concentrated in clusters. A country's ability to produce high-value products and services that support high wage jobs depends on the creation and strengthening of such clusters.<sup>33</sup> As part of its infrastructure development, UAE has focused on developing a number of clusters. Today, the country hosts several industrial free zone clusters that vary from renewable clean technology clusters such as Masdar, to media clusters such as Two-four 54 Media and Production in Abu Dhabi and Media City in Dubai, and a Financial Cluster in Dubai, DIFC. The UAE ranks 4th in the state of cluster development according to the WEF Global Competitiveness Report (GCR).<sup>34</sup> The combined output of the country's free zones accounts for more than half of its non-oil exports and underpins the UAE's ranking as the third most important re-export center in the world.35

<sup>28 &</sup>quot;United Arab Emirates: Country Note," (n.d.): n. pag. https://www.mofa.gov.ae/ Ministry of Foreign Affairs, 2013. Web. 2015.

<sup>29</sup> Professor Michael Porter, Harvard Business School, UAE's Competitiveness for the Third Millennium, presentation to UAE's leadership, 2010.

<sup>30 &</sup>quot;We Want to Be Among the Best Countries in the World by 2021," UAE Vision 2021, 2014. Web. 09 Sept. 2015.

<sup>31 &</sup>quot;Introduction & Milestone." *Http://mbrsc.ae/en/page/introduction*. Mohammed Bin Rashid Space Centre, n.d. Web.

<sup>32 &</sup>quot;UAE Takes First Step to Mars Mission." *Emirates Mars Mission*. Mohammed Bin Rashid Space Centre, 21 Oct. 2017. Web. 27 Sept. 2015.

<sup>33</sup> Emirates Competitiveness Council.

<sup>34 &</sup>quot;Global Competitiveness Report," World Economic Forum, WEF, 2015. Web. 2015.

<sup>35 &</sup>quot;United Arab Emirates: Country Note," (n.d.): n. pag. https://www.mofa.gov.ae/ Ministry of Foreign Affairs, 2013. Web. 2015.

# FROM RETAIL TO ROCKETS

#### UAE'S INFRASTRUCTURE-DRIVEN EVOLUTION TOWARDS A KNOWLEDGE-ECONOMY

This infographic illustrates some key infrastructure developments that have fast-tracked the United Arab Emirates' growth. Using the World Economic Forum's (WEF) framework of three stages of development, it spotlights UAE's rise since its establishment in 1971, along each of these stages from a factor-driven economy to one poised as a leading innovation-driven nation. Through the development of its physical infrastructure and institutions in the fields of education, health and social well-being, the country has evolved to become a very prosperous nation.

## FACTOR-DRIVEN ECONOMIC DEVELOPMENT (1971-1990)

In the factor-driven phase, revenues from oil provided the financing for robust infrastructure. This included world class seaports, airports, and roads as well as telecommunications systems that connected and integrated the seven emirates to the global economy.

#### EFFICIENCY-DRIVEN ECONOMIC DEVELOPMENT (1990-2010)

Another wave of investments expanded the initial infrastructure assets to accommodate the rapid growth in the resident population, and develop hubs for education, retail, hospitality and tourism. These investments supported the diversification of the economy and cemented the UAE's position as a key trading hub.

#### INNOVATION-DRIVEN (2010 ONWARDS)

In the current phase, within the context of the National Innovation Strategy, spending on infrastructure is directed at initiatives to support the UAE's vision of a knowledge-based, sustainable and diversified economy. Investments aim at spurring innovation in many spheres. In particular, it includes an ambitious space exploration program with the goal of launching a mission to Mars by 2021.



#### **Box 5: Higher Education**

His Highness Sheikh Zayed Al Nahyan, the late President of the UAE, said, "[t]he real asset of any advanced nation is its people, especially the educated ones, and the prosperity and success of the people are measured by the standard of their education." The focus on education has been a development priority since the country's inception in 1971, and the UAE's commitment to higher education is demonstrated by significant government investment accounting for 7 percent of total government budget.<sup>36</sup>

The UAE has 102 higher education institutions, and the development of educational hubs is an important aspect of the UAE's knowledge and innovation strategy.<sup>37</sup> Sharjah University City and Dubai International Academic City are clusters of tertiary institutions that are intended to make the UAE a global destination for higher education. Dubai International Academic City houses campuses of 22 international universities. INSEAD, New York University in Abu Dhabi, the French Fashion University Esmod in Dubai and the Paris-Sorbonne University in Abu Dhabi are examples of renowned institutions that have recently established a presence in the country.

#### Box 6: A New Model for Urban Development-Smart Cities

The Dubai Plan 2021 sets out a framework to adopt the model of a smart city to enable sustainable growth by balancing out the ease of mobility, taking into account environmental sustainability. Electric vehicle power and charging, advanced parking management systems and network-enabled utility metering are just some of the components of the framework.<sup>38</sup> Silicon Oasis and Masdar are examples of recent smart city developments, and the ongoing development of the Dubai Design District aims to provide a creative ecosystem incorporating smart city elements. Masdar, Mohammed bin Rashid Solar Park and Shams 1-the world's largest concentrated solar power plant-are examples of built infrastructure that pave the way for the transition to a green economy.<sup>39</sup> Masdar is a live urban space and a live test bed for a green city in the making. It includes a research institute (Masdar Institute), a graduate level university affiliated with the Massachusetts Institute of Technology (MIT), and is dedicated to innovation in clean energy. The institute is the first of its kind in the region making the UAE a frontrunner in the sector.<sup>40</sup> Masdar is not only home to the headquarters of International Renewable Energy Agency (IRENA), but is also featured in Harvard Business Review as a global best practice for its approach to the clean-tech industry.41,42

- 40 Dossier Expo 2020 Dubai, UAE, 2014.
- 41 Emirates Competitiveness Council.
- 42 Emirates Competitiveness Council, Policy in Action-The Heart of Competitiveness: Higher Education Creating the UAE's Future, Issue 06, April 2014.

36 "Ministerial Cabinet Approves 2015 Budget and Allocates 3.4 Billion Dirhams for Higher Education," N.p., 14 Oct. 2014. Web. 09 Sept. 2015.

37 Indicators of the UAE Higher Education Sector, Rep. N.p.: Center for Higher Education Data and Statistics, Ministry of Higher Education and Scientific Research, United Arab Emirates, 2012. Print.

<sup>38</sup> Dubai Design District Smart City Comments, Dubai Design District, 2014. Web. 09 Sept. 2015.

<sup>39 &</sup>quot;Masdar Launches Shams 1, the World's Largest Concentrated Solar Power Plant in Operation," Masdar, n.d. Web. 16 Sept. 2015.

#### Next Steps

The UAE's Vision 2021 statement makes a strong commitment to transitioning the UAE to a knowledge and innovation-driven economy. It envisions that by 2021—the year of the golden jubilee of the country—the UAE will "transform its economy into a model where growth is driven by knowledge and innovation."<sup>43</sup> In addition to efforts in developing resilient institutions, Vision 2021 sets out an important role for continued investment in infrastructure and in achieving sustainable environmental outcomes.<sup>44</sup> The National Innovation Strategy sets forth a plan for the UAE to become one of the most innovative countries of the world by 2021.<sup>45</sup>

#### **Ensuring Sustainability and Competitiveness**

For the UAE to continue its trajectory as a knowledge-driven economy, there will need to be a relentless drive towards its ongoing competitiveness. While the country has made great strides in diversifying its economy, oil and related industries remain a significant component (35 percent) of GDP<sup>46</sup> Therefore, broadening the country's revenue base and maintaining appropriate reserve buffers to deal with fiscal challenges as a consequence of oil-price volatility will remain a concern in the near term. A related challenge is for the country to use its natural resources more sustainably, reduce its carbon footprint, build infrastructure and create policies that lead to better environmental outcomes. There are strides being made in this direction, for example, the ongoing investment in solar parks and other solar initiatives.

#### **Attracting Global Talent**

The UAE continues to be an attractive destination for people from across the skill spectrum, and is home to more than 200 nationalities that live and work within its borders. However, it faces competition from a number of countries. If the UAE is to continue to attract the best and brightest of the internationally mobile workforce, it will have to continue to develop its physical and social infrastructure, and ensure that the country remains an oasis of opportunity and political stability.

#### Incentives for Entrepreneurship

Recognizing that a country's competitiveness is inextricably tied to innovation, and that the most competitive countries are the most innovative, the UAE also endeavors to rank among the top countries in entrepreneurship by increasing the share of GDP produced by high-tech small and medium-sized enterprises (SMEs) and expanding the share of knowledge workers in the labor force.<sup>47</sup> The UAE already ranks 7th in the world in terms of the availability of scientists and engineers, and has made a commitment to increase R&D expenditure from 0.5 percent to 1.5 percent of GDP by 2021.<sup>48,49</sup>

<sup>43 2021,</sup> Vision. (n.d.): n. pag. 2014. Web. 2015.

<sup>44 &</sup>quot;Sustainable Environment and Infrastructure," Vision 2021, 2015. Web. 2015.

<sup>45 &</sup>quot;UAE National Innovation Strategy," Astrea Mideast Internationalization UAE Made in Italy Promotion in Dubai, 20 Aug. 2015. Web. 09 Sept. 2015.

<sup>46</sup> Emirates Competitiveness Council analysis, Tanmia, UAE Ministry of Economy.

