

Catching-Up in the Digital Economy: The Need for Rapid Policy Evolution

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[Abstract: *Each of the new digital technology systems driven by Big Data, the Internet of Things, robotics, online platforms and artificial intelligence presents significant opportunities to firms from developing countries like India to catch up. But several strategies adopted by leading firms to sustain their competitive advantages and consolidate their monopoly positions—including their proprietary ownership of platforms and data—become barriers to entry for follower firms. Meanwhile, lead firms are integrating new digital technologies into the production of goods and services in myriad ways. The Indian economy therefore faces new challenges in its ability to remain competitive and survive against the onslaught of import of digitalised products and services across sectors. Without improving its capabilities in electronics hardware production rapidly to forge synergies with the country’s software capabilities, India faces the risk of witnessing another wave of import surge. While data is the prime driver of these new technologies, the increased use of sensors in devices and application-driven machines, and the growth in networked devices are continuously increasing the scale and scope of real time data extraction by the lead firms. The convergence these data-based technologies are driving across sectors has national security implications too. Therefore, India’s ‘digital development trajectory’ needs to be guided by the government by quickly putting in place adequate regulatory systems and policies related to data ownership and security standards. Reformulating competition/anti-trust policies and trade and investment policies to reflect the emergent concerns all come within the ambit of the regulatory shake-up that is urgently needed to allow secure and sustainable digital transformation and catching up by India.]*

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The eruption of advanced digital technologies has led to increasing assimilation and diffusion of ICT in developing countries, including India, over the last three to four years. The greater ICT-led convergence across sectors that we are witnessing now (compared to the earlier internet phase) follows the emergence of the inter-related technology systems driven by Big Data, the Internet of Things, robotics (or computation-intensive automation), online platforms¹, and what is being called artificial intelligence (AI). The increased dynamism is reflected in the emergence of a number of developing country start-ups. In India, these are the most prominent in service sector activities such as retail, transport, restaurants, hospitality, education, finance, etc. Seemingly leveraging India's strength in the IT software domain and driven by new business models facilitated by the new technology systems, these sectors are undergoing significant digital transformation.

Many of the new disruptive technologies which have together provided data storage, computing power and networking abilities, allow data analysis on a scale unparalleled in human history as well as cross-sectoral coordination and flexible organisations and operations. Given that these permit the reorganisation and transformation of not only services, but also manufacturing and agriculture, there are huge opportunities for Indian firms to emerge as fast followers, catching up and overtaking digital technology leaders in various industry segments and even to emerge as innovators. Against this backdrop, this article identifies some of the technological and anti-competitive barriers to developing country firms trying to catch up and the associated policy issues.

Catching Up Potential over Technology Lifecycles

According to the neo-Schumpeterian economist Carlota Perez who theorised the global evolution and transformative impacts of technological revolutions historically in terms of the “techno-economic paradigm”,² the “irruption” and “maturity” phases of technologies offer the best opportunities to developing countries to attempt technological catch up.³ As Perez (2001) pointed out though, during the irruption phase of technologies, the period of paradigm transition from the old to the new—when new technologies co-exist with old technologies—also offers opportunities to firms in the old paradigm.

The technology systems of Big Data and the Internet of Things (IoT) are currently going through the intermediate phases of their respective technology lifecycles (see Figure 1) and experiencing incremental innovations. Within the platform technology system, while e-commerce platforms (like Amazon), sharing service platforms (like Uber), electronic payment platforms (like PayPal) and streaming entertainment services (YouTube, Apple Music, etc.) also appear to be in the incremental innovations phase of their technology lifecycles variously, Blockchain is only in the initial optimisation

