Driving a Digital Recovery: IT Investments in the G-20 Stimulus Plans

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While many countries can still benefit from improvements in physical infrastructure, spurring investments in digital infrastructure can have a greater positive impact on job creation, while at the same time laying the groundwork for increases in productivity, innovation, and quality of life.

The global economic downturn has threatened the welfare of tens of millions of individuals due to declining levels of consumer spending, business investments and, in some cases, exports. In response to these economic conditions, many countries have implemented fiscal stimulus plans to lessen the impact of the recession and boost economic recovery. In the past, one typical response to this type of economic crisis would be to increase investments in physical infrastructure, such as roads, bridges and sewer systems. However, in the new global economy, information technology (IT) is the major driver of not just economic growth, but also of improved quality of life. While many countries can still benefit from improvements in physical infrastructure, spurring investments in digital infrastructure can have a greater positive impact on job creation, while at the same time laying the groundwork for increases in productivity, innovation, and quality of life.

In this report, the Information Technology and Innovation Foundation (ITIF) reviews the benefits and opportunities of including IT investments in a fiscal stimulus package. In addition, we assess the degree to which the G-20 countries have invested in IT as part of their fiscal stimulus plans. Our major findings are as follows:

- Robust investments in IT infrastructure can not only boost economic recovery, it can also help countries to emerge from the crisis stronger than before.
- The G-20 countries have invested nearly $2 trillion in general stimulus, and over $100 billion in IT.[1]

ITIF

- As a percent of GDP, Korea, Japan, and the United States have made the largest investment in IT, allocating 1.1, 0.7, and 0.3 percent of GDP, respectively, to IT-related stimulus investments.

- As a percent of their total stimulus plan, Korea, France, and Japan have made the largest investment in IT, allocating 24, 17 and 12 percent, respectively, to IT- related stimulus investments.

- And, in terms of the largest total IT-based stimulus, the leaders are the United States, Japan, and France allocating $41 billion, $32 billion, and $5.5 billion, respectively, to IT-related stimulus investments.

- Countries have used a mix of policy tools, including tax incentives, direct investments, and regulatory changes, to spur public and private investment in digital infrastructure.

THE BENEFITS OF IT INVESTMENTS

Spurring investment in IT leads to numerous benefits including job creation in the short term and productivity growth, economic competitiveness and improvements in quality of life in the long term.

Short-Term Job Creation

As we have shown in previous studies, investments in IT can spur significant job creation in the short term. We found that in the United States an investment of $30 billion in digital infrastructure—$10 billion for broadband, $10 billion for health IT, and $10 billion for smart grid—would create approximately 949,000 U.S. jobs.[2] Similarly, we found that a £15 billion investment in broadband, intelligent transportation systems, and smart grid in the United Kingdom would create 700,000 UK jobs.[3] For both of these estimates, we found that over half of the jobs created would be in small businesses.

Infrastructure investments—of both the digital and physical variety—will create direct jobs, indirect jobs, and induced jobs. Consider an investment in broadband networks or highway infrastructure. Direct jobs are those created specifically by new spending (e.g., the technicians or road workers hired to lay broadband "pipes" or tarmac). Indirect jobs are those created to supply the materials and other inputs to production (e.g., fiber optic cable or concrete). Induced jobs are those created by newly employed (or retained) workers spending their wages, thus creating jobs in establishments such as restaurants and retail stores.

However, investing in certain types of IT infrastructure offers superior job creation benefits in part because it creates a "network effect."[4] This network effect leads to an additional employment growth multiplier, herein referred to as the "network multiplier," which arises from the new consumer and business behaviors, functionalities, and downstream industries enabled by the IT infrastructure. A multiplier is a number that expresses the extent to which a change in a given economic activity generates additional effects through interdependencies associated with some linkage system. Thus, when calculating employment growth generated by a given level of investment, employment multipliers are used to estimate the number of indirect and induced jobs created.

The network effect employment multiplier refers to the new jobs that will be created through the new applications and services—some manifested in entirely new industries—that digital infrastructure makes possible. This possibility arises because digital infrastructures act as platforms that serve as the foundation for a multitude of innovative technologies and services.[5]

Investments in networks that are at an early stage of development will create even more additional jobs as a result of the network effect. Building out these networks leads to new jobs generated by upstream investment in industries that create new and innovative applications and services to take advantage of the more robust IT network. For example, building the smart electric grid will spur a host of innovative new products and services from hybrid plug-in electric vehicles to smart appliances to more investment in renewable energy. Likewise, bringing broadband to underserved or unserved areas will create additional jobs through the emergence of new firms and industries that require high-speed networks. In contrast, public expenditures (either through grants or tax incentives) to support expanding a mature network using relatively mature technology will not yield comparable network effects. Building or improv-

ing highways, for example, while certainly a necessary investment to maintain a nation's transportation infrastructure—will not likely spur innovations in the auto industry or, for example, consumer purchases of better tires for cars. Thus these more traditional investments are less likely to create additional jobs through network effects.[6] IT infrastructure projects also create more high-skilled, high-paying jobs; in many countries IT jobs pay a substantial premium over non-IT jobs.[7]