<sup>47 &</sup>quot;Competitive Knowledge Economy," Vision 2021, n.d. Web. 2015.

<sup>48 &</sup>quot;Global Competitiveness Report," World Economic Forum, WEF, 2015. Web. 2015.

<sup>49 &</sup>quot;UAE National Innovation Strategy." Astrea Mideast Internationalization UAE Made in Italy Promotion in Dubai, UAE 20 Aug. 2015. Web. 09 Sept. 2015.

#### About the authors

Omar Aziz is a Senior Project Manager at the Emirates Competitiveness Council. He was formerly a senior economic analyst at the New Zealand Treasury and a research advisor to New Zealand's Ministry of Justice. He holds an MPA from Harvard University's John F. Kennedy School of Government, an M.Sc. from Imperial College London and a B.A. (Honors) from the University of Auckland, New Zealand.

Hanan Ahli is a Project Manager in the International Organizations team at the Emirates Competiveness Council (ECC). Her previous experience includes working at Mawarid Finance, PJSC where she handled treasury deals, asset and liabilities management, shareholder relations, and internal and sharia audit processes. Hanan holds an MBA from American University of Sharjah and a Bachelor in Business Sciences with a concentration in Finance from Zayed University.

Amna Essa Al Abdulla is an Associate Project Manager in the International Organizations team at the Emirates Competitiveness Council. Prior to joining the Council, Amna worked for Emirates Foundation for Youth Development. An Emirati national, Amna holds a Bachelors degree in Applied Communication Studies from Dubai Women's College and a Masters in General Management from LUISS Guido Carli University (Rome).

Ghaya Al Midfa is a Research Analyst at the Emirates Competitiveness Council (ECC) in the Strategic Planning and Innovation department. She works on government and private sector competitiveness issues at the federal and emirate level. Ghaya is an International Studies graduate from Zayed University.

#### RUSSIA

#### **Eurasia Competitiveness Institute**

Dramatic growth of Moscow's vehicle-to-population ratio in the 2000s has overloaded the city's road network. Miles-long traffic jams have become commonplace in Moscow. In 2012-2013, Moscow was at the top of the most congested megacities analyzed in TomTom Traffic Index. Fighting traffic jams emerged as one of the main tasks of the government of Moscow. The task necessitated strong actions for modernizing the city's transportation system.

Analysis carried out in 2011 has shown that despite the relatively low vehicle-to-population ratio, the city's road network was overloaded and consistently failed to cope with the daily load. By the end of 2014, Moscow and Moscow Oblast had about 7 million registered cars, with up to 1 million cars driving on the streets during peak hours (including transit transport). What is more, the number of private cars maintained a steady growth rate of 250 thousand per year. The situation was aggravated by ineffective cargo logistics. The number of trucks on the city's streets reached 200-300 thousand.

Due to the scarcity of road space (28 m2 per 1 car in Moscow as compared to 150 m2 in Los Angeles, 140 m2 in Paris or 100 m2 in London), the regional authorities' immediate priority was to improve the efficiency of road use (coupled with long-term road construction projects). The task has required an integrated approach, involving detailed analysis and development of private car traffic management as well as public transport development.



#### **Moscow Parking Space Management**

One of the key problems of the city was unregulated car parking on the streets (with multiple lanes occupied by parked cars) obstructing the traffic, making pedestrian movement difficult and tainting the city's image. The culprit was the lack of effective enforcement mechanisms for the parking regulations (mostly limited to minor fines with low probability of imposition).

The total cost to develop a modern system of paid parking in 2013-2014 amounted to about 16 billion rubles. Key measures aimed at normalizing the city's parking were as follows:

- Phased introduction of paid parking in downtown areas;
- Strict parking regulations enforcement;
- Substantial increase in fines for parking outside of designated places;
- Paid towaway of cars parked in prohibited places.

The towaway has become the most effective measure of enforcing the parking discipline. Just 1 day after a towaway, an average car owner would have to pay around 9 thousand rubles (~\$300 at the rate for March 2013, when the measure was introduced) and lose a few hours of time to collect his or her vehicle from an impoundment lot. The fleet of specialized tow trucks was increased to 300 units, with 50 percent of vehicles owned by commercial organizations providing towaway services in accordance with government contracts and specific targets for vehicle towaway and fees collection. Budget expenditures for towaway services and impoundment lots in 2013-2014 amounted to 6.8 billion rubles.

Paid parking on the roads is based on locationspecific per-minute fees paid in several ways:

- Through parking machine;
- By SMS;
- Through a special smartphone application.

The latter option has proven to be the most popular—according to 2014 statistics, more than 65 percent of parking payments were carried out through the application (running on all popular mobile platforms). International experts appreciated the application and noted that, at the time of its launch, it was the most advanced in the world.

Parking regulations enforcement was enhanced by 300 Mobile parking enforcement cars equipped with special cameras for monitoring car parking in paid parking zones and places where parking is prohibited. Violators spotted by the cameras had to deal with significant fines and even tougher penalties for refusing to pay. The introduction of paid parking faced the following problems:

- Drivers intentionally violating parking rules, most often by screening their license plates with stickers, ribbons, etc. thus making it impossible to identify the car and penalize the violators on the basis of photos taken by the Mobile parking enforcement cars;
- Residents of homes located in the paid parking zones organized protest actions calling attention to the fact that they could not afford to pay for parking their cars on the roads every day (while the parking space in the back alleys and courtyards was not sufficient);
- In turn, car users travelling to downtown for work began to park their cars in the back alleys and courtyards to avoid parking payments;
- In some areas, it was hard to park a car due to insufficient space allocated for parking lots.

The first problem was partially solved by complementing the Mobile parking enforcement cars with controllers tasked with removing screens from the license plates. Initiative on the introduction of heavy fines for screening the license plates has not yet materialized due to legal restrictions.

To ameliorate the sharply negative public reaction observed during the first months of the new parking regulations, "resident permits" were introduced (granting free parking from 20.00 to 08.00 in the paid parking zone near one's place of residence). In addition, parking on Sundays and public holidays remained free throughout the entire city. Apart from that, residents of the city's central districts were given permission to install barriers preventing access of unauthorized cars to their back alleys and courtyards.

The results of the aforementioned measures were recorder during the first years of the system's operation. For instance, the speed of car traffic in the area of paid parking increased by an average of 12 percent, the average time of parking in the downtown fell from 6 hours to 1.5 hours, and the total number of vehicles entering the central areas (within the Garden Ring Road - the second smallest of the city's four concentric ring roads) improved by 25 percent.

To resolve this problem of insufficient paid parking lots, the city authorities have introduced the parking tariff differentiation. The fee for the first hour of parking within the Boulevard Ring Road (the one closest to the city's center) is 80 rubles (\$ 1.25), while the parking fee for the following hours is 130 rubles (\$2).

It is official that Moscow's paid parking zones will continue to expand in the near future. It will be followed by further development of differentiated tariffs based on the distance from the center of the city, time of day, duration of parking, etc. It is important to note that, in a fairly short period, the residents' negative reaction to the innovation has been replaced by cautious optimism—at the end of 2014, more than 60 percent of Muscovites supported further expansion of paid parking zones.

#### Public Transit Development

Following the experience of most global megacities, the government of Moscow was tasked with incentivizing car users to switch to public transport. By the end of 2014, public opinion surveys showed that more than 25 percent of Muscovite motorists were willing to move to the public transit if the city's public transport could satisfy their requirements for speed, comfort, and reliability.

However, at the beginning of the current decade the quality of public transit left much to be desired:

- All types of surface transit were characterized by irregular headways (unpredictable arrival time and trip duration);
- Significant congestion (20 to 40 percent above capacity during peak hours) on all modes of public transport;
- The proportion of low-floor transport with accessibility upgrades was less than 60 percent;
- Muscovites perceived public transport as a "transport for losers".

The most critical of these challenges was the irregularity of surface transit. The main problem was buses, trolleybuses, and trams becoming locked in vast traffic jams. The average speed of surface public transport during peak hours did not exceed 12 km/h, and the passengers had no confidence in the schedules. Commuters had to waste a lot of time at the stops.

The main solution was the introduction of bus lanes. As of 2014, the total length of dedicated public transit lanes was over 200 km, and the average speed of surface transit on these lanes reached 16 km/h. Nevertheless, the full potential of bus lanes has not yet been realized because of the following problems:

- Significant number of traffic interferences, especially in areas of roadway narrowing or near intersections where right turns are performed from the right lane, thus bus lane ends a few tens of meters before the intersection;
- Drivers using the bus lanes to bypass congestion in areas where there are no bus lane cameras.

The solution to the problem of private cars entering bus lanes was the installation of bus lane cameras directly on the buses, in the driver's cabin.

In addition, there have been many other changes, which considerably increased the attractiveness of public transport:

- A unified electronic card "Troika";
- Accelerated upgrading of the rolling stock (accessibility is now a mandatory requirement);
- Information boards at public transport stops showing expected time of arrival for each route;
- A smartphone application that allows the user to locate the desired bus route on a map and determine the expected time of arrival.

The "Troika" card was a copy of similar payment systems used worldwide, but now it has additional functionality, which is highly appreciated by the inhabitants of the city, such as bicycle rent and remote top up through credit card or SMS. More than 3.2 million passengers have purchased a Troika card.

In the next 5 years, Moscow's public transit system will continue developing through 52 new Metro stations, light rail transit (LRT) and bus rapid transit (BRT) systems, as well as the new unified standards of transit service for all carriers, both private and public.