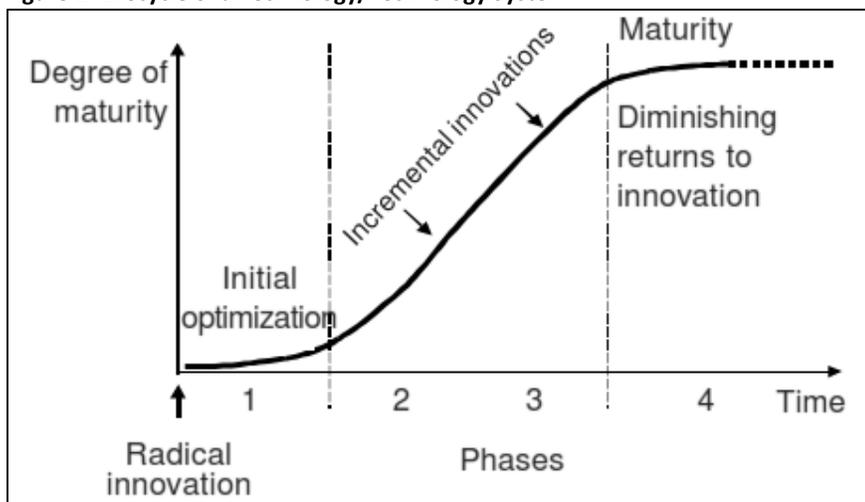
¹ Some of the currently prevailing platforms are search engines, social media, e-commerce, electronic payment, streaming entertainment services, hosted services and applications, blockchains, etc.

² In fact, within Carlota Perez's framework, these new technology systems/ technologies that have emerged are part of the same fifth technology revolution—that is, the ICT revolution, rather than a new technology/industrial revolution being popularly referred to as Industry 4.0.

³ See Francis 2018 for a detailed discussion.

phase following introduction. Technology systems like robotics and AI are also only in their initial optimisation phases.⁴ Being in the initial phases of their lifecycles, each of these technology systems present significant opportunities to follower firms from developing countries as seen in the emergence of Flipkart, Ola, Paytm, etc.

Figure 1. Lifecycle of a Technology/Technology System



Source: Perez (2001: 114).

New generic technologies as well as new business models can also be applied to modernise and rejuvenate mature technologies and even traditional technologies. Thus while digitalisation of traditional services has been proceeding apace, the new technology systems are also driving digitalisation of the manufacturing and agricultural sectors. The latter is causing the alteration of existing product lines and leading to the launch of new product cycles. The availability of platforms, cloud, data analytics, etc. as infrastructural services and an increasing range of other digitised services being offered through them, along with the availability of risk capital, are enabling fast followers and new disruptors from developing countries such as India to self-organise, scale up rapidly, and generate rapid financial returns.

However, while their “rapidly falling average total costs and zero marginal costs” (Ernst 2016) are driving this dynamism, digital technologies are also characterised by “strong network externalities, standards battles and path dependence”. Therefore, overlapping and inter-linked innovations within these and other technology systems mean that the lifecycles of new upstream and downstream products/services may involve much shorter phases of maturity than under the previous mass production techno-economic paradigm. Some products may die out before even reaching maturity. This substantially curtails the possibilities for catching up by follower firms.

Moreover, the entry barriers erected by lead innovator firms by extending their market power in various ways also present significant hurdles in developing countries’

⁴ As in the case of blockchain, while there is a lot of research and investment in these two technology domains also (which have vast potential), there are several technical challenges remaining to be resolved and consequently not too many commercially-viable products/solutions (Francis 2018).

path towards industrial and technological catching-up through digital transformations.

Barriers to Entry and Competition for Follower Firms

An earlier study (Francis 2018) found that several strategies adopted by innovator/leading firms to sustain their competitive advantages and consolidate their monopoly positions become barriers to entry for follower firms from developing countries like India. These can be considered under the following categories:

- Expansion of IP protection into new spheres and strategic patenting by innovators, leading to “patent thickets” that block innovation;
- Increasing embeddedness of software and hardware in networked products that entrench the innovator’s monopoly position in new products;
- Proprietary ownership of platforms and networked data to appropriate the largest revenue share within each segment of users in multi-sided markets (or platform-based businesses);
- Exclusionary pricing practices by leading platform firms such as Google, Amazon, etc. to increase network effects;
- Acquisition of competitors and innovator start-ups by leading firms to buy up new technologies or/and thwart the entry of successful developing country competitors; and
- “Private innovations” in government support by leading firms like Amazon that have got billions of dollars in tax breaks from sub-federal governments (see Francis 2018: pp. 51–61).

