DATA LOCALISATION

India's Double-Edged Sword?

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Foreword

The role and significance of data have evolved over the years for industries and countries alike. The advent of ever-changing technologies, has transformed businesses operations, processes, contribution to global data value chains and participation in international trade.

Lately, recognising its economic value, data has often been called as the new oil. With the increasing reliance on advanced data driven technologies such as artificial intelligence and machine learning, the debate has advanced from discussing the potential benefits of data analytics to realising the value of data and its commercial use and/or surveillance by foreign agencies and social intermediaries/ data fiduciaries.

In this context, countries around the world have been gradually introducing data protection policies to regulate the use of data and to promote data privacy and security. In doing so, countries are looking to build new data industries, restrict foreign surveillance and improve data access for law enforcement agencies, by restricting cross border flow of data. However, on the flip side, such data restriction measures could potentially impact domestic businesses, foreign trade partners and consumers.

Thus, it becomes significantly imperative to analyse the cost and benefits of implementing such policy measures. This is even more relevant for India since it is recognised as a global leader in digital services exports. The IT-BPM industry in India has grown progressively over the years, contributing significantly to the GDP of the country and is an integral part of the digital economy growth objective of the Government of India, including making India self-reliant.

The industry availed the opportunity of an uninterrupted flow of data across borders and favourable policies, which have been available domestically as well as in its major export markets. Similarly, India is at a vantage point to incentivise private industry to set up data parks across the country.

In this light, this report by CUTS International is an enlightening resource in informing the discussion about the impact of cross border data flow restrictions on India's digital services exports and its impact on the country's GDP. A very peculiar aspect of this study is its novel analysis of the IT-BPM industry and its significance to the Indian GDP and thus bringing a very important perspective in the discussion around data localisation. The report takes the readers through the significance of digital trade for the world and India, and the emergence of data protection and restrictions on data flows across the countries.

The report then clearly illustrates the importance of India's IT-BPM Industry, specifically through focusing on the digital services exports and its statistical significance with the GDP. It employs econometric analysis to comprehensively inform the correlation between digital services exports, GDP, foreign direct investment and innovation at the national and state level. Ultimately, the

report estimates the likely impact of cross border data flow restrictions on India's digital services exports and GDP through building seven hypothetical scenarios and what it would mean for India while it is targeting to become a US$5 trillion economy by 2025.

The scenarios include varied degrees of data localisation, and reciprocal actions by trade partners. The report does not take a one-sided approach to understand the impact, however, has rightly engaged various industry stakeholders to construct evidence on the potential drawbacks and benefits of implementing data localisation in India.

Overall, the astute analysis highlighted in the report leaves a thought-provoking impact on its readers, for which CUTS should be congratulated. I wholeheartedly encourage the regulators and policymakers across the globe, particularly India, to be guided and inspired by the findings of the report in regulating cross border data flow, particularly at a time when the whole world needs to come together to leverage the potential of digital economy in moving forward while dealing with Covid-19 pandemic.

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Amar Patnaik
Member of Parliament, Rajya Sabha and
Member of Joint Parliamentary Committee,
Personal Data Protection Bill 2019

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Key Findings

- With a globally competitive Information Technology-Business Process Management (IT-BPM) industry, India is a leading exporter of digital services, enjoying a significant services trade surplus with the United States and Canada, its top export destinations. India's digital services exports are dependent on favourable policies abroad that ensure open market access, including the ability to transfer data across borders.

- Digital services exports have a positive and statistically significant impact on India's gross domestic product (GDP). We find that a 1 per cent increase in digital services exports results in a 0.02 per cent rise in GDP. Conversely, a fall in digital services exports may result in a reduction in India's GDP.

- The economies of several states, especially Karnataka, Maharashtra, Telangana, and Tamil Nadu, depend on export-driven services, as these hosts much of India's IT-BPM industry and benefit from higher standards of living, employment and foreign direct investment.

- Digital services exports are associated with additional spillover effects for the innovation economy, a number of start-ups and patent filings. We can, therefore, draw a link between policies that promote digital trade, such as data flow, with India's innovation economy.

- We model the impact of restrictions on cross-border data flows and data localisation on India's digital services exports and GDP across seven scenarios. The scenarios vary according to the restrictiveness of the measures and whether they are implemented by India, its major trading partners in retaliation, or by multiple governments.