## Improvement of freight traffic regulations

Unregulated freight traffic was one of the culprits behind the congestion. Each truck user had a free rein to optimize freight logistics with no regard for other road users, which was inconvenient for everyone. Most trucks were underutilized (average load factor was less than 25 percent). Moreover, Moscow is the country's largest cargo transit hub (for example, up to 65 percent of goods transshipped on Moscow freight yards of the "Russian Railways" JSC are transit). In addition to the negative impact on urban congestion, the unregulated traffic of trucks contributed to environmental deterioration and affected important wellbeing factors such as noise level and air quality in the residential areas. Existing restriction on the movement of trucks with capacity over 1 t within the Third Ring Road were void since the police failed to maintain systematical enforcement and fines were minor (500 rubles).

The main objective of the changes introduced by the government of Moscow was reducing the negative impact of freight traffic on the city's road network and the urban ecology while minimizing the potential costs to truck owners. One specific priority measure was restricting daytime access (from 6:00 AM till 10:00 PM) of large trucks (with gross vehicle mass (GVM) exceeding 12 tons) to the Moscow Ring Road and the areas inside. Along with the restrictions came the new traffic cameras for automatic enforcement and special right-of-entry permits for trucks. The permits database is now electronic, and the need for paper passes attached to the windscreen has disappeared.

Another important innovation was the introduction of "truck routes" – list of streets (selected on the basis of capacity and/or distance from residential areas) where access of trucks with a GVM of > 2.5 t is permitted. Truck movement outside of the truck routes is only allowed for local deliveries. In 2015, a pilot project was implemented in one of the eight administrative districts inside the Moscow Ring Road. In the remaining seven districts, truck routes will be implemented in 2016. The results of the pilot project implementation are significant:

- 25 percent reduction of fine particle emissions in residential areas;
- 10 percent reduction of average noise level in the vicinity of residential buildings;
- Positive feedback from the residents of the district (approximately 80 percent of the respondents recommended introducing truck routes in other districts).

Initially, the restrictions aroused considerable public outcry, especially among the owners of freight vehicles (individuals, carriers and retailers afraid of additional expenses). However, this negative backlash has been curbed by a successful information campaign for explaining and clarifying the new regulations.

Unfortunately, there is no way to enforce the truck routes by means of traffic cameras, because the current technology cannot determine whether the truck had a local delivery. Currently, the enforcement is carried out by police officers without any IT-infrastructure. Such situation precludes consistent enforcement of the new regulations. As a result, the government initiated the works on a new system of automatic truck traffic enforcement designed to track the movement of trucks on-line via GPS/GLONASS-trackers (installation of such equipment will be mandatory for all commercial truck owners). The system will allow truck routes enforcement through rapid detection of violators, and it will also provide information for citywide traffic analysis. Full-scale implementation of the system is scheduled for the end of 2016.

Few years after being introduced, the aforementioned innovations produced tangible results:

- During the previous 2 years, the share of trucks carrying transit goods declined by 6 percent;
- In 2014, the average traffic speed on the Moscow Ring Road increased by 9 percent, and during the first 6 months of 2015 it improved further by 15 percent;
- In 2010-2014, the number of overloaded trucks (an important accident risk factor) has been reduced by 2/3;
- Percentage of trucks transporting goods during night time increased from 16 percent to 20 percent.

#### **Cycling Infrastructure Development**

In 2015, 250 thousand people used the bike rent services (up 67 percent from 2014). The Department of transport's approach to citywide bicycle infrastructure development has generated some very positive feedback from Moscow's residents and tourists (especially among the younger generation). Prior to the 2012 cycling initiatives, Moscow ignored the needs of cyclists. However, during the last 3 years much was made to encourage urban cycling:

- More than 150 km of bicycle tracks were build;
- 269 bike rental points were organized (2050 bicycles);
- A website and a mobile application were created for locating bike rental point and paying the rent fees (the latter is now possible through the "Troika" card).

#### Conclusion

The government of Moscow views the transport system efficiency as one of the top priorities. Initiated in 2011, the large-scale reform of traffic regulations has already resulted in significant improvements visible to all the citizens and outside observers. It is not surprising therefore, that in 2014 Moscow left the top-3 of TomTom Traffic Index ranking, while recent surveys conducted among Muscovites revealed that more than 70 percent of Moscow's residents have endorsed the government's reform of the public transit system. In 2013-2015 the city's annual expenditures on the transport system development program amounted to around 300 billion rubles (about \$5 billion). It is anticipated that the city will maintain this rate of investment until 2020, and the program's KPIs are very ambitious:

- Average public transit speed on the bus lanes should rise to 18.2 km/h (+17.5 percent as compared to the 2014 level);
- Public transport's traffic mode share should increase to 71 percent (+10 p.p. compared to 2012).
- Public transport's accessibility rate should increase to 96 percent (a significant improvement on the current 69 percent rate);
- Transit traffic's share in the city's truck traffic should decrease to 15 percent.

#### About

Eurasia Competitiveness Institute (ECI) is a think tank with a focus on competitiveness, prosperity and economic integration in the Eurasia region. ECI works with leaders from public sector, business community and NGOs and provide insights, solutions, and a platform for engaging, forward-looking strategic dialogue and cooperation.

#### KOREA

#### Intelligent Transportation System (ITS) in Korea

## Background and development of ITS in Korea

#### Background

Source: Statistics Korea

With the remarkable economic success in the late 1960s and the 1970s, Korea experienced rapid urbanization throughout major cities. Urbanization caused a surge of population inflows as well as concentration of public and private institutions into the cities. Among others, Seoul metropolitan region became the most concentrated area in the nation encompassing 49.1 percent of the population in 2010. Due to the urbanization and economic growth a number of registered vehicles in the major cities sharply increased after 1970s.

Figure 1: Registered vehicles in Korea, 1968-2014



However, the growth rate of new roads could not catch up that of number of vehicles because of shortage of the space for roads and hike of the land price. From 1994 to 2012, the number of registered vehicles increased by 155 percent while the length of roads increased only by 43 percent.



Due to the significant increase of the number of vehicles, traffic congestion costs rapidly went up. Traffic congestion costs in 1994 were 10 trillion won (approximately US\$12.5 billion) and since then the costs have increased continuously except in 1998 (35 percent year-on-year decrease) when Korea was heavily hit by the Asian financial Crisis in 1997. In 2010, the traffic congestion costs reached about 30 trillion won, 2.43 percent of Korea's GDP.

#### **Development of ITS**

Since the 1990s, the Korean government recognized the need to apply cutting-edge technologies to its transportation system to solve the traffic congestion as well as to improve road safety and traffic condition. In the early 1990s, Advanced Traffic-Signal Control Systems and Expressway Traffic Management Systems were introduced. Advanced traffic signal control system controls traffic signals in real time, and Expressway Traffic Management Systems collects real-time traffic information and transmits it to the National Transport Information Center which then provides the traffic information to the Korean citizens free of charge through various channels. These system can be regarded as the early form of ITS.

The development of ITS in Korea breaks down into three-phases. **Phase I (before 2000)**: beginning of ITS project implementing fundamental infrastructure for ITS services, **Phase II (2001-2010)**: Activation of ITS project focusing on the development and expansion of ITS services, and **Phase III (2011-2020)**: enhancement of ITS technologies concentrating on the provision of advanced and sophisticated ITS services and introduction of a new ITS service, C-ITS (Cooperative-ITS) which is an advanced version of ITS service for reducing the mortality of traffic accident.

The Korean government formulated its very first national ITS master plan in 1997, and the Traffic System Efficiency Act—the legal foundation of the ITS project—was passed in 1999. The Act was designed to set ITS standards, facilitate the coordination of traffic-related policies and draw

Figure 2: Traffic congestion costs in Korea, 1994-2012 (million KRW) Source: Statistics Korea



up investment plans for transport facilities. In 2001, the government unveiled the National ITS Master plan for the 21st century which provides a guideline for development of ITS including goals, systems, procedures and directions along with time schedules and budgets. The National ITS Master plan for the 21st century consists of seven ITS service sectors: Advanced Traffic Management, Advanced Vehicle and Highway, Advanced Traveler Information, Advanced Public Transportation, Commercial Vehicle Operation, Advanced Traffic Information and Electronic Payment.

In 1996, the Korean government started the ITS Model Cities Project with a pilot in Kwa-chon City and set up three more model cities in Daejeon, Jeonju, and Jeju from 2000 to 2002 for developing standards for ITS architecture and implementation. Adaptive signal controls, real-time traffic information, public transportation management, and speed violation enforcement were installed in the model cities. By providing these ITS services, travel speed increased by an average of 22.6 percent and traffic congestion reduced by an average of 14.2 percent. In 2011, the 'ITS Master Plan 2020,' an updated version of the previous master plan, was formulated. The Master Plan 2020 includes key tasks for the ITS development and operation by sectors such as car-road, railway, marine, and aviation transport. Specifically the car-road transport sector aims to achieve 'accident-free safe roads,' 'easy and convenient roads,' and 'punctual and highly efficient roads.'

