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INVESTMENTS AND INNOVATIONS IN TELECOM: AN ADVOCACY ON THE TELECOMMUNICATIONS' RESEARCH AND DEVELOPMENT

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BACKGROUND

The moral fibre of the communications industry, research is an acute and integral national resource. Key to the future development of foremost telecommunications products and services, the exigency for federally funded telecommunications research is on a drastic acceleration. The year of 2000 witnessed the market crash of telecommunications along with a lag in the intense market competition and on low price points that keeps the profit margins at a minimum. In the midst of the current recession after almost a decade, survival is the only focus of the companies. Which in turn has transformed into a stage of escalated cost cutting and lean workforces, as well as a focus on the product development and incremental research. The recession has paved way for

the negligence of future innovations and seeding technology development. United States, though the acclaimed global leader of technological researches the recent years' innovations cannot be taken for granted. The process of communications research is regarded to be time consuming, cost and foresight involving, and complex which has to be sustained for a decade or even more to reap the harvest of investment. The industry naturally is capital accelerated, non-cynical and long-term in terms of industry investment. The alterations in the U.S. telecommunications industry and the competitive demands faced by the company has devised way for a scenario, where the long term basic researches costs less.

According to the National Research Council's report *Renewing U.S.*

Telecommunications Research, “U.S. leadership in telecommunications did not come by accident—success at the Physical, network, and applications levels was made possible by the U.S. investment in decades of research and the concomitant development of U.S. research leadership in communications-related areas”. According to the researchers’ testimony before the Council, “Designed as a facilitator for improving the current products and services, the long-term, fundamental research steered for breakthroughs have abated in favour of not only the shorter-term but also the incremental and evolutionary projects. The developmental work of research is aimed at achieving the returns within a time span of couple of months to a couple of years. And it does not engage the needs of the telecommunications industry as a whole in the future as well”. The above statement is a key finding in the report, which portrays the real reason as to why the federal government’s budget for the research has matured into a crucial source of U.S. telecommunications research’s fund. Also, to ensure our country’s future and constant growth, the targeting of similar funds on accordant programs within the federal research agencies is crucial.

TELECOMMUNICATIONS RESEARCH: A BENEFIT, AN INVESTMENT.

Investment in telecommunications has been identified as factor to spur the economic growth of a company, or of a nation as a whole. The investments does not only provide a short term economical boost but also is a facilitator of long-term growth and employment outlooks. Advances in telecommunications has been noted to transform people’s way of living, working, communicating, conducting business, learning etc. Long-term research ensures the sustainability of the transformations, productivity in society and to ensure that these transformations serve the human needs. About 7.4% of the country’s Gross Domestic Product is represented in telecommunications. A mere increase of 1% in broadband deployment can open up the possibility for as many as 300,000 new jobs i.e. in terms of job creation alone, which includes jobs in the telecommunications sector and manufacturing jobs generated to meet the added demand of network equipment and customer premise equipment (CPE). However, it does not comprise of jobs that would bindingly result from the recent access to broadband and also the benefits accompanied to all types of businesses.

In terms of technical and economical spill over, long-term communications research has substantial positive effects. As it is a key factor in enhancing the innovative performance and productivity. Telecommunications acts as a supporting sector for the not only the economy but also for specific industrial sectors, such as, retail, agriculture, distribution, financial services and machine building amongst many others. The Federal Government should comprehend the poor state of the telecom research funding and reveal stern support for the sector because, almost all sectors depend and derive benefits from the telecommunications research. Telecommunications research is the ground source of constitutive advances in the digital technologies; powering the integral national defence, homeland security and national security competences. Innovation in imperative infrastructure protection magnitude is benefitted by an effective, well-endowed telecommunications research program. It expedites the research program by the means of advancing the innovation of imperative infrastructure protection measures such as, constancy and survivability of networks, elevated information security, and it also enhances the development of the tools and

technologies used to detect and prevent terrorist attacks.