  All the seven scenarios estimate a decline in India's digital services exports and GDP, ranging from 10 to 19 per cent, or US$19bn to US$36bn shortfalls towards the Government of India's US$1tn targets for the digital economy. The decline in digital services exports may likewise lead to a reduction in India's GDP by 0.2 to 0.34 per cent. This loss would translate to a shortfall of US$9bn to US$17bn in achieving the US$5tn economy objective in 2025.

- The impact also extends on investments and welfare with losses of US$18bn in investment and US$2.4bn in welfare in 2025 under complete data localisation.

- Industry perspectives gathered during this study have raised concerns regarding the impact of restrictions on the cross-border flow of data. Compliance with data localisation requirements would require companies to restructure and redefine their business processes and system architecture, thus having financial and operational consequences for them.

- Companies also note that the innovation and start-up ecosystem's ability to scale up globally and participate in global data value chains would be compromised. Industry players unanimously say that the privacy and security of data are not dependent on the physical location of servers.

- Although data localisation may lead to increased demand for data centres in India, it is not likely to generate substantial employment post-construction. Further, as India's economy becomes more data-driven, there will be natural growth in market demand for server capacity built within the country. Finally, industry respondents cited concerns that permitting requirements, difficulties around obtaining land and access to consistent water and electricity serve as supply-side constraints on the construction of data centre in India.

- Our findings illustrate that policies mandating data localisation and restricting the flow of data may likely harm India's digital services exports, GDP, investment, welfare, innovation, and start-ups. It is crucial to consider these implications in formulating and implementing data privacy and data protection policies or else the undesirable economic ramifications may outweigh purported benefits. A stance that mandates data localisation could place India on a reverse course, impacting its progress, potential and position as a world leader in the IT-BPM industry.

- Consequently, India has a vested interest in maintaining an open digital economy and in promoting the free flow of data across borders, as these policies support its position as a global leader of digital services. In other words, data localisation measures at home and abroad are a threat to India's global digital competitiveness.

Executive Summary

Digitalisation and cross-border data flows have transformed international trade. Enterprises in developing and developed countries alike are today able to participate in global markets and benefit from global value chains with greater collaboration and innovation, voluntary technology transfers, and improved business processes. Data-driven innovation is responsible for greater shares of global economic growth and for diversifying modes of trade and exports. While a digital divide persists between developed countries and many in the developing world, the opportunities associated with connecting the developing world are significant. The flow of data across borders — and the government policies that enable data flows — underpins this digital transformation.

India is an active participant in harnessing the opportunities made available through the free flow of data. Prominently, India has established and consolidated itself as a leader in the global IT-BPM industry, primarily through consistent growth of digital services exports to other countries. Digital exports, which we define as the export of digital goods and services, comprise India's second largest export sector. Digital trade more broadly benefits the Indian economy by increasing productivity, connecting Indians to best-in-class digital goods and services and reducing the cost of engaging in international trade for Indian micro, small and medium enterprises (MSMEs).

India's digital trade is expected to grow more than 14-fold by 2030, from US$35bn currently.[1] The revenue of the IT-BPM industry was US$167bn in 2017-18 and has the potential of reaching US$280bn to US$350bn by 2025.[2] The IT-BPM industry alone is expected to contribute a quarter of the economic value to the US$1 trillion digital sector objective by 2025.[3] In all, digital trade is fundamentally important for the growth of the IT-BPM industry in India with data flows at the core.

India's success as a global leader in digital exports is the result of favourable public policies at home and abroad, including the open market access granted to Indian digital exports by its foreign trading partners. Worryingly, we are now seeing a rise in global digital protectionism, including a series of policies restricting the international processing, storage, and transfer of data, often referred to as "data localisation" (DL). While India benefits significantly from its digital exports, including the processing of sensitive personal data of foreign citizens, India has a various existing and proposed policies that impose data localisation requirements or that restrict the flow of data across borders. These are detailed in Appendix D, and include the Information Technology Act and Rules, 2011, RBI Notification on Storage of Payment System Data (RBI Notification) and the Personal Data Protection Bill, 2019 (PDP'19).

This study measures the economic importance of digital services exports for the Indian economy and analyses the implications of foreign and domestic data flow restrictions on the economy. We found that digital services exports have a positive and statistically significant impact on the country's GDP. To elaborate, **an increase in digital services exports by 1 per cent would advance**

India's GDP by 0.02 per cent and vice versa. The services sector, of which digital services constitute a major share, attracts the highest FDI inflow, which brings with it associated technological and knowledge benefits. Moreover, digital services exports have a positive correlation with the indicators of innovation such as the number of start-ups and the number of patents filed. In view of this, policies enabling digital services exports such as seamless cross-border data flows would be crucial for the growth of the sector and in turn boost the country's GDP and advancing innovation.