Various ITS services gain popularity as the ITS project makes its progress. Hi-Pass, the electronic toll collection system (ETCS), covers most part of the national expressway, and more than five million vehicles use Hi-Pass which improves traffic flow, reducing stops and gas consumption. Travelling via public transit also became more convenient with the help of passenger-friendly ITS services such as the bus information system (BIS) and the public transportation card system. The BIS provides real-time bus operation information to passengers by equipping buses with GPS (Global Positioning System). The public transportation card system, so called 'T-money', enables

#### Figure 3: Concept of Intelligent Transportation Systems in Korea



Source: Ministry of Land, Infrastructure and Transport

passengers to pay public transit fares for bus, subway and taxi with just one card. These kind of ITS services let public transportation operators provide enhanced quality of services and increased the efficiency of the public transportation system with lower costs.

## Coordination and collaboration for the ITS project

The ITS master plan advised the role of the central government, local governments and the private sector for establishing the ITS in Korea. More than 40 authorities are engaged each other including the Ministry of Science and Technology, the Ministry of Commerce, Industry and Energy, the Ministry of Information and Communication, the Ministry of Construction and Transportation and National Police Agency, the Korea Agency for Infrastructure Technology Advancement (KAIA) and other organizations which specialized in traffic and transportation.

#### Budget for the ITS Master Plan

The Ministry of Construction and Transportation estimated a cost of 8.34 trillion KRW (\$7.58 billion) for the entire plan when the ITS Master Plan for the 21st century was released in 2001. The investments were to be funded by the central government, local governments, and the private sector. 3.49 trillion KRW (\$3.17 billion) was to be funded by the central government, 3.46 trillion KRW (\$3.15 billion) by local governments, and 1.39 trillion KRW (\$1.26 billion) by the private sector.

Average annual budget spent on the ITS plan was \$0.23 billion from 2001 to 2010. Korea spent total of \$2.72 billion to implement the ITS countrywide for 12 years - the central government spent \$1.1 billion, the local governments spent \$0.86 billion and the Private sector spent 0.75 billion from 2001 to 2010. When the government unveiled the 'ITS Master plan 2020' the investment schedule was revised; a total of \$3.2 billion (an average of \$230 million annually) was promised to invest in ITS.

#### Table 1: Budget spent on the ITS in Korea, 2001-2012 (Billion USD)

	ʻ01	<b>'02</b>	'03	<b>'</b> 04	<b>'0</b> 5	<b>'</b> 06	<b>'07</b>	<b>'08</b>	'09	ʻ10	ʻ11	'12	Total
Central Government	0.09	0.09	0.07	0.08	0.17	0.09	0.09	0.09	0.14	0.08	0.07	0.07	1.10
Local Governments	0.08	0.04	0.06	0.05	0.07	0.09	0.06	0.07	0.12	0.07	0.08	0.09	0.86
Private sector	0.02	0.03	0.01	0.00	0.05	0.03	0.12	0.08	0.06	0.12	0.09	0.14	0.75
Total	0.19	0.16	0.13	0.13	0.28	0.21	0.26	0.23	0.32	0.26	0.24	0.29	2.72

Source: Ministry of Land, Infrastructure and Transport

#### Achievements

#### Improvement in Traffic congestion

By providing most appropriate traffic information to drivers, each driver can reduce driving time and cost, and national traffic congestion costs also can be reduced. As Table 2 shows below, traffic congestion costs itself steadily increased from 2000 to 2008, but costs as a percent of GDP nudged downward from 3.4 percent in 2000 to 2.8 percent in 2008. It also resulted in 11.8 trillion KRW worth of social benefits and increased an average traffic speed on roads by 15-20 percent.

#### Increase in use of Public Transportation

By adopting the bus information system and the electronic fare collection system, use of public transportation increased progressively from 2003 to 2013. Table 3 displays changes in modal shares. Modal share of 'Privately owned vehicles' was 58.3 percent in 2003, decreased by 3.6 percent, 54.7 percent in 2013 while modal share of 'Public transportation' increased from 36.8 percent to 42 percent. The modal share of 42 percent is exceptionally high compared to 30 OECD countries where an average modal share of public transportation of OECD countries was 19 percent in 2012.

#### **Overseas Exports of ITS**

Korea has specific strengths in certain areas of the ITS such as the real-time traffic information provision, electronic toll collection and provision of ITS services in public transportation. Korea is pushing forward ITS as a new export engine by taking advantage of these strengths. Since 2006, Korea records strong exports in ITS to China, Latin America, Southeast Asia, the United States and Europe. The leading Korean companies in ITS - LG CNS, SK C&C, Samsung SDS and other SMEs—continuously won overseas ITS projects which worth one billion KRW or more. Table 4 shows a list of selected overseas ITS projects in which Korean businesses participated.

#### Table 2: Traffic Congestion Costs (2000-2008)

Source: Ministry of Land, Infrastructure and Transport (Unit: million KRW, percent)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Traffic Congestion Costs	19,448	21,108	22,135	22,769	23,116	23,540	24,621	25,862	26,573
(as a percent of GDP)	(3.4)	(3.4)	(3.2)	(3.1)	(3)	(2.9)	(2.9)	(2.9)	(2.8)

#### Table 3: Modal Share in Korea (2003-2013)

Source: Ministry of Land, Infrastructure and Transport (Unit: percent)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Privately owned vehicles	58.3	58.7	59.1	59.8	54.7	53.8	55.3	54.4	56.8	55.2	54.7
Public Transportation	36.8	36.8	36.7	36.4	38.8	42.2	40.3	41.9	39.6	41.5	42
Others	4.9	4.5	4.2	3.8	6.5	4	4.4	3.7	3.6	3.3	3.3

#### Table 4: List of Overseas ITS projects

Source: Ministry of Land, Infrastructure and Transport

Year	Country	Details	Company	Value (1,000 USD)
2006	China	Automatic Fare Collection System	LG CNS	50,000
2008	Azerbaijan	Traffic Information System, Traffic Management System, BIS and etc.	SK C&C	110,000
2008	India	Automatic Fare Collection System	Samsung SDS	20,000
2011	Columbia	BIS, Public Transportation Cards System and etc.	LG CNS	300,000
2012	USA	Electronic Fare Collection System for Taxis	Samwon FA	4,200
2013	Kazakhstan	Traffic Enforcement System against Speeding and Traffic Signal Violation	Keon-a Information Technology	5,200

#### More to be Done

Through providing advanced ITS services, the overall transportation system has been improved significantly which reduces traffic congestion costs and improves citizens' quality of life. Yet, the traffic accident mortality rate is still high which implies there's more to be done for improving the accident prevention system. In that sense, enhancing the ability to control unexpected situations on the roads becomes a very important task for operating the traffic management system.

After the establishment of ITS, many local government faced operational problems. The people in charge of traffic issues in local governments and personnel at branch offices of the traffic information center did not have enough expertise to operate the ITS which unsurprisingly impeded expansion of the ITS throughout Korea. So as to achieve full operation of the ITS, it is inevitable to cultivate professional ITS personnel and set up a standard manual for operating procedures. Lastly but not least, it is essential to keep developing ITS technologies and to arrange strategic R&D plans through active industry-academic cooperation with the aim of achieving competitive edge.

#### About

Korea Economic Research Institute is Korea's leading nongovernmental research institute founded in 1981. Guided by founding principles of free market, free enterprise and free competition, KERI has successfully integrated research in both the entirety of the Korean economy and long-term and short-term prospects for corporate growth.

#### IRELAND

#### Infrastructure as a Driver of Competitiveness

#### Introduction

As a small, open, trade dependent economy, Ireland's economic growth and sustainable employment depend on the ability of businesses to trade successfully in increasingly competitive global markets. The availability of competitively priced world-class infrastructure (e.g., energy; telecommunications; transportation such as roads, public transport, airports, and seaports; and waste and water systems) and related services are critical to support competitiveness, which in turn determines the sustainability of living standards, employment, wage rates and the financing of public services. Ireland's island status reinforces the absolute necessity of ensuring world-class connectivity.

This paper summarizes the National Competitiveness Council's (NCC)<sup>1</sup> views on capital investment, making the case in support of increased public funding. It also provides a framework for prioritizing investment. Special attention is given to the importance of investing in intelligent infrastructure as a means of maximizing returns on investment. Finally, the role of cities in driving competitiveness is considered and the Council's four "cornerstones" for driving city competitiveness are briefly summarized.

#### National Competitiveness Council

#### The Challenge: Increasing Investment While Maintaining Fiscal Stability

As a result of the global financial crisis and subsequent economic recession, Irish GDP declined by approximately 8 percent between 2007 and 2009. Following a period of stabilization, the Irish economy is for now the fastest growing economy in Europe with GDP increasing by 4.8 percent in 2014, and Ireland's GDP per capita remains well above the euro area average and is the fourth highest in the OECD-32.

There was a significant reduction in public capital expenditure over the course of the economic downturn, from approximately €9bn in 2008 to €3.4bn in 2013, although weaker demand for infrastructural services (e.g., reduced road traffic, and declines in energy demand) partially mitigated the impact of this reduction.

Currently, the Irish Government is considering its Capital Investment Plan for the period 2016 to 2020.<sup>2</sup> The Council believes that there is now a need to increase public capital expenditure, and that public investment in infrastructure is prioritized and targeted at those areas that can have the greatest positive impact upon Ireland's competitiveness.

<sup>1</sup> Through the Minister for Jobs, Enterprise and Innovation, Ireland's National Competitiveness Council reports to the Taoiseach (Prime Minister) and the Government on key competitiveness issues facing the Irish economy and offers recommendations on policy actions required to enhance Ireland's competitive position. The Strategic Policy Division of the Department of Jobs, Enterprise and Innovation provides the Council with research and secretariat support.