Among these, the central barriers to new entrants in the platform businesses currently dominating the digital space are their emphasis on proprietary technology platforms and “ownership” of networked data. By their very nature, the benefits from data analysis increases with the size of users on any one side of these so-called multi-sided markets. The asset and knowledge asymmetries between lead firms and followers—in both the data extraction and analysis phases—institutionalise the leader’s position in such markets (“the Big Data divide” attributed to Mark Andrejevic 2014). This, together with especially the exclusionary pricing practices they engage in, makes the nature of monopoly rents quite different in the sectors the leading firms are directly engaged in (for instance, Amazon or Google). The largest share of the revenue accrues to the platform company due to its proprietary ownership of platform design and monetisation of the data extracted. This also means that the immense opportunities to small and medium businesses—which are being projected as significant beneficiaries in the platform phase—may not lead to the same wealth generation capabilities for them as for the owners of platforms, cloud, etc.

These lead platform-owing firms are also entering into several sectoral verticals in the production space. Advances in data analytics combined with greater sets of data such companies gain access to through their various products and business strategies enable them to develop and offer totally new products. These can displace existing products in industrial segments totally different from the digital space the firms

originally inhabited, and even traditional sectors (for example, through the emergence of precision agriculture). It will also create demand for new networked products.

In manufacturing, this has begun to happen in a variety of industries, starting with the electronics industry. In the electronics industry, rather than being stand-alone pieces of electronics with capabilities that were limited to the hardware and software inside the unit (Ross 2016), several new networked products are being launched, for instance, by platform companies such as Google (Home), Amazon (Echo), etc. These can now interact with their user as well as their environment (including with each other). These innovative products promise to disrupt traditional products. For example, Amazon's latest offering Echo Show is an Alexa speaker with a display. It offers news briefing with a quick video overview, in addition to several other uses people expect Alexa to do (like video calling, texting, etc.).

The transformation being brought about by digital technologies is not limited to the electronics industry. In the automobile industry, for instance, many cars (and other vehicles soon) are coming into the market with pre-installed IoT apps and devices, which capture huge amounts of data related to the vehicle, user, traffic, pollution, etc.

Thus the new digital technology systems that leverage data ownership and analytics will likely disrupt a number of existing industries of the mass production era, whose varying business needs can be met through platforms, IoT, automation, etc. It is important to recognise that the impact of digital technologies on the (different sectors of the) economy—or digital transformation—is multi-dimensional and go far beyond what may be visible products such as sensors and robots, or e-commerce, as commonly perceived.

Looming Challenges for Indian Policymakers

New digital technologies are getting increasingly integrated into the production of goods and services in myriad ways. The Indian economy therefore faces new challenges in its ability to remain competitive and survive against the onslaught of import of digitalised products and services. An understanding and assessment of how digital transformation is impacting a developing country like India must take into account transformations at three levels:

- those in the digital space itself (including Big Data, digital platforms, robotics, artificial intelligence, etc.);
- digital transformation of services (retail, finance, transport, health, etc.); and
- digital transformations of the industrial and agricultural production spaces (through computation-intensive automation, IoT, etc.).

The current phase of the ICT revolution is one where inter-related innovations in technological systems, markets, and organisational forms are occurring at a rapid pace. The current phase also brings together synergies in hardware and software capabilities together with access to data of all kinds. Therefore, India needs to have capabilities in both electronics software and hardware technologies to be able to face up to these challenges.