The study builds seven scenarios, each varying in the level of restrictiveness imposed on cross-border data flows by the Government of India and by its major trading partners in retaliation. The scenarios estimate retaliation from India's top export destination for digital services (United States) due to restricted market access for the US firms, and lastly, when all importers of digital services from India impose retaliatory restrictions on CBDF. All seven scenarios estimate a decline in digital services exports and GDP because of data flow restrictions. **India's digital services exports may plunge by 10 to 19 per cent due to increasing data flow restrictions instituted by India and its major trading partners. These translate to a shortfall of US$19bn to US$36bn in achieving the US$1tn economic value potential** of the digital sector in 2025. Moreover, **the decline in digital services exports may negatively affect GDP by 0.2 percent to 0.34 percent. This translates to a shortfall of US$9bn to US$17bn in the Government's objective to be a US$5tn economy by 2025.** Furthermore, the impact may also extend to investments and welfare with losses of US$18bn in investment and US$2.4bn in welfare in 2025 under complete data localisation. This is significant considering India's vision of becoming a US$5tn economy.

In addition to the econometric analysis conducted, the study includes views and experiences of industry stakeholders, collected via in-depth interviews, which details the impact of data localisation on India's domestic industry, innovation, compliance and more. The primary finding of these interactions was that privacy and security of data are not dependent on the physical location of servers. Companies would need to restructure and redefine, inter alia, their business processes and system architecture, with financial and operational consequences. The innovation and start-up ecosystem may also be affected, as the ability to scale up globally and participate in global data value chains would be compromised.

Respondents also conveyed their concern that the cost of data servers and services may increase for all companies in India because of supply-side constraints. In this regard, a limited number of domestic suppliers would be compounded by regulatory challenges, including permitting requirements, land acquisition and the lack of uninterrupted supply of electricity and water, which would further restrict the growth of data centres. Since data centres are currently largely powered by coal, they tend to have a bigger carbon footprint. Emissions from data centres in China in 2018, for example, were equivalent to 21 million cars on the road. India desires to take the lead in building data centres, but also has the highest rate of growth of carbon emissions than the US and China.[4] An emphasis on building local Indian data centres, therefore, is at cross-purposes with India's commitments to lower greenhouse gas emissions.[5] Additionally, data centres dominantly use water to cool their systems where climate is hot, thus affecting water resource allocation for local communities.[6]

Our findings illustrate that policies mandating data localisation and restricting the flow of data may likely harm India's digital services exports, GDP, investment, welfare, innovation and start-ups. It is crucial to consider these implications in formulating and implementing data privacy and data protection policies or else the undesirable economic ramifications may outweigh purported benefits. A stance that mandates data localisation or unduly restricts the cross-border transfer of data could place India on a reverse course, impacting its progress, potential and position as a world leader in the IT-BPM industry.

Background and Context[7]

The digital economy drives growth and development and boosts competitiveness, efficient business processes and innovation across new and emerging sectors.

Digital technologies facilitated through cross-border data flows and innovation have transformed global trade. The digital economy drives growth and development and boosts competitiveness, efficient business processes and innovation across new and emerging sectors[8]. Most importantly, in the context of developing countries such as India, cross-border flows of data enable start-ups and small businesses to participate in global markets[9]. Driving on the value that cross-border data flows offer and factors such as a favourable policy environment and access to foreign markets, India has been a significant participant and a beneficiary.

The free flow of data facilitates innovation as it allows sharing and dissemination of ideas, information and knowledge and builds collaboration between individuals and companies.[10] Cross-border data flows were estimated to have contributed US$2.8tn to the global economy in 2014, and this is estimated to scale up to US$11tn by 2025.[11] By some estimates, these data flows now generate more economic value than the traditional flow of traded goods.[12]

The digital economy also attracts investments including foreign direct investment (FDI). The new international investment patterns shaped by the digital economy have created incentives for countries to advance their digital infrastructure including a favourable policy environment to attract FDI.[13] To this end, the capacity and capabilities of countries to provide digital infrastructure for digital-intensive international production networks have become new determinants of business location decisions.[14] FDI has also been acknowledged as an important source of new technology for developing countries such as India and hence a contributor to economic growth.[15]

The free flow of data facilitates innovation as it allows sharing and dissemination of ideas, information and knowledge and builds collaboration between individuals and companies.