<sup>2</sup> Land transport accounts for the bulk of publicly-funded economic infrastructure. A Strategic Framework for Investment in Land Transport is currently being developed; in August 2014, the Department of Transport, Tourism and Sport published a draft strategic framework for consultation.

There is also a vital private sector dimension to consider as many economic infrastructure areas receive little, if any, Exchequer funding – including energy, telecommunications, waste, and air and seaports infrastructure. Such investment, however, is largely beyond the scope of this paper.

#### **How Ireland Performs**

At present, Ireland is investing significantly less in capital infrastructure than many of our peers and countries against whom we compete for trade and investment. Overall, Irish investment fell by more than 50 percent between peak levels in 2007 and 2013, coinciding with the global recession, although gross fixed capital formation began to recover in 2014 (Figure 1).<sup>3</sup>

In terms of the impact of this investment, a range of international benchmarks, mostly qualitative in nature, are available comparing the stock and quality of infrastructure in Ireland against our key competitors.<sup>4</sup> The WEF's Executive Opinion Survey assesses perceptions about the quality of Ireland's infrastructure vis-à-vis perceptions in other countries (Figure 2).

#### The Policy Challenges

#### **Increasing Investment**

As the economy returns to strong growth, the Council has argued that it is time to reverse some of the cuts to the capital expenditure budget imposed over recent years. Capital investment (as a percentage of GDP) should at least mirror levels in competitor countries that are at a similar stage of infrastructural development.

Boosting investment would help address competitiveness bottlenecks, and would increase potential growth in the medium term, while also increasing aggregate demand in the short term. Investment can also contribute towards unlocking the potential of regions to grow.

#### Figure 1: Gross fixed capital formation (GFCF), current prices (percent GDP), 2014



Source: European Commission, AMECO Database

Growth in investment resumed in 2014 and further growth is forecast for 2015, likely to be driven primarily by increases in private sector investment.

In GNP terms, Irish private investment (17 percent) exceeds the euro area average (16.8 percent), while public investment (1.8 percent) is significantly below average (2.8 percent).

<sup>3</sup> Gross fixed capital formation (GFCF) measures the value of acquisitions of new or existing fixed assets by the business sector, governments and households less disposals of fixed assets. GFCF is a component of GDP, and illustrates how much of the new value added in the economy is invested rather than consumed.

<sup>4</sup> Perception-based indicators do not necessarily reflect the progress made in recent years, or take relativities between countries into account.

Ireland's likely demographic profile also necessitates an increase in investment. Ireland's population is expected to increase from 4.57 million in 2011 to between 4.85 and 5.31 million by 2026, and to between 5.0 and 6.7 million by 2046.<sup>5</sup> Additional infrastructure will be required to meet the demand generated by this larger population.

Government must also be ambitious in tapping external sources to fund infrastructure (e.g., the European Investment Bank, and institutional lenders such as pension funds, etc.).

#### Leveraging Private Sector Investment

The State has a critically important role to play in encouraging private service providers to improve infrastructure capacity and deliver more cost-effective, higher-quality services to business users. We need to ensure the right policy framework is put in place to stimulate investor confidence in long-term projects (e.g., regulatory and planning certainty), and ensure the supply chain has the certainty and tools to deliver effectively.

### Evaluating, Prioritizing and Targeting Investment

Well-targeted capital investment can influence economic growth performance by boosting long term potential output, and by improving productivity and competitiveness through efficiency gains and reduced average production costs. The Council recommends that investment be prioritized to maximize impact; while the short-term stimulus effect of capital spending is welcome, it is critical that the current review (referenced above) prioritizes investment based on long-term competitiveness gains.

#### Figure 2: Perception of the quality of overall infrastructure, 2015

Source: World Economic Forum



Ireland's score has improved (from 4.1 to 5.1) since 2010, but perceptions of quality in Ireland still lag the OECD average (5.5) and are well behind leading performers. In the IMD's World Competitiveness Yearbook 2015, Ireland's infrastructure ranking dropped 4 places to 24th.

<sup>5</sup> The CSO has produced projections of both the total population (classified by age and sex) at five-year intervals for the period 2016 to 2046 and of the total labor force (classified by age, sex and female marital status) for the years 2016, 2021 and 2026. These ranges reflect various assumptions relating to future trends in fertility, mortality, migration and labor force participation. Two sets of assumptions were chosen for fertility, one for mortality and three for migration up to the year 2046, giving six sets of results. See CSO, Population and Labour Force Projections, April 2013.

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Clarity is required regarding the evaluation process for prioritizing capital spending. The Council believes that this should be evidence-based, using a sound methodology based on benefitcost principles. The methodology, evaluation and results should be available for public scrutiny.

Targeted investment should anticipate future demands to the greatest extent possible. The development of a new national spatial strategy should also support prioritization. The range of infrastructures to support competitiveness includes:<sup>6</sup>

- Urban Transport: An efficient and integrated national transport system with adequate capacity and service levels is vital to move goods and people quickly, effectively and in environmentally sustainable ways. We need to enhance urban mobility in Dublin<sup>7</sup> and the other city regions by ensuring existing resources are focused on providing public transport services that best meet changing customer needs and provide high quality access to, from and within the main cities.
- Inter-urban Transport: A number of bottlenecks in the road network should be addressed to capture the full benefits of previous investments in road and other infrastructures. In particular, there remains a need to improve access between and around the main regional urban centers and to enhance access to the regions, critical for supporting the tourism sector.

- Telecommunications: Enhancing Ireland's international and national connectivity is critically important to support the future needs of existing and new companies in ICT, digital media and other data intensive sectors. The Council recommends that Ireland prioritize the investment required to deliver the Government's commitment to provide fiber-based broadband services to all parts of the country. In particular, it is recommended that Ireland accelerates (through market reform and, where necessary, State investment) the availability of competitively priced, advanced broadband services that offer significant upload capability (including widespread availability of symmetric services for enterprise), low latency and low contention ratios in all urban centers where they are not or will not be available in the short term. Mandatory sharing of specified infrastructures (e.g., mobile phone masts) should be considered.
- Water services: A strategic medium to long-term approach to investment planning is required, one that balances the need for quality water services with the need for cost competitiveness. In the short term, it is vital that the current water services constraints in Dublin are addressed urgently to ensure that the region has sufficient supply to meet future demand. To support regional development, Ireland needs to establish sufficient capacity to support expansion plans and new developments, especially in the large regional urban centers. In particular, providing the required water services capacity and quality levels in enterprise agency strategic sites, business parks and strategic development zones should be a priority. The Council also recommends a strong focus on reducing leakage nationally.<sup>8</sup>

<sup>6</sup> While energy and waste infrastructure is not funded directly from public capital expenditure budgets, public policy has a critical role to play in ensuring that the private sector invests in a timely manner to ensure that the current and future needs of enterprise are met. Energy investment is required to ensure adequate regional/local spare network capacity, especially in the main urban centers. Greater interconnection is also a priority, while a range of integrated and diversified waste treatment options are required along the waste hierarchy.

<sup>7</sup> Within Dublin, delivery of the actions outlined in the National Transport Authority's investment plan for the Greater Dublin Area should be prioritized to fully capture the benefits of existing infrastructure (e.g., Luas Cross City and the re-opening of the Phoenix Park Tunnel).

<sup>8</sup> Water will be privately funded in the medium term when Irish Water becomes self-funding.

• *Housing:* In the context of rapidly increasing rents and residential property prices, an expansion in the supply of housing is urgently required, particularly in Dublin. This will help alleviate pressures elsewhere in the housing market. Innovative approaches to funding (including off-balance sheet funding) should be developed, and mechanisms to harness private institutional and charitable investment in social housing should be considered, in addition to enhanced direct provision.

#### NCC Focus: Maximizing Returns on Investment Through Intelligent Infrastructure

The NCC believes that the public capital program should recognize the impact that investment in intelligent infrastructure can have on national competitiveness.<sup>9</sup>

The significant economic challenges facing Ireland and the need to address infrastructure deficits have focused attention on the potential for using smart technology to fulfill infrastructure objectives. By optimizing the capacity of assets that are already in place as well as future assets, intelligent infrastructure can play a substantial role in reducing the burden on the Exchequer and freeing up scarce capital resources.

In addition to reducing the need for capital expenditure, smart technology can be used to create revenue-raising opportunities for the Exchequer, and improve national competitiveness through reduced business costs (e.g., less congestion) and more productive use of resources.

## Delivering on the Potential of Intelligent Infrastructure

To fully realize the benefits of investment in intelligent infrastructure, a range of barriers must be overcome. At a broad level, the Council recommends that:

- Policymakers explicitly outline the potential for intelligent infrastructures to maximize the value of existing infrastructure and its potential to enhance the value of future investments.
- An assessment of the potential for intelligent infrastructure to substitute for or complement traditional capital investment be undertaken as part of public capital investment appraisal processes.
- Given the cross-infrastructural synergies of smart technology, a more integrated approach to infrastructure planning would facilitate improved efficiency, effectiveness and competitiveness.
- Consumer concerns regarding privacy, data security and costs be addressed through cooperation among consumer and citizens' rights groups, infrastructure providers, utility regulators and the Commissioner for Data Protection.
- The provision of fiber-based broadband services to all parts of the country is progressed to support intelligent infrastructure deployment.