Electronics industry is the most directly impacted by digital transformation, and is also the one upon which the *sustainable* digitalisation of the economy will depend—indeed, it is the backbone of the digital economy. Without improving its capabilities in electronics hardware production rapidly to forge synergies with India's software capabilities, India faces the risk of witnessing another wave of import surge with adverse macroeconomic implications. Lack of rapid indigenous technological improvements could lead to dwindling of its manufacturing base across a number of other industries as the use cases of the new digital technologies expand in sectors as varied as healthcare and education to industrial automation, renewable energy, public safety, smart cities, finance, and agriculture. The impact on different manufacturing industries such as electronics, automobiles, non-electrical and electrical machinery, metal products, textiles, food processing, etc. will vary depending on the existing levels of capabilities in these industries, indigenous entrepreneurs' abilities to foresee the synergies and leverage capabilities across different areas and activities including software, and the government's abilities to put in place the necessary ecosystem to improve the first two capabilities through a systemic approach.

Big Data has become the prime driver of many of the new technology systems in the digital economy. The increased use of sensors in devices and application-driven machines, and equally importantly, the growth in networked devices are continuously increasing the scale and scope of real time data extraction. Greater the data for analytics and predictive modelling, the greater is the revenue potential for the owners of data as well as the innovation that follows it for future revenue generation. Advancements in the new technological systems such as artificial intelligence, network technologies, robotic process automation and cloud robotics, blockchains, etc. are all also contingent on Big Data. Thus data ownership has critical implications for the 'digital development trajectory'.

Given the convergence that data-based technologies are driving across sectors which has national security implications, the 'digital development trajectory' needs to be guided by the government by quickly putting in place adequate regulatory systems and policies related to data ownership and security standards. This entails a challenging policy task to strike a balance between data needs for innovation on the one hand, and issues surrounding privacy, data protection, and the ethics of data use (including for AI for eg.), on the other side.

In the case of digital technology systems based on data generated within developing countries, we must not have a policy of first introducing the technologies and then imposing standards. Unfortunately, this is the manner in which things have been proceeding recently, with many digital technologies having already been introduced into India. India needs to put in place national standards related to data ownership, privacy and security in accordance with its socio-economic and strategic imperatives. Unlike the previous generation of internet-linked products, lack of security standards for the emerging generation of networked products is a call to disastrous consequences for national security given the vast range of channels through which security may be compromised. Equally importantly, India needs to ensure that critical

ICT infrastructure networks—starting with telecommunications networks, are not kept open to foreign companies.

Policy responses to evolving corporate strategies for value appropriation in the digital economy will determine the direction and impact of digital transformations and the associated income distribution effects on aggregate demand in the economy. None of the cross-sectoral anti-competition impacts of the proprietary ownership of platform and networked data of e-commerce companies were considered by the Indian competition authority, when it recently allowed the acquisition of the Indian e-commerce company Flipkart by the US supermarket giant Walmart. Ironically, this happened in India at a time when the Chinese' e-commerce giant Alibaba is reportedly exploring a strategic alliance with the top-ranking supermarket chain in the US, Kroger, as a way to counter Amazon's aggressive expansion into physical stores by acquiring the US retail chain Whole Foods. In order to ensure that emerging digital economy players promote competition and entail broader economy-wide benefits, policies need to quickly evolve to support indigenous digital companies by reigning in monopolistic tendencies and practices in the digital space. Reformulating competition/anti-trust policies and trade and investment policies (including at trade and investment negotiations) to reflect the above concerns all therefore come within the ambit of the regulatory shake-up that is urgently needed to allow secure and sustainable digital transformation and catching up by India.

Envisioning these challenges and seeking solutions calls for a significant leap in the capacity of bureaucracy and policymakers to deal with the issues related to the new technologies, and a huge step up in the resources allocated to technology funds, SMEs, start-ups, etc. Not evolving such an ecosystem as quickly as possible and dynamically tweaking the same based on continuous evaluation and monitoring will cost India dearly through compromised national security. India will also find its import bill ballooning up further as the demand for new generation products increase from across sectors. If the country is not to be overwhelmed by such eventualities and is not to be exposed to the exponentially rising digital security threats, India must urgently prioritise public and private R&D and indigenous manufacturing efforts in the electronics industry, as well as in "emerging" technologies like 5G, which is poised to become the harbinger of the next wave of ICT products and services. Without indigenous technological strength there will be no room left to influence the setting of standards. Only the latter will give our companies long-term competitive advantage in several inter-related markets and also protect national security.

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