An innovation ecosystem enabled by the Internet and free flow of data and information requires an open environment that facilitates experimenting of new use cases. However, under

restrictions on digital collaboration and data flows, people experiment less, which hampers innovation. Countries with an open Internet tend to be more innovative and participative in digital trade as the free flow of data is fundamentally a significant enabler of innovation.[16]

An innovation ecosystem enabled by the Internet and free flow of data and information requires an open environment that facilitates experimenting of new use cases.

Digital Trade

Digital trade comprises digital imports and digital exports.[17] For this research study, **digital services exports include exports of ICT services and IT-enabled Services.**[18] Exports of **ICT services and IT-enabled Services,** hereafter, will be referred to as **"Digital Services"** exports. Overall, digital trade has increased trade in services, including small-value digital services such as online streaming music, e-books and online games.[19] These digital services are increasingly bundled with goods (e.g. Internet of Things devices with digital personal assistants), blurring the lines between goods and services, and previously non-tradable services are now traded across borders. In summary, digitalisation is changing the nature and delivery of such services.[20]

Between 2004 and 2014, it is estimated that digital trade increased world GDP by more than 10 per cent, equivalent to US$7.8tn.[21] About 75 per cent of the value created by cross-border data flows accrues to "traditional" industries, especially via increases in global growth, productivity and employment.[22] This is especially relevant because policies thought to be impacting the technology sector only could have a widespread impact across traditional sectors as well.

Similarly, for the Indian economy, the gains of digital trade rests on the fulcrum of cross-border data flows. Global data flow hold potential for enabling the Indian firms to enter new markets, generate business insights, facilitate efficient management of global value chains and improve business practices.[23] The economic value supported by digital trade across the major sectors in India could grow by more than 14-fold by 2030 in the absence of barriers to digital trade and free flow of data.[24]

Global data flow hold potential for enabling the Indian firms to enter new markets, generate business insights, facilitate efficient management of global value chains and improve business practices.

Emergence of Data Protection and Restrictions on Data Flow

Digital transformation across the globe has made it easier to engage in global trade, however, as new business models come to the fore, they also bring new global trade and policy implications. Additionally, just as governments are beginning

to realise the value of data and its commercial use, countries across the globe are beginning to consider data protection and restriction policies.[25]

As a result, numerous trade restrictions and barriers have gradually emerged to regulate the use of data, advance controversial industrial policy and attempt to promote data privacy and security. These measures can be collectively called as data restriction measures and may either **block the transfer of data across borders (data localisation) and or place conditions on the flows of data and its storage and processing.** (See Figure 1)

Figure 1: Types of Data Restriction Measures[26]

| No restrictions | Local storage | Local processing | Ban on transfer |

- - - If coordinations are fulfilled - - - **Conditional flow regime**
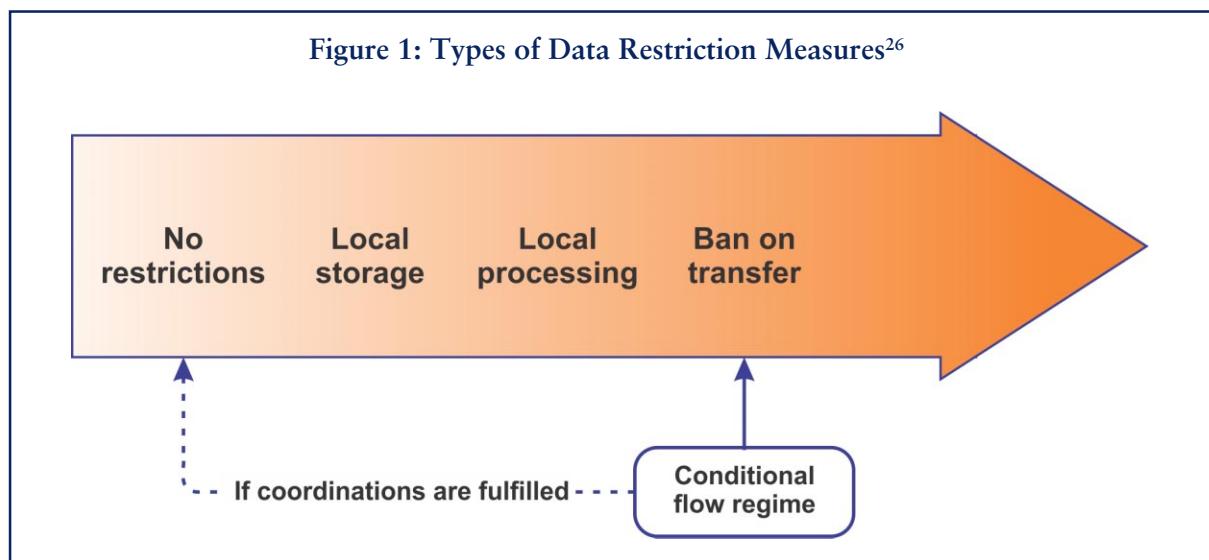
Data restriction measures can appear in many forms such as -
- rules that prevent the flow of data outside the country;
- rules that require the flow of data to countries or companies with adequate data protection framework;
- rules that require the prior consent of the data principal[27] before the information is allowed cross borders; and
- rules that require local storage and processing of data.