<sup>9</sup> For a more indepth discussion of this topic, see Forfás, Intelligent Infrastructure: Delivering the Competitiveness Benefits and Enterprise Opportunities, 2011.

#### What is Intelligent Infrastructure?

"Intelligent infrastructure" or "smart infrastructure" is the application of technology to deliver a more effective and efficient infrastructure service. It uses a layer of technologies, which can be embedded in the design of new infrastructure or applied to existing infrastructure.

Intelligent infrastructure can apply to a systemwide application, for example, the development of smart electricity grids. It can also be targeted at a specific element within the infrastructure chain, for example, the use of sensors to detect the presence of a toxin at a landfill site.

While the ability to apply technology to infrastructure assets has existed for some time, rapid advancements in sensor, communications and analytical technologies mean that intelligent infrastructure is a relatively new phenomenon. Research, development and deployment of smart technologies are ongoing in a wide range of infrastructures.

Across the world, policymakers, infrastructure providers, researchers and enterprises are working to develop solutions that use advanced technologies to address infrastructure challenges in more efficient ways. It is not surprising, however, that infrastructure solutions usually emerge in response to a particular issue or deficit faced by a country or region. For example, faced with crippling congestion, Singapore has become a world leader in intelligent transport systems.

## NCC Focus: Putting Cities on the Competitiveness Map

Cities play an increasingly crucial role in enhancing competitiveness in modern knowledge-based economies.<sup>10</sup> As people become more mobile and firms more selective about where they locate, competitive cities have emerged as magnets for talent and investment.

The majority of the population, businesses, jobs, innovation systems and higher education institutions are concentrated within Ireland's cities and their hinterlands. They are hubs of international trade, transport and communications, and attract higher numbers of immigrants and tourists than other more rural areas. Our cities, therefore, play a critical role in driving national competitiveness and national income levels.

The concentration of more and more of the Irish population, enterprise activity, innovation networks and cultural amenities in cities and their hinterlands, as well as the presence of higher education institutions, has unfortunately created a sense of ambivalence about the central role our cities play in supporting national economic growth and standards of living.

The National Competitiveness Council has played a key role in the debate about the role of cities, arguing that it is critical that both national and regional policies support the development of Dublin (the capital city) and Ireland's other main cities. Central to this work has been the idea that the development of our cities is fully understood as being in the national interest. The challenge is not the redistribution of resources between

10 The NCC has previously written on cities in more detail in NCC, Our Cities: Drivers of National Competitiveness, April 2009. Dublin and the rest of the country, but rather of enhancing the competitive advantages of Dublin and other major urban centers as drivers of overall national prosperity, and contributors to social cohesion and wellbeing.

In seeking to enhance our understanding of the role they play driving competitiveness, the Council has outlined four cornerstones for city competitiveness, each of which is outlined briefly below.

#### Enterprise

The development of an enterprising city is influenced by a sectoral mix of firms weighted towards high value industries, the availability of a skilled workforce and competitive costs of doing business. As Ireland has targeted high-tech, highvalue internationally trading sectors, Irish cities have developed sectoral specialisms, for example, medical technology in Galway, software and financial services in Dublin, pharmaceuticals and chemicals in Cork, and ICT hardware in Limerick.

Given the small size of Irish cities and their proximity to one another, the NCC believes that Irish cities should endeavour to have a relatively wide sectoral mix. Building on significant progress in recent decades, further potential exists to enhance the depth of local education and innovation systems in Irish cities. Despite improvements, third level institutions in Irish cites are not yet among the best in the world and there are significant disparities in secondary level student performance among neighborhoods within our cities.

#### Connectivity

Successful cities have the physical and electronic infrastructure to facilitate trade and business, and to move goods, services and people quickly, efficiently and in environmentally sustainable ways. External connections, such as airports, seaports and adequate internal road and public transport are vital. The airport and seaport in Dublin are significant national assets. The completion of the inter-urban motorway network will improve travel times and the connectivity of national air and seaports.

However, Irish cities are highly car dependent and average peak hour speeds in Dublin are very low by international standards. It is critical that infrastructure systems are integrated and that ICT is utilized.

#### Sustainability

A sustainable urban environment enhances the competitive performance of our cities in a variety of areas. It improves quality of life, maximizes land use potential, attracts more overseas talent and tourists, and reduces negative environmental costs. Policy areas of specific importance to ensure sustainable city competitiveness include land use policy and planning, and transport and environmental sustainability.

Much of the city development of recent years has been extremely positive, for example, modernizing and revitalizing previously dilapidated and abandoned areas in the center of cities. However, urban development has been accompanied by sprawl, as growing numbers of people have located in expanding commuter belts around our cities. Poor planning decisions and a failure to properly coordinate private development with public infrastructure and service needs have affected the quality of life and competitiveness of our cities. This has also previously resulted in excessively high house prices, severe traffic congestion, long commuting times, and increased pressure on local authority services such as water and waste. These risks can re-emerge as the economy returns to growth.

#### Attractiveness and Inclusiveness

Cities are competing for citizens, workers and investment. Competitive cities are attractive and inclusive, and these characteristics are nurtured when disparities are minimized and social exclusion is avoided. A cohesive society enables all of its members to be active participants and contributors, enabling individuals to achieve their goals and communities to exploit their economic and social potential. It also reduces criminality and negative reputational effects. Vibrant recreational, entertainment, cultural and sporting infrastructures are also key to enhancing city attractiveness. Irish cities perform relatively well in terms of international benchmarks.

#### About the author

Conor Hand is an Economist in the Strategic Policy Division (SPD), Department of Jobs, Enterprise and Innovation. The SPD provides executive, research and analytical support to the National Competitiveness Council. Previously Conor worked as an economist in the Competitiveness Department in Forfás (Ireland's National Policy Advisory Board for enterprise, trade, science, technology and innovation), where he was engaged in projects relating to migration policy, labour market affairs and international competitiveness. Conor has also served on the secretariat of both the Expert Group on Future Skills Needs and the Management Development Council, and has co-authored a range of reports including the National Skills Strategy, Catching The Wave: A Services Strategy for Ireland, and Making It Happen: Growing Enterprise for Ireland.

#### BRAZIL

#### The Brazilian Entrepreneurial Mobilization for Innovation-MEI: A Successful Case in Innovation Governance

#### A Brief Introduction to Brazil's Innovation System

Brazil's innovation system is relatively young compared to similarly sized economies. Brazil's gross domestic product (GDP) is among the 10 largest in the world, behind the United States, China, Japan and leading European Union countries; and ahead of Russia, Korea and India. Brazil has legislated on science and technology development since the 1930s, and several industrial sectors important from a national security perspectivesuch as oil and gas extraction, mining, automotive and aircraft manufacturing-were established as statist monopolies mainly under military regimes. It was not until Brazil had moved toward democracy in the 1980s and gradually opened its markets to trade in the 1990s that the government turned its attention to global competitiveness and innovation issues (IDA, 2013).

The first major funding program targeting innovation went into effect in 1999 (Sectoral Funds). Since then, several policies and strategic plans have been implemented that target both specific technology sectors as well as the framework conditions that support innovation. Going by commonly accepted indicators, innovation in Brazil is low compared to that of peer countries; the country ranks 99th in the World Economic Forum's Global Innovation Index 2015.1 behind Russia and Greece, due to a complex but interrelated set of conditions. Despite this low ranking, Brazil leads other South American countries in the science and technology arena with a strong manufacturing sector and an economy that accounts for close to 60 percent of the region's GDP (IDA, 2013).





As IDA (2013) suggests, when it comes specifically to government's role in innovation, Brazil has leveraged its rich and plentiful natural resources to build strong science and technology driven sectors with state support. Recent examples are the development of the biofuels industry and research into pre-salt oil reserves. Some industry leaders in these sectors are Petrobras (oil and gas), Embrapa (agriculture) and Embraer (aircraft manufacturing). While public funding for research has increased over the past decade, the private economy has largely not exploited public R&D resources to its benefit. In addition, a cultural bias toward pure research has traditionally diverted the majority of gualified science and technology researchers to academia, where they have little interaction with industry, a trend that policies have not been able to alter thus far. As a result, basic research is not being transitioned out of the universities. Recent laws tried to address these problems, but it may take a decade or more for them to have an effect (and if they are maintained).

State involvement in industrial and innovation policy is significant in Brazil. Public policies and support to science, technology and innovation have expanded, with substantial increases in public funding, policy instruments and programs.

<sup>1</sup> https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf.

#### Figure 1: R&D as Percent of GDP

Source: OECD STI Scoreboard (2014), World Bank Development Indicators 2014 and RICYT (Red de Indicadores en Ciencia y Tecnología)



For example, the levels of public support to innovation (particularly to R&D activities) as share of GDP places Brazil among the countries with the highest levels of governmental support (IPEA/ OECD, 2015).

This situation calls for a review of the effectiveness, efficiency and relevance of current policy mechanisms and, more broadly, of the whole policy making framework for innovation. In spite of steady increases in public support to science, technology and innovation, the Brazilian innovation policy model remains "supply-oriented" with a major focus on the promotion of science and technology competencies in the public sector. Although demand-side policies have multiplied to promote innovation in the business sector and several appear to be effective, these initiatives have had limited effect, reaching a very limited number of companies (IPEA/OECD, 2015). Figure 2 ilustrates the discrepancies between public expenditures on R&D and the apropriation of these resources by Brazilian companies.