U.S. FEDERAL TELE- COMMUNICATIONS RESEARCH FUNDING, TODAY

Compared to other industries in the U.S., the telecom research has always lacked support in the U.S. Government's federal budget for years. But the situation has shifted as, the overall federal budget for has been significantly increased as a result of the goals set out by the America COMPETES Act (PL 110-69). The America COMEPTES Act consisted of doubling the budget for the federal research agencies which has been functioning for more than seven years. Though the budget doubling aided the telecom researching, a substantial need for additional funding for basic telecommunications research.

The U.S. Government budgeted \$3.8 billion for networking and information technology research and development across relevant agencies, for the fiscal year of 2009. This in fact is only a minute fraction of the \$147 billion (about 2.5%) total estimated federal research and development Fiscal Year 2009, which does not consist of the one-time

spending on R&D through the “American Recovery & Reinvestment Act (PL 111-5).

The total amount of federal funding allocated for the large scale networking (LSN) research is an instance of the inadequacy of federal focus on the communications basic research. The LSN research is an integral part of the National Coordination Office for Networking and Information Technology Research and Development, which consists of the communications and high-performance networking research and development in the leading-edge technologies and services. A total of about \$448 million in the fiscal year 2009, that is a 0.3 percent of the federal government’s total research and developmental budget, allocated to the research purposes raises a dilemma because, LSN does not only comprise of communications-focused research, but also the research and development spending, infrastructure and application spending as well. Therefore, only a fraction of this number (\$448 million) is utilized on the communications basic research.

Between the fiscal years of 2002 and 2008, a distinct increase in the actual dollar amount committed to the large scale networking was

observed. But, the percentage of U.S. government research funding that has been apportioned to the large scale networking program expense received a blow of decline of over four percentage points; from 18 percent to 13.8 percent. Communications as a framework, is the grit and guts for all information technologies and has a colossal impact on the economy and security of the United States. But, all of the previously described statistics clearly advances that the communications-sector basic research is not given the right light of importance by the federal government. Every industry, from automobile manufacturing to healthcare to financial services etc. is dependent on communication. The survival of any company or organization without communication technologies and services is unattainable and impractical.

TELECOM RESEARCH IN U.S. VS TELECOM RESEARCH IN OTHER COUNTRIES

Being a global industry, Telecommunications is a highly competitive industry. The report Rising above the Gathering Storm stated that, “as we enter the 21st century, however, our leadership is being challenged. Several nations have faster growing economies, and they are

investing an increasing percentage of their resources in science and technology. As they make innovation-based development a central economic strategy, we will face profoundly more formidable competitors as well as more opportunities for collaboration. Our nation's lead will continue to narrow, and in some areas other nations might overtake us."

Europe's competitive race with the U.S and Asia for the lead position in technology, i.e. technology that impact the global markets is an example of the countries' race towards leadership and technological growth. Information society technologies (IST) research has been recognized as the prime source of EU funding for IST research projects, by funding a hefty sum of 9 billion euros during the European Union's (EU) 7th Framework Programme, as a part of the EU's overall goal to hike the development and research expenditures to a three percent of the GDP by the year of 2010. Therefore, making IST research the largest funding priority in the entire EU research program. According to the European Commission, "Europe can lead the world if it can develop a common vision embracing researchers, industrialists, governments and societies across Europe."

A five year plan (2006-2010 period), developed by China aims on the continued establishment of the telecommunications industry as the leading industry as compared to the other industries in the country's national economy. As a share of the gross domestic product, between 2000 and 2006, China's science and technology research and development funding observed a rise from 0.9 to 1.4 percent, with a target of 2 percent by the year 2010. The Medium and Long-term S&T Strategic Plan (2006-2010) by the country is a layout for the farther developments in the nation's innovations capacity and to reach the goal of transforming into an innovation oriented country by year 2020. China, as a nation has vowed on improving the country's competitive disposition which in turn pressurizes the U.S entities to compete along.

