How to reap the Digital Dividends? Factors affecting Digitization and its Absorption for Innovation and Productivity.

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"Before 4000 BC, not being able to read and write was not a handicap, since no one was literate. Literacy became a new necessity starting some 5,000 years ago. Likewise, digital connectivity is the new necessity of our times. If societies cannot provide this, inequality will rise; and so will poverty. [Digital developments] need a whole host of ancillary services, policies and regulations for their benefits to reach the segment least able to help themselves."— Kaushik Basu, Chief Economist, The World Bank (2016).[1]

1. Motivation and Overview

Emergence of information and communication technology (ICT)—as a general-purpose technology (GPT)—is like a paradigm shift in technology like in the case of Steam engine or Electricity paving the path for Industrial Revolution. Overwhelmed by its pervasiveness, World Bank's flagship publication such as World Development Report (2016, p. 2) has mentioned that: "Digital technologies have spread rapidly in much of the world. Digital dividends—the broader development benefits from using these technologies—have lagged behind. For digital technologies to benefit everyone everywhere requires closing the remaining digital divide, especially in internet access. But greater digital adoption will not be enough. To get the most out of the digital revolution, countries also need to work on the "analog complements"—by strengthening regulations that ensure competition among businesses, by adapting workers' skills to the demands of the new economy, and by ensuring that institutions are accountable."[2]

Innovations, spread and adoption in internet and digital technology has overwhelming ripple effects across any economy and the world in terms of connectivity, organizing socio-economic activities, trade network, vast data and information flows, and even in shaping identities. Rapid evolution of ICT gives access to rapid information network, faster execution of experimental scientific revolution and thus, facilitates quicker adaptability to new lines of inventions. In case of ICT, 'the *use* of IT, not necessarily its production, is what matters for economic development.' However, the "use" depends on multitude of factors like skill, education, social networks, infrastructure, and others´--to name a few—that we purport to highlight in this work. Some countries lag in harboring the benefits and hence, wide development differentials persist among the recipients differing in constellation of factors that enable them to reap the benefits. Due to the evolution of ICT as a prime mover of technological change, organizational changes occur with differences in entrepreneurial abilities and productivity. Digital advances are skewed towards skilled, educated, and socially advantageous groups. For integrating this digitalization into a coherent policy design, it is important to understand what 'capability trap' could stand in the way of reaping digital dividends or, what are the roles of the 'analog complements' or ancillary enablers (WDR, 2016, ibid.). Emergence of organically evolved functionalities is crucial for capability expansion. As in many developing nations the state often lack the capability to implement the human development policies, the sustained improvements in performance for spreading the digital benefits depend on host of factors like investment in education and training, which this research will explore.

2. Objective and Research Scope

Globalization has led to plethora of conduits via which the effects are transmitted across the participants—developed and less developed nations. Emergence of 'Southern Engines for Global Growth 'has changed the global development scenarios, established themselves as 'new' locus of technological dynamism. "Shifting wealth" from North to the emerging South has been due to not only global re-distribution of manufacturing capacity or industrial activity, but also by the pro-active government policy to enable technology absorption and acquisition. Tyson and Lund (2016) has referred to the knowledge creation, globalization of knowledge and resultant productivity as 'one-ring' influencing technology transfer, and development. Recently, the Information technology agreement (ITA, 18 April 2016) of the WTO has expanded

[1] http://blogs.worldbank.org/developmenttalk/development-digital-age accessed on 29th April 2016.