Brazil's governance framework for implementing and coordinating science, technology and innovation policies is complex, and many diverse ministries and agencies are dedicated to science and technology problem solving, and not rarely acumulate trade and commerce coordination

#### Figure 2: Brazil's Expenditure on R&D

Source: MCTI. Valores correntes em milhões de R\$



Brazil's total expenditure on R&D has grown 4.3 times between years 2000 and 2012

Public Expenditure

competencies. Sectoral driven ministries and other public institutions are also engaged in science, technology and innovation activities (as in more developed economies) and frequently face shocks with their many peers. In addition, Brazil's individual states have significant autonomy over their science, technology and innovation policies, and have created their own funding agencies and university and research institutions (Rodríguez et al., 2008).

To conclude, there is an evident gap between the policy efforts undertaken and the resulting innovation performance. Brazil's economic model based on natural resources and low-value added activities is reaching its limits. Productivity has not been improving at the same speed as output growth, and lags behind peer and developed economies. In other words, Brazil is not efficient in the use of productive resources and continues depending on primary industries. Brazil is at crossroads and needs to generate new sources of growth based on knowledge and innovation, competencies that drive global competitiveness. In doing so, Brazil has the challenge of expanding social achievements of the last decade and creating a more inclusive growth with enhanced opportunities for employment and income growth nationwide (IPEA/OECD, 2015).

#### Figure 3: Distribution of Public Expenditures on R&D by Socioeconomic Objective Source: MCTI.

## Only 35% of public resources of R&D are allocated to mission driven research



#### Distribution of Public Expenditures on R&D by socioeconomic objective

#### Origin of the Brazilian Entrepreneurial Mobilization for Innovatio-MEI

In which ways should policies for innovation in Brazil be improved? Although policy trends demonstrate that attention to innovation has become increasingly prominent in the agenda of government actions, the numbers still appear insufficient. Are policies for innovation mainly deficient in terms of design or implementation? To what extent do governance (and cultural) aspects and deficiencies in institutional incentives (regulatory frameworks) prevent investments in public research (science and technology institutions) from making a meaningful contribution to national innovation? Is the current combination of policies to promote business innovation the most relevant to business needs? How can support for innovation policies best be expanded to meet the needs of a wider range of firms, particularly small and medium-sized enterprises? In which ways

should policies for innovation be improved? These are some of the key questions identified in a very recent study undertaken by IPEA and OECD (2015), but they refer to the same doubts a group of leading entrepreneurs raised seven years ago. Under the leadership of the National Industry Confederation (CNI), this group founded the Brazilian Entrepreneurial Mobilization for Innovation-MEI as an initiative to respond and address these issues in a new governance model.

By 2008, as mentioned, the Brazilian government had driven strong efforts to implement innovation policies and establish different forums through which these policies should be formulated, monitored and assessed. The multiplicity of these forums, however, was one of the big barriers to the efficiency and efficacy of a legitimate movement towards national competitiveness. MEI's central challenges were to grow the number of innovative companies and promote the effectiveness of innovation policies. To ensure cohesion and leadership over the agenda, as well as broad representation, CEOs and founders of companies such as Grupo Ultra, Natura, Embraer, Braskem, GE Brazil, IBM Brazil, Altus, Totvs, EMS, and Cristália, among other important stakeholders, first met in 2008 to establish what today is considered to be the most successful publicprivate forum on innovation.

Today, more than 120 companies, represented directly by their CEOs or Chairmen, make up part of the group, which has met regularly every three months and been working on focused themes and consistent agenda. Supported by a team of nearly 20 experts, MEI is in constant interaction with government players, especially when the group is proposing specific policies. The National Development Bank (BNDES), the National Agency for Innovation (FINEP), the Ministry of Science, Technology and Innovation (MCTI), and the Ministry of Development, Industry and Foreign Trade (MDIC) are frequently part of the discussions and main interlocutors of MEI. On more than one occasion, President Roussef attended the MEI meetings in recognition of the relevance of the group.

Some of the elements that contribute to MEI success include: having meetings on a regular basis, requiring representation of companies from their highest level, reiterating the mission of the forum as an arena for collective and positive construction, setting and reviewing priorities every year, counting on support from top experts, creating bridges between the strategic and tactical levels of participant companies through technical dialogues, reinforcing the private sector role in the competitiveness environment through concrete initiatives and keeping close to legislative power.

#### Figure 4: Brazilian Innovation Ecosystem Timeline

Source: CNI, 2015.



As to the priority agenda, the evolution of the themes defined as critical over the years is remarkable and, at the same time, demonstrates the maturing of the group of MEI members. Instead of choosing more themes to address, MEI leaders have increasingly opted for a lean, but very pragmatic agenda. Today, there are six priority areas. The themes and respective goals are illustrated in Figure 5.

#### The Most Impactful Outcomes

During the first years (2008-2010), most MEI efforts were dedicated to mobilizing more entrepreneurs and government representatives for the purpose of evaluating public policies and defining priorities. But consolidating a speech and, more important, developing comprehension of innovation's relevance to the country's economic performance were not trivial. One should not attribute the incorporation of these ideas to a single player or forum, as it was a consequence of a complex movement involving hundreds of stakeholders in the private and public sectors. Yet, MEI catalyzed various demands and, with its strong representation, led concrete and unprecedented actions toward the improvement of the Brazilian innovation environment.

As understanding about the need to incorporate innovation in the companies' and the country's strategy for sustainable growth advanced, MEI focused its attention on two main themes: environmental improvements and in-company initiatives.

#### Figure 5: MEI Agenda

Source: CNI, 2015.

	PRIORITY THEMES	MAIN GOALS
Ĩ	INNOVATION REGULATORYFRAMEWORK	<ul> <li>To foster investments in R&amp;D</li> <li>To build a better environment for investments in R&amp;D and innovation</li> </ul>
	INNOVATION INSTITUTIONAL FRAMEWORK	<ul> <li>To build better governance arrangements for innovation</li> <li>Strenghening of Monitoring and Assessment</li> </ul>
5)))	FINANCING TO INNOVATION	<ul> <li>To provide better risk sharing mechanisms and stability of resources</li> <li>To reformulate innovation public funding system, starting from FNDCT</li> </ul>
	GLOBAL INSERTION TROUGH INNOVATION	<ul> <li>To access frontier technologies</li> <li>To atract R&amp;D centers for the development of future technologies</li> </ul>
	HUMAN RESOURCES FOR INNOVATION	<ul> <li>To increase business productivity</li> <li>To enhance quality and capability of innovation</li> </ul>
	INNOVATION FOR SMES AND STARTUPS	<ul><li>To foster entrepreneurship for the development of new markets and solutions</li><li>To foster venture capital and seed money</li></ul>

In regard to the legal, institutional and financial framework, during these seven years, MEI supported and contributed to the launching of initiatives such as:

- "Inova Empresa Plan," public policy under the management of BNDES<sup>2</sup> and FINEP,<sup>3</sup> with objectives to promote innovation and increase productivity of Brazilian industry by decentralizing credit and subsidies, sharing technological risk (government and companies) and strengthening the relationship between companies, universities and R&D institutions. When launched, the total budget for "Inova Empresa" was about US\$ 15 billion;
- The Brazilian Company for Industrial Research and Innovation, EMBRAPII, created to encourage industrial R&D projects in partnership with R&D institutions. When launched, the budget of EMBRAPII was about US\$ 450 milion, to be spent in five years;
- SENAI<sup>4</sup> Program to Support Brazilian Industry Competitiveness, which will broaden and modernize SENAI's physical infrastructure and knowledge assets. By 2017, there will be 26 SENAI Innovation Institutes and 61 SENAI Technology Institutes (specialized in several scientific fields defined according to pre-identified technological challenges);
- CNI-SEBRAE agreement to foster innovation in small businesses, a partnership that includes establishing governance arrangements in 25 states to extend MEI endeavors to each region of the country and grant financial resources to leverage small business capabilities;
- "Inova Talentos," an initiative led by CNI, with the goal of helping Brazilian industry find a highly skilled workforce to implement pre-approved innovation projects funded with public resources. To date, Inova Talentos has supported 291 companies that submitted 630 innovation projects and hosted 968 fellows; and

 "Inova Global," another initiative led by CNI, which supports Brazilian industry sending their employees to world class R&D instituions around the globe.

Considering its role of providing high quality information to decision makers, MEI also has become a kind of think tank and published several studies on innovation management, intellectual property protection, innovation in value chains, successful cases in small businesses, STEM bottlenecks, and the Brazilian legal, institutional and financial framework for innovation.<sup>5</sup>

To recognize best practices in the private sector, MEI launched the National Innovation Award that, in four editions, has awarded 41 companies (distributed in the five regions of the country) and supported them in training activities.

Finally, MEI oversees the largest and most important event about innovation in Brazil: the Brazilian Industry Innovation Summit, which takes place every two years. The last Summit (2015) attracted more than 2,000 attendees and featured some of the most prominent speakers who addressed regulations on innovation, governance, financing, intellectual property, industrial use of biodiversity and global technology trends. The main purpose of the Summit is to regularly gather experts from around the world to guide the debates about innovation and push Brazil to higher levels of performance.

Beyond these outcomes, perhaps one of the most remarkable results of MEI is to keep growing and engaging entrepreneurial leaders, who increasingly seek to dedicate part of their busy schedule to build a better and more competitive country.