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No widely applied econometric analysis is currently used to capture the effects of digital infrastructure investments. This situation may put IT infrastructure projects at a disadvantage in comparison with more traditional infrastructure projects that economists and policymakers are more familiar with. For that reason, ITIF developed estimates of the network effect of IT infrastructure investments.[8]

Longer-Term Benefits

IT infrastructure projects, in addition to creating jobs today, also spur longer-term economic growth.[9] ITIF has shown in previous reports that IT is central to economic growth. IT has played an important role in productivity and economic growth in most developed nations. Between 1995 and 2002, for example, IT was responsible for two-thirds of total factor growth in productivity and virtually all of the growth in labor productivity in the United States.[10] From 2000 to 2005, IT continued to perform, contributing around one percentage point per year to growth in labor productivity in many nations.[11]

The network effect of IT infrastructure projects, beyond leading to additional job creation, higher productivity, and increased competitiveness, also generates positive personal and societal benefits. For example, investments in intelligent transportation systems (ITS) will not only create jobs in the short term, they will also improve road safety and reduce traffic congestion. The network effects will go even further as advances in ITS will support applications like real-time traveler information systems, more efficient freight logistics, and more traveler-friendly transit systems. Likewise, increased broadband infrastructure will spur improvements in educational outcomes, enable more telecommuting, and have a wide range of other societal benefits. Similarly, health IT investments will lead to better quality of care and cost savings by allowing health professionals to communicate and share information more easily. And investments in the smart grid will make the electric grid more efficient, contributing to a less carbon-intensive economy.[12]

LESSONS LEARNED FROM PAST ECONOMIC DOWNTURNS

Despite its severity, the current economic crisis is not the first global downturn, nor is it the first time countries have turned to technology as the bedrock of their crisis management strategy. In the late 1990s the Asian financial crisis hit South Korea's large firms particularly hard. In the following months lay-offs skyrocketed, particularly in high-skilled fields, while corporate R&D plummeted. The South Korean government responded quickly by drastically increasing investments in research and education to compensate the loss of corporate R&D. The government also used the crisis as an opportunity to restructure the economy towards technology-based small and medium enterprises (SMEs) by creating a more venture-friendly regulatory environment as well as providing tax incentives for investors and research facilities. The policy measures resulted in a 300 percent increase in corporate R&D labs from the time of the crisis to 2001, with SMEs accounting for 95 percent of the growth.[13]

Strong investment in IT infrastructure can also lead countries to emerge from an economic crisis stronger than before. Although not G-20 countries, Sweden and Finland both demonstrate this principal. For example, in Sweden, just 1.6 percent of people in 2007 lived in homes without wired broadband availability. The central reason for Sweden's almost ubiquitous wired broadband coverage is that during the last economic downturn in 2001 the Swedish government al-

located $820 million to stimulate the broadband infrastructure rollout, including $250 million in grants to communities to build local broadband networks, both in the towns and in the surrounding countryside, and $250 million in tax incentives, amounting to 50 percent of the cost to build the network.[14] Similarly, in the early 1990s Finland experienced a deep economic recession combined with a domestic bank crisis with unemployment rates hitting 17 percent. In order to counteract the decline in business R&D, TEKES, the government's funding agency for technology and innovation, drastically increased R&D funding.[15] The increased R&D investments not only reduced the depth and length of the decline in corporate R&D, but also laid the groundwork for a faster recovery and helped transform the economy into a high-tech powerhouse.

Supporting investments in IT projects earlier rather than later creates the foundation for faster economic growth once the economy turns around.

The broader lesson that emerges from South Korea, Sweden and Finland is that spurring IT investments during a crisis created dual opportunities. On the one hand, the shovel-ready nature of IT projects, along with consumption spending that follow tax breaks and other demand-oriented IT stimulus policies, creates a timely response to economic downturns. At the same time, supporting investments in IT projects earlier rather than later creates the foundation for faster economic growth once the economy turns around. Moreover, given that a country cannot participate in the digital economy without a robust IT infrastructure, such as an advanced broadband network, it is becoming less a question of if governments invest in these projects but rather a question of when. While some may argue that the decreasing costs of IT dictate that countries should wait to invest, this argument ignores the fact that much of the cost of IT projects is in labor or materials which are not likely to decrease in cost. Moreover, waiting is unwise for four reasons. First, waiting delays the economic growth that comes from advanced IT infrastructure. Second, without universal broadband and other IT infrastructure in place, nations run the risk of losing out on emerging technologies that rely on such infrastructure. Third, if governments wait to invest in infrastructure (of any kind) until it is absolutely necessary, then they are waiting until it is too late. For example, if governments wait to build out their broadband network until they observe a lack of supply then already there is a bottleneck in the network. Finally, waiting until after recovery and full employment means that the investment will have little effect on short-term economic growth.