[2] All these have revolutionized lives in Kenya and Tanzania and still lots remain to be done for 'realizing the full potential'. Kenya's M-PESA and Tanzania's mobile finance are good examples of digitization as is the spread of on-line E-commerce activities—via use of digital benefits to reduce transaction costs—has facilitated trade network.

the number of IT-products in the list to 201 and proposed tariff elimination for further boost in trade in such products (7% of global trade with $1.3 trillion in value per year).[3] 'Global Alliance' for ICT and economic development is launched to 'promote the use of ICT in fighting poverty, illiteracy and disease, in protecting the environment and empowering women and girls.' In case of low income countries, esp. the Sub-Saharan Africa, inadequacies of infrastructure in broad sense and weak governance (the pernicious syndrome effects) act as anti-growth. Although some of the developing countries are registering growth, in a post-economic crisis world of uncertainty sound macroeconomic policies and enabling environment via facilitating state apparatus could be necessary to overcome development traps such as lack of human capital, inadequate infrastructure, slack institutions, civil strife, resource extraction, instability, to name a few syndromes of anti-development. Thus, globalization of knowledge and digitalization of production activities leads to restructuring of activities (e.g., flexible and decentralized process like outsourcing off-shore) with networks of individuals and organizations with niches of expertise, and this could lead to organizational change and different returns to human capital as per educational attainment. The variations across nations are explained in terms of structural determinants such as schooling or education, political feasibility, governance, demographic factors as these are necessary for including the marginalized disadvantaged group.

3. Methodology and Contribution:

The aim is to *review/survey* the extant literature. Then, in a quantified framework, we analyze how all country-specific factors create a climate conducive for nurturing the innovation potential for informatization or digitization. The research intend to explore the effect of global diffusion and national innovation systems on organizational changes, and income inequality in the wake of skill-biased nature of ICT-induced technological change. In order to quantify, I intend to measure: the Technology Achievement index, Digitization Indicator, and Absorptive Capacity Index for gauging the capability to reap benefits in the digital age via E-government and E-commerce penetration. All these will be useful for quantifying the relationship between ICT and work organization, productivity, and organizational change in terms of skill-composition, product heterogeneity, trade in sophisticated products, and investments in ICT and training. This will also give insights on synergy between firm performance, productivity, and job creation.

In order to enhance digitization-led inclusiveness for the sustainable development goals by 2020, access is key and this will affect firms' productivity, profitability, and performance through organizational changes. Surveying such aspects, the research will explore: (i) the impact of digitization on organizational factors, for example, labor, firm organization, firm heterogeneity and product diversification, or product sophistication; (ii) demand for skilled labor due to new necessities; (iii) relationship between ICT and organizational factors (complementary); (iii) how does the relationship differ across countries at different levels of development; (iv) role of public infrastructure and digitization for TFP and technical efficiency. We consider firm-level studies for industries, such as, Electronics, Transport Equipment, Chemicals, Metal and Metal Products, which are exposed to competition, and sensitive to digitization and infrastructure.[4]

For quantifying the impact of digitization and its role for inclusive growth, we will estimate these at the Firm-level using panel data and generalized methods of moments (GMM) with lagged dependent variables as instruments. Also, a lower dimensional version of a global multi-regional, multi-sectoral computable general equilibrium (CGE) model will be used for addressing cross-border technology diffusion issues. In particular, Global Trade Analysis Project's (GTAP) Version 9 global database will be used for undertaking the research (see Hertel ed. 1997). Version 9 of the GTAP database disaggregates the World economy into 119 regions and 57 sectors. Major regions are likely to be India, China, USA, Latin America and composite developing regions of Africa. Sectors will be classified according to technological intensity and also we consider services sector having higher incidence of outsourcing.

Followings are some of the potential policy scenarios from the analysis:

a) Effect of Technological spillovers due to R&D activities in ICT sector and impact of regional economic integration arrangements in achieving economic growth.
b) Impact of ICT on the adjustment of the labor market.
c) Effect of labor market competition on wage rates and welfare.

[3] https://www.wto.org/english/tratop_e/inftec_e/inftec_e.htm

[4] Jorgenson and Stiroh (1999) has given evidence on substitution of IT for inputs, such as, labor and capital in the US. This causes change in firms' organization, skill heterogeneity, and adjustment of wages to productivity gains.

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