While the number of restrictive measures put in place by governments has increased over time, these policies add significant costs on domestic businesses, foreign firms and consumers.[28] The rationale given by governments in favour of such restrictions ranges from national security, economic growth, innovation, and protect against foreign surveillance.

As the trade of services across borders is significantly based on the transfer of data, policies that target the global flow of data hinder services trade. Moreover, digital services exports of many

Data localisation may impede the scale and positive contribution of data intensive services in the economy.

countries rely heavily on imports of data-intense inputs from abroad.[29] Besides, in the context of global value chains, restricting the data flows would substantially impact the source of digital services inputs.

Strict data policies affect how services are traded. Restricting data flow could impact companies' ability to select the most efficient channel for trading many services.[30] As a result, the number of data-intensive services traded over the Internet would be less. Similarly, data restrictions also affect local firms to make use of efficient and secure global solutions for building new products and services. **Thus, data localisation may impede the scale and positive contribution of data intensive services in the economy.**[31] Similarly, restrictive data policies cause substantial productivity loss for local companies, which are data-dependent.[32] Similarly, a study by ECIPE estimated that India, Brazil, Indonesia, South Korea and Vietnam would have an adverse impact on GDP if these countries implement economy-wide data localisation policies.[33]

In contrast, **if all countries remove their restrictions on cross-border flows of data, their services import would increase by an average of 5 per cent across all countries.**[34] Thus, benefitting local companies and consumers who would access cheaper and better online services from abroad.

India: A Leading Global Exporter of Digital Services

The Indian IT-BPM[35] Industry

India aims to become a US$5tn economy by 2025. The digital economy will have to be a significant contributor to economic growth for India to meet this target. By one measure, India's digital economy may reach US$1tn by 2025. **It is important to note that almost one-fourth of the digital sector's growth potential, between US$202bn to US$250bn worth of economic value would come from the IT-BPM industry and more than half would come from new and emerging digital ecosystems.[36]** Although IT-BPM industry is an important engine of growth in itself, it also fosters growth through spillovers from innovation, FDI, exports and skilled human capital for the wider digital economy. The sector is growing at an accelerated pace in India. (See Figure 2)

Figure 2: The IT-BPM Industry's Contributions to the Indian Economy in 2019[37]
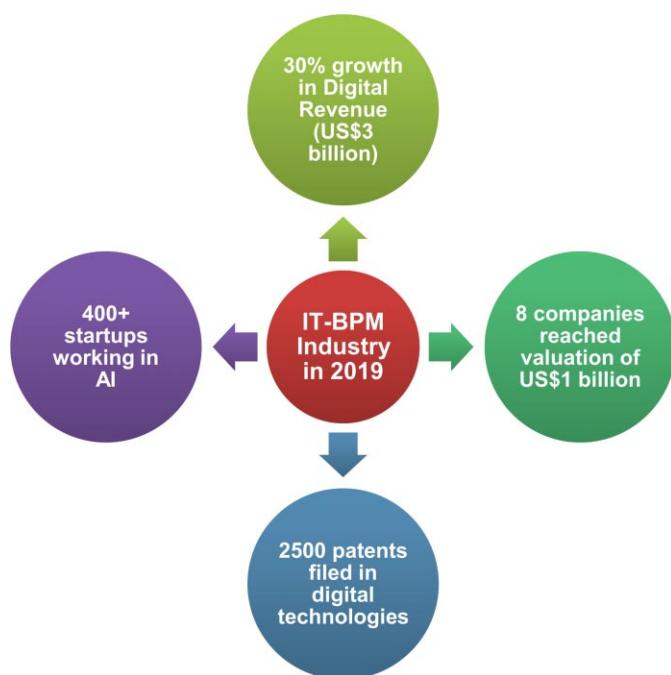
In 2017-18, the size of India's IT-BPM industry was US$167bn. With a growth rate of 6 per cent, the sector is expected to reach US$177bn in revenue in 2019.[38] The industry revenue has seen consistent growth over the last decade. (See Figure 3)