TYPES OF IT INVESTMENTS

G-20 countries have included various types of IT investments in their stimulus plans, including investments in broadband, e-health, intelligent transportation systems (ITS), the smart power grid, and e-government. All of these investments are in areas where government involvement is essential both because of the scale and national reach and because of the coordination necessary to sustain and extend benefits. The private sector will tend to underinvest in digital infrastructures because it is unable to capture all of the benefits (externalities) of its investments and because of other well-documented market failures, including "chicken or egg" challenges where the success of network investments is premised upon investments by other players also taking place. In broadband, for example, significant network externalities exist that consumers of broadband by definition do not receive.[16] Moreover, building out some parts of the broadband network, particularly to high-cost areas, is not economical absent some incentives. The same is true, for example with the smart grid, where savings from energy efficiency and reduced pollution benefit everyone, not just certain customers.

Broadband

High-speed broadband Internet access is increasingly viewed as an essential infrastructure for our information economy.[17] A recent cross-country analysis found that an extra ten percentage points of broadband penetration by 2006 accounted for a full 1.21 percentage point increase in per capita gross domestic product (GDP) growth in developed economies.[18] In the United States, broadband-enabled Internet business solutions are expected to add a total of 0.43 percentage points to U.S. productivity growth through 2011.[19] Broadband is therefore an essential contributor to long-term economic productivity and wage growth.

Generous government subsidies, including tax incentives, to telecom firms in Japan and Korea helped them become the world leaders in terms of broadband

speeds.[20] However, government cannot expect unwavering private investment in broadband networks to continue during a recession. In the United States, UBS Warburg found that absent of federal incentives, capital expenditures by telecom and cable firms would decline by 10 percent, if not more, in 2009.[21] Investment by government, for example through tax incentives and grants, can help spur private-sector investment in broadband. Moreover, because public support for broadband investments can, and usually are, accompanied by private investments to a much larger degree than other forms of stimulus-based infrastructure spending, spurring investments in broadband enables governments to leverage the private sector to gain a greater multiplier effect, or more economic stimulus for the government's investments. Indeed the proper level of government investment in broadband is the portion of the network which is not cost effective for the private sector to cover. The United Kingdom estimates that only one-third of its broadband rollout will need to be funded by the government, and Australia and South Korea are initially funding around 11 and 4 percent, respectively, of the total estimated costs, with the rest coming from government bonds and the private sector.[22]

As such, public-private partnerships are a good way for governments to piggyback on private sector investments (and vice versa). For example, the broadband investment plan in Limousin, a rural region in France, is structured as a twenty year plan to build and operate a backbone and wireless network, with costs being shared by both the government and private industries. However, some countries have established public-private partnerships unique to their particular region and infrastructure needs. For example, a consortium of private operators in East Africa, beginning in South Africa, has partnered with development financial institutions to create the Eastern African Submarine Cable System (EASSy), a project to build a fiber-optic cable that runs from South Africa to Sudan, connecting each passing country along the way.[23]

e-Health

From using IT to train nurses in Kenya to advanced telemedicine applications in Sweden, health care has entered the digital age.[24] Countries all over the world, large and small, rich and poor, have embraced IT as a critical component of health care reform. It has become clear to government and health care leaders that IT investments are central to delivering high-quality care, improving patient outcomes and reducing costs. Technologies such as e-prescribing and computer order entry offer the potential to improve patient safety and reduce medical errors. More deployment of telehealth applications will bring higher quality health care to underserved areas. Finally, modernizing our health care system will allow researchers to harness the vast quantities of data locked up in paper medical records. Tools such as rapid-learning health networks will enable researchers to spot dangerous side-effects from drugs or other treatments, as well as to identify effective treatments more rapidly.

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While some countries have made substantial progress on deploying e-health infrastructure on a national level, most countries are far from deploying a fully-mature e-health system. Investments in e-health offer the opportunity to not only create IT-related jobs in health care, but to make critical transformations to health care that can save thousands of lives every year.

Intelligent transportation systems (ITS)

ITS are the integration of information and communications technology with transport infrastructure, vehicles and users. By sharing vital information, ITS allow people to get more from transport networks, in greater safety and with less impact on the environment. For example, ITS enable transportation agencies to collect the data needed to measure and improve the performance of the transportation system. Using ITS, transportation agencies can collect data before and after construction projects to evaluate their effectiveness in relieving congestion. Deploying ITS technologies that contribute to more efficient traffic management should be a clear target of future ITS investments.