With countries around the globe compete for technological prowess over the next country, an extrusive maximization of shares has been perceived. The United Kingdom (UK), has set on proliferating its share of publicly funded science and technology research and development from 1.9 percent to 2.5 percent of GDP by year 2014. UK's Science and Innovation Investment Framework suggests that the public science budget has a 5.8

percent increment per year, from 2004-2005 and 2007-2008. Japan, between the fiscal year of 2006 and 2007, elevated a seven percent in the total amount of government research and development spending. Since 2000, the R&D intensity has increased, to 3.4 percent in 2006. According to OECD, Japan was one of the only four OECD countries in which the R&D to GDP ratio exceeded 3 percent. R&D and innovation are the primary elements in productivity and growth performance, one of the major reasons as to why an augmenting number of OECD governments have facilitated special incentives towards businesses to increase spending on research and development. The policies offered by countries like Spain, China, Mexico and Portugal advances no distinction between the large and small firms.

Since 2006, these countries have been providing the largest subsidies encouraging the other emerging economies to implement these policy instruments with the aim of encouraging the R&D investments. Countries like Brazil, India, South Africa and Singapore provides a considerate and competitive tax environment for R&D investments. These portrays how the other countries are investing the time, money and intellectual capital in creating a stable and attractive environment

for science and technology research. The crucial attribute that cannot be ignored by the United States is that, the U.S industry needs the federal government's support in order to remain long-term competitive in the field.

TIA'S ANSWERS TO U.S. TELECOM RESEARCH

The current condition of the U.S. Telecom research has been regarded as lacking and that without the advent of the federal government's support, the industry faces losing its competitive edge when compared to other countries. The Communications Research Division (CRD) of the Telecommunications Industry Association directs the various agencies to highlight the necessity of improved coordination of federal telecommunications basic research. The following aspects have been recommended as priority research areas, as the aspects are crucial to the next generation networks upon which the U.S economy progressively relies on. To further U.S's R&D efforts, the CRD had formulated policy recommendations for legislative action which also focuses on prioritizing initiatives to improve the country's competitiveness.

RESEARCH VITAL TECHNICAL AREAS

1. Universal Broadband – Affordable broadband access and connectivity, employs all available media (copper, coax, fibre, spectrum, etc.), broadcasting all services (voice, data, video) to the customers everywhere (urban, suburban, rural, mobile) in order to facilitate a greatly upgraded "superhighway."

- Technology convergence and advanced communications are critically supported by Broadband Internet. The U.S. Government must facilitate the universal access for broadband internet also, the policies that promote the widespread connectivity of it. These actions will help the country to easily access the future goals. Upgrading the infrastructures leads to increased economical returns and also encourages business developments, educational, entertainment and e-government solutions and capabilities.
- The field is in need of an additional research that is federally funded. The federally funded research can be utilized for rural access as special technologies

will be required to meet the technological needs of rural areas. Significant cost reductions has to be met and the corporate and venture capital financing for research has dropped considerably over the last several years. The provision of broadband access in to the rural areas are preferably costly due to the challenges like low population density, terrains etc.

- The specific areas include:
- Deployment costs: Research should be carried out in these areas to generate deployment efficiencies and advanced technologies to facilitate faster deployment and reduced costs. As an area of national priority, NIST should focus on the importance of carrying out the researches and it should be part of NIST's work in communications/network research.
- Remodelling back haul for wireless and wired access networks.
- Supporting data centres by reducing the power requirements: how to improve efficiencies can reduce the power requirements, including the energy adherent to cooling.
- Spectrum repurposing and utilization.
- Accessing technologies (ex. BPL, wireless access, optical networks)

- Reduced network bottlenecks and interconnect speeds.
- Satisfying the escalating consumer bandwidth demands, that is beyond 100 and 400G (to 1 Terabit).
- Test beds for next-generation networks.