<sup>2</sup> National Development Bank.

<sup>3</sup> National Agency for Innovation.

<sup>4</sup> National Service of Industrial Training.

<sup>5</sup> All of them can be accessed through the link: http://www.portaldaindustria.com. br/cni/canal/mobilizacao-empresarial-inovacao-publicacoes/

#### **Future Challenges**

Taking into account the political and economic environment, the MEI assumes an even more relevant role in boosting the country's competitiveness.

Considering that regulatory, financial and governance conditions for innovation are decisive factors affecting economic growth and competitiveness, the relevance of fostering better learning opportunities about global and game-changing technologies and, especially, the need to link broader business demands to innovation policies, this entrepreneurial forum is positioned to lead some of the most significant initiatives to drive Brazil's economy and business environment back on track.

Indeed, one of the most promising efforts is based on international partnerships, since global companies require global connections. Thus, the Global Federation of Competitiveness Councils (GFCC) is a key partner due to its powerful network, identification and promotion of best practices in innovation and to the opportunities it creates for cutting edge cooperation in knowledge intensive fields.

#### Figure 6: MEI Strategic Map

Source: CNI, 2015.



Brazil

In the coming years, MEI's main challenges include: driving efforts to maintain the framework for innovation; defending mission driven institutional structures; mobilizing more companies, universities and third sector institutions around the sustainable development agenda; helping the government in the formulation and assessment of public policies (through both fully sponsored studies and consultations with entrepreneurs); and forging international agreements to support corporations in catching-up technologically. Below, the MEI Strategic Map outlines the forum's path for the near future.

In this strategy, MEI serves as a mechanism to help drive Brazilian industry's transition to new pathways. The strength of the national industry, proven in so many and so varied adverse conditions, must be redirected to establishing an agenda capable of matching the diversity and fast pace of the domestic market with the opportunities of the global economy. Innovation is seen by the group as the way to enable effective solutions and thereby enhance competitiveness. Innovation fosters innovation. Once this virtuous cycle is established, our companies will develop enough competency and confidence to face any conjuncture, be it good or not.

#### References

CNI, 2015. "Agenda MEI 2015-O Estado da Inovação no Brasil"

http://arquivos.portaldaindustria.com.br/app/conteudo\_24/2014/08/21/506/AGENDA\_MEI2015\_WEB2.pdf

CNI, 2015. "Innovation is action. 22 business cases of small, medium and large companies"

http://arquivos.portaldaindustria.com.br/app/conteudo\_24/2015/06/11/540/Book\_EN\_web.pdf

Institute for Defense Analyses (IDA). Innovations Policy of Brazil. Paper P-5039, September, 2013.

https://www.ida.org/~/media/Corporate/Files/Publications/STPIPubs/2014/ida-p-5039.ashx

IPEA; OECD. Conditions for innovation in Brazil: a review of key issues and policy challenges. Background Paper for the Workshop on Innovation for Productivity Growth in Brazil. July 1-2, Brasília, 2015.

https://www.innovationpolicyplatform.org/system/files/ CONDITIONS%20FOR%20INNOVATION%20IN%20BRA-ZIL\_Background%20Paper\_Website\_2\_0.pdf

Rodríguez, A.; Dahlman, C. J.; Salmi, J. Knowledge and Innovation for Competitiveness in Brazil: World Bank Publications. 2008.

World Bank, 2014. "GDP ranking"

http://databank.worldbank.org/data/download/GDP.pdf

World Economic Forum, 2015. "The Global Innovation Index 2015"

https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf

#### About

The National Industry Confederation (CNI) represents and defends Brazilian Industry's interests before federal, state and municipal governments through a nationwide network of private entities responsible for initiatives to support industrial development and competitiveness. Under the leadership of CNI, the Brazilian Entrepreneurial Mobilization for Innovation (MEI) is one of the most successful forums in regard to innovation, that gathers the Founders and CEOs of the 120 biggest and most innovative companies in the country.

#### GFCC

#### Foundational Global Competitiveness Principles

The GFCC developed a set of foundational Global Competitiveness Principles, supported by its network of more than 30 national competitiveness organizations and deemed essential for every country. First released in 2010 and finalized in 2012, these principles offer an overarching framework for national policies and programs aimed at fostering innovation, competitiveness and prosperity in the 21st century global economy. They emphasize key drivers of competitiveness such as investment in research and development, education and training for all citizens, sustainable and responsible development of natural resources, strong intellectual property rights, open trade and a stable, transparent, efficient and fair environment for business investment, formation and growth.

Pioneered by the GFCC, the Global Competitiveness Principles represent ideals that can serve as a beacon for economic progress around the world. They have been recognized as a best practice by other nations and emulated, for example, in the 10 General Competitiveness Principles of the Americas adopted by the Inter-American Competitiveness Network comprised of public and private institutions that promote competitiveness from the 34 OAS member countries. The GFCC Principles have also been referenced by organizations such as the World Economic Forum.

To ensure they remain current and relevant to the ever-evolving global economy, each year the Principles have been refined to reflect the changing global competitive landscape and to highlight new critical priorities, while keeping their foundational roots.

#### The Foundational Global Competitiveness Principles

- Ensure Fiscally Responsible, Transparent and Ethical Governance. National fiscal stability, discipline and certainty foster private sector and foreign direct investment, economic expansion, new business formation and job creation. Transparent regulations and tax rules enable market efficiency and reduce the cost of doing business. Government corruption reduces the productivity and performance improvements that come from fair and open competition.
- Fulfill Human Potential. All nations should educate and train their citizens without regard for gender, race, religion, age, ethnicity or economic status. Worker safety and international labor standards also are important underpinnings for individual and national success.
- Invest in Research Technology and Innovation. As the driving force of innovation, nations should increase investment in research and development, coupled with the domestic deployment of new technologies, to stimulate increased productivity, standards of living and leadership in global markets.
- **Ignite Entrepreneurship.** Supporting entrepreneurs—who are the source of new ideas, new products and services, new companies and new industries—is essential to economic vitality and improving productivity, competitiveness and economic performance.

- Improve Infrastructure. Investment in a modern, well-maintained resilient infrastructure—transportation, energy, digital networks and telecommunications—is critical to encourage domestic and foreign investment, support modern commerce and grow an economy. Cybersecurity is essential to the performance and safety of all economic activity, consumer access to the marketplace and personal privacy protection.
- Establish Public-Private Partnerships. Collaboration between the public and private sectors is essential to drive innovation, economic growth and job creation. Private sector leadership is vital in developing national policy initiatives to address short- and long-term competitiveness challenges and opportunities.
- Foster Regional and Metropolitan Centers of Innovation. Regional clusters and metropolitan areas connect talent with science, technology, manufacturing and service resources, fostering the creativity, idea generation and innovation that drive competitiveness.
- Encourage Sustainable Growth. Sustainable growth and responsible development through increased natural resource productivity, energy efficiency, and access to or development of critical materials will foster innovation, increase standards of living, help ensure food security and access to clean water, improve health and enhance national security.

- **Protect Intellectual Property.** Strong intellectual property rights are a prerequisite to attract high-value investment and innovation in new technology, new product development and creative works such as software and entertainment.
- Expand Access to Global Market Opportunities. Open and transparent markets expand global trade and investment, and drive economic growth around the world. Protectionist policies hinder innovation, growth and business performance. Well-defined international standards are essential to facilitate global commerce.

#### GLOBAL FEDERATION OF COMPETITIVENESS COUNCILS MEMBERSHIP

#### **MEMBERS AND NETWORK**

Brazilian Agency for Industrial Development

Brazil Competitiveness Movement-MBC

Business Foundation for Quality and Excellence–FUNDECE (Argentina)

BusinessNZ

Centre for Competitiveness (United Kingdom)

Centro Nacional de Competitividad (Panama)

Competitiveness Office of Abu Dhabi, Abu Dhabi Department of Economic Development

Competitiveness Unit Suriname

Consejo Nacional de Competitividad (Dominican Republic)

Consejo Nacional de Innovación para la Competitividad (Chile)

Consejo Privado de Competitividad-Colombia

Council on Competitiveness-Nippon

Dubai Competitiveness Center, Dubai Economic Council on Competitiveness

Economic Policy and Competitiveness Research Center (Mongolia)

Egyptian National Competitiveness Council

Emirates Competitiveness Council

Eurasia Competitiveness Institute

Financiadora de Estudos e Projetos-FINEP (Brazil)

FUNPRECIT (Argentina)

Go Productivity (Canada)

India Council on Competitiveness

International Competitiveness Research Institute-URAK (Turkey)

Kazakhstan Competitiveness Council, National Chamber of Commerce

Kingdom of Morocco Competition Council

Korea Economic Research Institute

National Competitiveness Council (Ireland)

National Competitiveness Council (Philippines)

National Competitiveness Council of Nigeria

National Competitiveness Foundation of Armenia

National Competitiveness Program (Guatemala)

National Confederation of Industry-CNI/SENAI/SESI/IEL (Brazil)

National Council for Competitiveness and Innovation (Trinidad & Tobago)

Orkestra-Basque Institute of Competitiveness

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The Global Federation of Competitiveness Councils (GFCC) is a network of leaders from competitiveness organizations around the world. The GFCC believes that acting globally is now a prerequisite to economic competitiveness nationally.

For more information, please visit www.thegfcc.org.