Applying IT to a nation's transportation system in the form of intelligent transportation systems can deliver five key classes of benefits by: 1) increasing driver and pedestrian safety; 2) improving the operational per-

formance of a country's transportation network; 3) enhancing personal mobility and convenience, especially through provision of real-time traffic information; 4) delivering environmental benefits through alleviating congestion and streamlining traffic flow; and 5) boosting productivity and expanding economic growth. Only once travelers, vehicles and infrastructure can freely exchange information will the performance of the transport network be fully optimized.

Smart power grid

The central idea behind modernizing the electric power grid's infrastructure is to use two-way communication, sensors, and advanced IT to create an intelligent and connected power grid—that is, the "smart grid." The smart grid is intended to be a revolutionary network, much like the Internet, that will deliver power more efficiently and more reliably than our existing grid. With the smart grid, utilities can utilize real-time data from sensors and advanced meters throughout the power grid to understand better specific supply and demand requirements, spot failed or failing equipment, and better manage their resources. The role of IT in smart grids includes the adoption of ubiquitous automation systems, sensors and monitoring devices (smart sensors), data collection systems and communications systems.

The smart grid can enable a host of societal benefits including lowering peak power demand and the associated costs and electricity generation, enabling the greater use of renewable energy, and providing electricity more reliably. Moreover, the smart grid can enable the use of new technologies including plug-in hybrid electric vehicles, distributed generation, and energy storage solutions.

The smart grid can also lead to a number of additional cost savings by making electricity transmission and distribution more reliable and efficient. Without the smart grid, for example, a utility will not know that a customer has lost power unless the customer reports the outage. The costs of these outages are substantial: the RAND Corporation and the Electric Power Research Institute have estimated that outages in the United States cost businesses as much as $100 billion per year.[25] Better sensors throughout the grid will give utilities more situational awareness and allow grid operators to repair damage more efficiently and anticipate potential problems earlier.

E-Government

Governments are increasingly using IT to provide more efficient and more convenient access to government services. Although not traditionally seen as a stimulus measure, e-government investments can streamline government operations, for example, by improving the procurement process and reducing regulatory redundancies thus helping the private sector more efficiently do business with the government. Indeed, South Korea, a global leader in e-government, estimates the country has invested $1 billion on e-government between 2003 and 2007, directly saved over $1 billion, and increased economic activity by $16 billion through more efficient government procurement, trade, and construction.[26] E-government not only allows governments to provide services better, but it can also serve as a medium for commerce. For example, Posten, Sweden's postal service, has an online service called ePostboxen that allows citizens to collect mail in one secure location and then link to their online bank to pay all of their bills in one location.

Other IT Investments

Governments can also enact various policies to support IT-related investments for citizens and businesses to improve quality of life for citizens and increase efficiency for businesses and government. Governments can reduce consumption taxes on computers and other IT investments, thus spurring consumers and businesses to accelerate their purchases. Similarly, tax credits or improved tax policies for businesses, such as accelerated depreciation for IT investments, can help increase the use of IT by businesses and lead to greater productivity. In addition, allowing companies to expense new research equipment within the first year of expenditures can encourage businesses to invest in IT-related equipment. Finally, government can make its own IT-related investments in a whole host of areas, including education, public safety, and scientific research. While some of these applications are not necessarily general purpose technologies that will have the same network multiplier effect as technologies like broadband, these IT applications can lead to improvements in efficiency, productivity and quality of life.

IT INVESTMENTS IN THE G-20

Overall, G-20 countries have committed to investing nearly $2 trillion in general stimulus, with over $100

billion directed at IT within the next two years. While all G-20 countries have created economic stimulus plans those plans differ in both scope and design. The range of funding for the total economic stimulus is between 0.2 percent of 2008 GDP for Mexico up to 13.4 percent for China, with around 3 percent of GDP being average for the G-20. For the purposes of this report, we define stimulus spending as funds allocated specifically in response to the downturn in the economy or new government programs created between 2009 and 2011.

Overall, G-20 countries have committed to investing nearly $2 trillion in general stimulus, with over $100 billion directed at IT within the next two years.

Getting an accurate picture of stimulus investments for IT is a complicated task because it requires finding which countries have actually put funds in the budget as opposed to having only promised to do so. Some countries have allocated funds in broader areas, but have not explicitly stated what percentage IT will comprise of these areas. For example, China has committed 9 percent of its stimulus to technology as a whole, of which a portion will go to IT, yet it is unclear how much that portion will be. Similarly, the United States has indicated that certain agencies will receive funding to refurbish existing infrastructure, including new IT systems, yet it is up to those agencies to decide in what way to allocate funds. In these situations we could not account for the exact amount being invested in IT so we do not include these funds in our total.