2. Security – Advanced authentication, encryption and monitoring capabilities for all public broadband networks with the aim of protecting the communications assets from attack.

- Being a post-industrial information society, America’s cyber-infrastructure is susceptible to attacks.
- The systematic attacks directed at the infrastructure can be eliminated by the advent of continued research. And it can lead to an opportunity for university-based “centres of excellence.”
- Specific Areas Include:
- Investment in secure operating systems- not only does it work on preventing harm but also makes sure that the operations are functioning well during crises
- Wireless network security.
- Digital rights management.
- Restoration of complex networks
- Malicious software protection.

3. Interoperable Mobility – The capability to access commercial mobile services as well as the emergency services over any mobile network from any mobile instrument.

- The basic and the most critical characteristic of Interoperable mobility is that, it enables public safety. It also facilitates the use of various public safety and cellular mobile networks without the clutter of multiple devices, majorly for the law enforcement officials. Interoperable mobility allows the higher priority use of scarce spectrum resources for emergency use as well as promotes the coordinated communications between numerous public service agencies.
- As the emergency services market is decisive for the common good, federally funded research is critical to it. By bringing the commercial technologies and emergency services together, advanced features for critical emergency services and low costs can be derived.

4. Interoperability, security, survivability and encryption and Telecommunications Research for Homeland Security

- Homeland Security is a superset of several listed visions. Public networks and public infrastructures can be protected by security technologies from malicious attacks. The economic activities today are dependent on the continued availability of public infrastructure and broadband networks. National economic activities can be severely affected by attacks along with other disastrous consequences (e.g. in case of identity theft).
 - All the areas, consisting of interoperability, security, survivability and encryption requires research. Because, the needs of the first responders and crucial infrastructure protection exceeds the typical commercial applications needs. With the constant inventions of new worms and viruses, new techniques and extended research is required before any significant damages ensue.
 - America as a country needs a broader program to establish the vulnerabilities to ensure the integrity of the first responders' systems. As these "extreme case" applications are adequately developed in basic commercial systems, the support of the government is significant.
 - The network issues related to the disaster responses, long-term outages (man-made or natural) which can shut the system down, outages caused by attacks (electromagnetic pulse methods) has to be investigated by the country.
 - As a whole, America's success in influencing the information-based economy of tomorrow is directly related to the capabilities of the country's broadband infrastructure.
- 5. Recommendations for Federal Activities:**
- Basic network research is being done on the federal level across a broad swath of agencies and it is being managed in a stove-piped manner. This is detrimental to the effort to approach issues and gaps in basic science that inhibit the development of next generation networks. There needs to be a better coordinated effort that allows all entities to understand what efforts are occurring at all levels.
 - The long term commitment to basic research is also required as compared to the need for a coordinated effort for telecommunications research. It consists of, multi-year federal plans, multi-year R&D tax credit commitment and commitment to researches that are high-risk in nature and does not produce any short term successes.

- The appropriation of limited research resources can be avoided by ensuring a coordinated approach to solving problems. To carry out this purpose, policies that encourages cooperation and information sharing can be instituted.
- A panel to inspect the gaps in broadband researches should be congregated by the National Academy of Sciences. A better coordination between the research and commercialization can be formed by developing the processes for industry input on priorities.
- Identify the innovative research breakthroughs which could augment the goal of internet access for all Americans, which will reduce the cost involved in broadband deployment.

6. Policy Recommendations:

- Represent a permanent and simplified, R&D Tax Credit.
- Enactment of H-1B visa reforms which allows the companies to hire the finest and brightest minds in the world.
- Continued appropriations to fulfil the COMPETES Act authorization levels (PL 110-69). Focus on remaining on the path to inflate the basic science budget by fiscal year 2015.
- To ensure the educating of the future workforce of America, a commitment and investment in the Science, Technology, Engineering and Mathematics (STEM) education should be facilitated.