Most G-20 countries have also focused on getting stimulus into the economy quickly; only four countries, China, Germany, Saudi Arabia and the United States, plan to spend more in 2010 on economic stimulus than they spent in 2009. Below is a review of the IT investments in G-20 stimulus spending, as well as a brief overview of the overall economic stimulus measures underway or planned in each of the G-20 countries.

As expected, most countries are investing heavily in infrastructure, yet at least five see IT as the lynchpin of current and future growth and have implemented IT stimulus measures that reflect this belief. South Korea, Japan, and Canada have allocated 1.1, 0.7, and 0.3, percent of GDP, respectively, to IT-related stimulus investments. Although exact figures for China's IT investments are not available, with $70 billion going to modernizing its electric grid and some portion of the $55 billion allocated to technology going to IT, China is likely to be amongst the G-20 leaders in IT-related stimulus investments. If Australia appropriates the $3.4 billion it has promised to invest in broadband, it too will be a G-20 leader, investing 0.45 percent of GDP. The United States' investment is above average, but behind the pack of leaders with roughly 0.26 percent of GDP being invested in IT stimulus. The most popular IT stimulus investment is broadband. Within 2009, the United Kingdom, Canada, Germany, Spain, Australia, France, Japan, South Korea, Italy and the United States have developed broadband expansion plans. While some lack clear funding mandates and others fall outside the realm of specific stimulus measures, it is still clear that universal, high-speed broadband service is a high priority for G-20 countries.

Argentina

Argentina's initial stimulus bill amounts to $3.8 billion, some of which will go towards loans for farmers, automakers and exporters.[27] The measure also includes selected tax reductions. For example, individuals and firms can repatriate capital at a preferential tax rate of 1 to 8 percent, compared to the standard 10 to 35 percent.[28] President Fernandez has also proposed a $21 billion public works program that has yet to be approved by the Congress.[29] Argentina's stimulus spending in 2009 represents 1.3 percent of GDP.

Although Argentina has not made IT a key part of its stimulus plan it has made small investments in the IT industry. For example, the government extended the Mi PC program, a public-private partnership initiative that helps families and small businesses finance a computer.[30] However, it is unclear whether these funds constitute stimulus spending beyond general discretionary spending.

Australia

Australia has also proposed three separate stimulus bills for a total of $58 billion. The first and second plans, worth $22 billion, were predominately infrastructure investments and pre-Christmas cash pay-

ments aimed at the elderly, low-income families, and first-time home buyers.[31] Other funding in the first round of stimulus spending went to the automobile industry to create environmentally-friendly vehicles.[32] The third round of stimulus investments, worth $36 billion, went mostly to low- and medium-income families and infrastructure spending, and included financial support for pensions, workers, homeowners, and others.[33] Australia's stimulus package represents 7.7 percent of GDP.

Australia has unveiled a $30 billion broadband plan, of which the government plans to invest $3.4 billion with the hope that the rest will come from the private sector and government bonds.[34] The goal of the national broadband network is to reach 90 percent of homes, schools, and businesses with 100 Mbps, which is nearly 60 times faster than the country's current average speed. The remaining households would be able to subscribe to 12 Mbps service through wireless networks. In what is anticipated to be an eight-year effort, Prime Minister Kevin Rudd estimates the plan will create an average of 25,000 jobs each year in construction and 37,000 jobs during the peak year of construction.

Brazil

Brazil's economic stimulus plan consists almost entirely of tax cuts, some of which will affect buying IT equipment.[35] For example, all personal computers up to $1,750 are exempt from the expenditure tax. In addition, the tax on financial transactions will be cut from 3 percent to 1.5 percent. Personal income tax for those making less than $874 per month is also scheduled to be reduced.[36] Brazil's total stimulus package is estimated to be worth $8.6 billion, representing 0.7 percent of GDP. Brazil's stimulus spending in 2009 represents 0.3 percent of GDP.

Canada

Canada's $36 billion stimulus plan is a blend of infrastructure investments, IT investments, and tax cuts. On the tax side, the government is reducing taxes on low and middle-income taxpayers by $18 billion and on business by $1.7 billion.[37] On the infrastructure side, the government is investing $10.8 billion in roads, public transportation and low-income housing repairs and construction. Canada's economic stimulus package represents 2.9 percent of GDP.

Canada plans on investing over $3 billion in IT through its 2008 stimulus plan.[38] Canada is investing $452 million on electronic health records so that half its citizens can have an electronic health record by 2010.[39] During 2009 the government is scheduled to invest $1.7 billion in science and IT initiatives including support for equipment and funding industrial research assistance programs devoted to SMEs. The Canadian government has also allocated $790 million towards smart grid technology.[40] Finally, Canada will invest $205 million over the next three years to extend broadband coverage to unserved rural and remote communities.[41]

China

In November 2008 China launched its $586 billion stimulus package consisting of spending in ten areas: low income housing, rural infrastructure, transportation infrastructure, health and education, environmental development, science and technology, natural disaster relief, direct subsidies, business tax cuts, and investment in the financial system.[42] China's stimulus package represents 12.1 percent of GDP.

Although it's not clear how much of China's stimulus package will go specifically to IT, the government has announced IT investments will make up part of the stimulus package. Investments in technology currently make up 9 percent of overall spending, or $55 billion (which does not count smart grid spending), of which the government has indicated an explicit interest in promoting indigenous IT production and has stated it expects the IT industry to create over 1.5 million jobs over the next three years.[43] In addition, China is investing $70 billion in modernizing the electric grid, including investing in smart grid technology.[44]

France

France's $33.1 billion package consists of three general areas: $14.7 billion to help businesses improve their cash flow through subsidies and tax credits (specifically the auto industry), $14.7 billion on direct state investment in housing, and $5.7 billion on state-owned firms in such sectors as rail, energy and the postal service.[45] France is also investing in research networks for higher education and e-government.[46] France's stimulus package represents 1.3 percent of GDP.

When including broadband investments, France is investing close to $5.5 billion in IT. France has a five-

year broadband plan (beginning in 2008) to provide universal broadband coverage by the end of 2010 and ultrafast broadband to 4 million households by 2012, expanding the network further thereafter. The government anticipates broadband investments to reach $13 billion over the course of the next 10 years. Funding will come from an undetermined mixture of public and private sector funds. Currently the government has authorized the French state-owned investment business Caisse des Dépôts et Consignations to invest $1.1 billion on rural broadband. France is also investing $4.13 billion in smart grid technology.[47] Additionally, the government is investing over $127 million on the national railway operator's IT system and $73 million in e-government. Of the e-government investments $30 million goes to "Serious Gaming", or computer "games" that serve as teaching material, $14 million for Web 2.0 applications and another $29 million for miscellaneous e-government public purchases. The government is upgrading and expanding internet access in schools across the country.

Germany

Germany has passed two stimulus packages, the first worth $42.5 billion and the second worth $66 billion for a total of $108.5 billion. Both stimulus packages reduce taxes on lower income taxpayers and increase spending on infrastructure.[48] Germany's economic stimulus package represents 1.4 percent of GDP.

Within the second stimulus package roughly $441 million has been allocated towards broadband investments. The National Broadband Strategy aims to have universal broadband access for all citizens by 2010 and to make sure at least 75 percent of households have at least 50 Mbps connections by 2014. The plan is estimated to cost between $50 to $71 billion; however, it is undetermined how much of that will be publicly funded and how much will be privately funded. Some scholars have predicted that the plan will create over 300,000 jobs by 2014, and, through network effects, 968,000 by 2020.[49]

India

India has put in place two stimulus packages worth $4 billion each.[50] Neither package has specific IT investment proposals. India's economic stimulus package represents 0.7 percent of GDP.

Indonesia

Indonesia's $6.3 billion stimulus does not explicitly allocate any funds to IT. The overall package cuts corporate income tax from 30 percent to 28 percent in 2009 and to 25 percent in 2010. In addition, the stimulus package increases direct funds to consumers to shore up consumption, invests in infrastructure and rural development, and reduces electricity costs from state-owned electric companies.[51] Indonesia's economic stimulus package represents 1.3 percent of GDP.

Italy

Officials in the Italian government have claimed the Italian economic stimulus bill is worth $114 billion; however, many economists believe that most of the funds are actually extensions of the annual budget.[52] Unofficial estimates put the package at $10 billion in new funds. Most new funding goes to tax cuts and infrastructure spending.[53] Italy's economic stimulus package ($10 billion) represents 0.5 percent of GDP. Although the country has not explicitly allocated funds for IT, the Italian government will invest $2.16 billion to expand broadband coverage in rural areas.[54]

Japan

Japan has passed three economic stimulus plans with a combined value of $275 billion.[55] Japan's economic stimulus package represents 5.5 percent of GDP.

The Japanese government has drawn up an IT strategy that invests$32 billion to foster public-private partnerships through IT such as intelligent transportation systems, a fiber-optic network for health care, and more user-friendly e-government. Specifically, Japan plans to expand broadband access to rural areas with an investment of $371 million between 2009 and 2010.[56] Japan is also investing in IT personnel training and its growing green IT industry.[57]

Mexico

Mexico's economic stimulus plan, worth roughly $1.3 billion, focuses predominately on tourism, transportation infrastructure investments and small businesses.[58] The government is freezing gasoline prices and reducing the price of natural gas by 10 percent and reducing electricity costs for businesses by 20 percent. The government also plans to make 20 percent of purchases

from SMEs. For low- and middle-income households the stimulus package increases social and unemployment benefits and gives a credit to consumers for trading in old appliances for energy-efficient appliances.[59] Mexico has no explicit IT investments in its stimulus package.

Russia

Russia announced a $20 billion stimulus plan in late 2008. The package is predominately based on tax cuts and has no explicit IT funding.[60] Russia's economic stimulus package represents 2.4 percent of GDP.

Saudi Arabia

Although the Saudi Arabian government has not enacted a specific stimulus package, increased public expenditures, investments, and tax cuts have been included in the overall budget. For example, the new budget increases public expenditures by 15.8 percent. At least $2.1 billion will go to the National Plan for Science and Technology (NPST), which spearheads the country's e-government initiative and R&D.[61] However, it is unclear whether NPST investments in the 2009 budget should be considered stimulus spending as the 2008 budget appropriated a similar amount.[62] The budget also allocates $5 billion for infrastructure and communication technology but it is unclear what percentage will be allocated to IT, and of that, how much is above general discretionary spending. Analysts believe specific stimulus spending will equal $17.6 billion in 2009 and $49.6 billion overall.[63] The majority of funding goes to industry and infrastructure, health care, education, and public lending through the government-run Saudi Credit Bank.[64] Saudi Arabia's stimulus spending is estimated to be worth 4.3 percent of GDP.

South Africa

South Africa's $7 billion stimulus package goes to economic infrastructure, support for low-income workers, employment benefits and skill training, and improvements to government service delivery. Within the funds allocated for economic infrastructure, the South African government plans on investing in IT infrastructure; however, the government has not yet provided details on the specific projects.[65] South Africa's economic stimulus package represents 1.9 percent of GDP.

South Korea

South Korea's stimulus package is worth $11 billion, which goes predominately to support low-income households, help local governments, and foster green technology. South Korea's economic stimulus package represents 4.5 percent of GDP.

South Korea is planning on investing $2.27 billion over 4 years on green IT (this is part of the Green New Deal, which is funded at $87.7 billion).[66] Korea's green IT investments will go to faster broadband networks, green IT products and more energy-efficient transportation systems.[67] South Korea plans to upgrade broadband networks to 1 Gbps by 2012 and expand its 3G broadband services to 30 million households, with the government investing $1 billion of the $24.6 billion in anticipated total costs.[68]

Turkey

Turkey's overall economic stimulus packages equals $3.2 billion, most of which is non-IT related, and includes tax reductions, funds for pension plans and financial assistance to exporters of automobiles and new appliances.[69] Turkey is also planning on cutting taxes for computers and cable, wireless, and mobile Internet services; however, the government has yet to release the exact value of these tax cuts.[70] Turkey's economic stimulus package represents 3.2 percent of GDP.

United Kingdom

The British government has enacted a $30 billion stimulus package. The stimulus bill also cuts sales taxes from 17.5 to 15 percent. The package includes $4.5 billion for highways, housing and schools as well as greater spending on social services. The United Kingdom's economic stimulus package represents 1.5 percent of GDP.

It is not clear much will go toward IT investments. However, Prime Minister Gordon Brown has stated that the stimulus plan will allow the United Kingdom to "build both the technological base and human capital to equip us for the opportunities ahead."[71] Specifically, the Digital Britain initiative crafted in January 2009 calls for upgrades to both wired and wireless networks, universal broadband coverage and an increase in e-government.[72] The stimulus package also

allows for expensing of new capital equipment, some of which will be spent on new IT systems, and there have been discussions of increasing capital investment in the country's research infrastructure.[73]

United States

The United States' stimulus package, the American Recovery and Reinvestment Act, invests $789 billion with the goal of "creating or saving 3.5 million jobs." However, while payroll tax cuts have been implemented relatively quickly, only $46 billion or 11 percent of authorized spending measures, had taken place through mid-May 2009, concentrated in the Department of Health and Human Services.[74] The United States' economic stimulus package represents 5.6 percent of GDP.

The United States is investing over $41 billion in IT-related economic stimulus. These investments include: $22 billion for health information technology, $11 billion towards advanced technology for electrical systems (such as smart grid demonstration projects and smart metering), $7.4 billion for broadband, $219 million to modernize IT systems at the Department of State, $85 million for IT and telehealth programs for Indian Health Services, $50 million for IT advancements at the Farm Services Agency, $20 million for IT systems involved in lending towards small businesses, and numerous other minor IT funding projects.[75] The stimulus package also allocated funds to the Social Security Administration for IT infrastructure development, amongst other infrastructure projects.

European Union

The European Union's stimulus package is worth $294 billion, the majority of which ($250 billion) comes from national budgets. The plan funds direct payments to workers, households and small businesses as well as grants and loans to the private sector, specifically the construction and automobile industries.[76]

The European Union has allocated $6.3 billion to IT investments out of its stimulus spending. The EU plans on investing $5 billion on smart grid.[77] In addition, the EU will invest $1.3 billion for broadband deployment to unserved areas, particularly rural areas in southern and eastern Europe.[78]

CREATING AN EFFECTIVE IT STIMULUS PLAN

There are a number of factors governments need to consider in crafting effective IT stimulus initiatives. First, the initiatives should be sizeable enough to make a real impact. For many IT infrastructure projects a sufficiently large stimulus package can jump start progress. Second, nations should craft IT stimulus in ways that get actual investments made as expeditiously as possible. While it may take several years for many nations to reach full employment, beginning stimulus activity sooner rather than later will shorten the length of the recovery. Related to this, an effective IT stimulus package relies on both tax incentives and direct expenditures. A major advantage of tax provisions is that they can spur investment relatively quickly, thereby creating needed jobs sooner. For example, governments can reduce consumption taxes on broadband, computers and other IT equipment. Governments can also encourage businesses to invest in IT in general by providing tax credits or accelerate depreciation for investments in IT hardware and software or in specific areas by using tax policy to spur investment in health IT, broadband networks, or other targeted areas.

Grants can also play an important role, as they can often be targeted to specific areas of importance. They can also be used to fund investments in IT by government and non-profit organizations which may not be directly affected by tax policy. For example, grant programs can subsidize the purchase of PCs in schools.

Governments can also boost IT investments in ways that cost little money. They can enact regulatory changes. For example, governments can promote investment in smart grid technology by enacting regulatory changes to create cost recovery mechanisms for utilities and mandate smart metering. Governments can also accelerate existing projects, such as investment planned by a national ministry or department for ITS. The long-term impact on the budget would be the same from such acceleration but the short-term economic impact would be larger and the long-term benefits would be realized sooner.

Countries can also leverage various other budget-neutral policy tools to stimulate investment in IT infrastructure in the near and long term. For example, governments can allocate radio spectrum to promote

broadband growth, either by making new spectrum available for technology like WiMax or by swapping licensing spectrum in exchange for broadband infrastructure delivery. To increase investment in ITS projects, the government can increase the share of transport funding allocated to ITS over traditional infrastructure projects.[79] South Korea, when faced with declining revenue, also developed low-cost strategies to increase IT awareness and use by vigorously promoting e-business and e-government applications already in place. The outcome was not only increased IT spending which shortened the economic downturn, but also a more technologically engaged public and private sector once the economy rebounded.[80]

Countries can also leverage various budget-neutral policy tools to stimulate investment in IT infrastructure in the near and long term.

In this regard, investments in IT infrastructure should not be minimized out of concern that the projects will take too long to begin to have an immediate impact on the economy. If the investments are designed properly, they can quickly spur a large number of investments—from deploying more and faster broadband networks to implementing intelligent transportation systems to rolling out advanced energy metering technologies (i.e. smart meters)—that are currently ripe for development. However, well-crafted stimulus measures need to get investments out the door as quickly as possible. Legislative requirements intended to ensure funds are allocated appropriately, while important, can hold up funds and reduce the impact stimulus funds can have on economic recovery.

IT stimulus investments also need to be considered from a global perspective. Just as the current economic crisis is a global problem, stimulus spending has global ramifications. Although each country is responsible for its own economic wellbeing, economic spillovers occur. No country can capture 100 percent of the value of a given stimulus measure because some funds inevitably leave the country through imports and other leakages. As such, if all countries adopted adequate stimulus measures then each country would gain from the leakages from every other nation. However, if nations minimize their stimulus efforts in the hope that other nations' stimulus efforts will spur exports and growth then the overall global recovery will be delayed.

In line with this, governments should not use the economy as a justification for increasing protectionist measures that only promote domestic production or domestic companies. While it is true that leakages could be greater for foreign-owned companies, if domestic firms do not have the shovel-ready capacity to begin projects soon, the employment benefits will be smaller. Furthermore, deploying and maintaining IT infrastructure requires a level of sophistication that multinational firms may have whereas domestic firms may not.

Finally, if governments choose not to take advantage of the economic impact of IT stimulus investments, they should at a minimum not created roadblocks that hinder IT investments. Tax increases on IT goods and services are particularly unwise in an economic downturn because they lower consumption on goods that have natural network effects associated with them. Just as increased use of computers and broadband creates economic opportunities through network effects, decreasing demand for such products decreases economic activity in other areas through similar network effects. For example, Argentina is considering increasing the tax on imported cell phones (although 90 percent of cell phones in Argentina are imported) in the hope to spurring domestic production. However, such a tax will reduce demand and do little to spur domestic manufacturing.

CONCLUSION

Many G-20 countries have used their stimulus plans to spur investment in IT. Those nations that have invested in IT infrastructures have not only received an important short-term economic boost, they have also laid the groundwork for long-term economic growth, international competitiveness, and significant improvements in quality of life.[81]

ENDNOTES

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