The IT-BPM sector has also emerged as a major employer of India's skilled labour force. The sector directly employs 4.1 million people[39] and indirectly supports employment for 10 million people. The employment in the IT-BPM industry – direct and indirect has been consistently growing over the years. (See Figure 4)

Figure 3: IT-BPM Industry Revenue
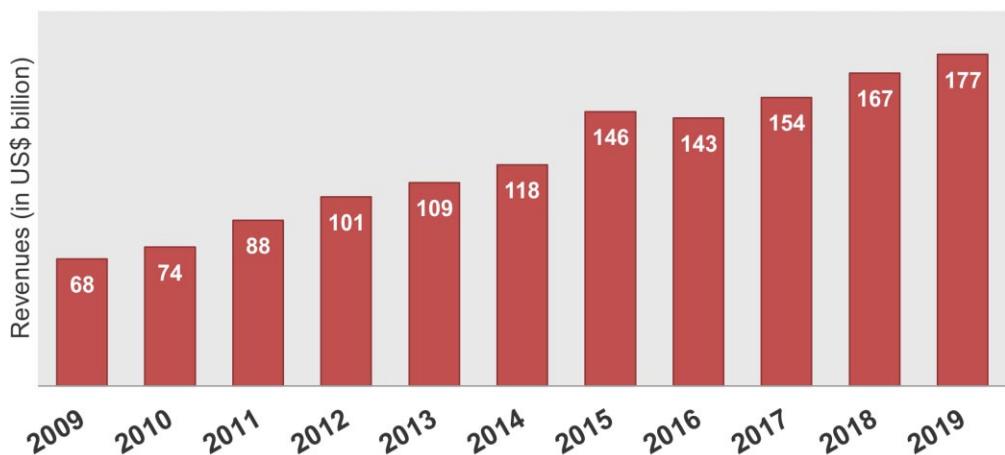
Source: Statista

Figure 4: Employment in IT-BPM Industry
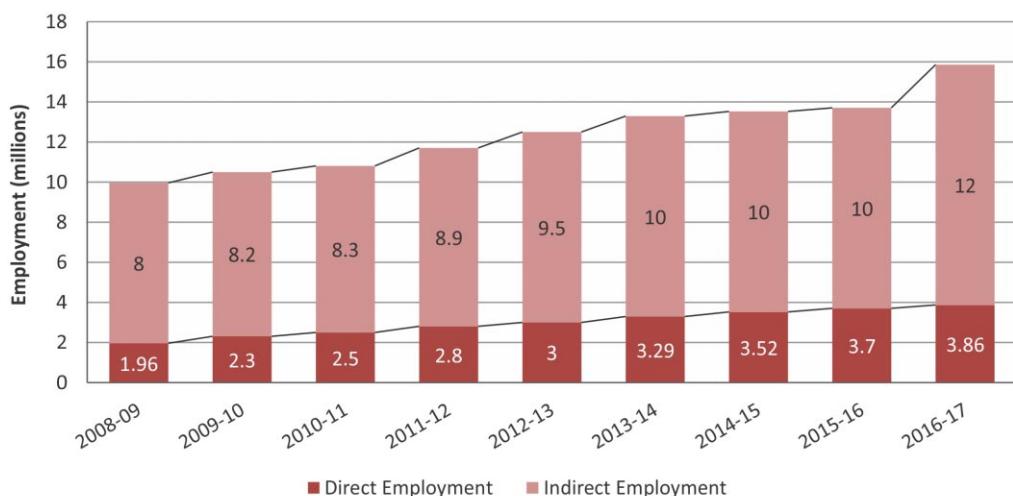
Source: Teamlease Services

The government needs to adopt policies that significantly improve the ease of doing business, maintain foreign market access and reduces operating costs for digital businesses.

It is important to note that the growth of IT exports has been fundamental for the rise of the IT-BPM industry in India (See Figures 5 and 6). This achievement is possible only when the ecosystem is enabled and sustained by policies, platforms, and partnerships and by bolstering the enablers and strengths of the IT-BPM industry. To this end, the government needs to adopt policies that significantly improve the ease of doing business, maintain foreign market access and reduces operating costs for digital businesses.

Figure 5: Size of Indian IT-BPM Industry
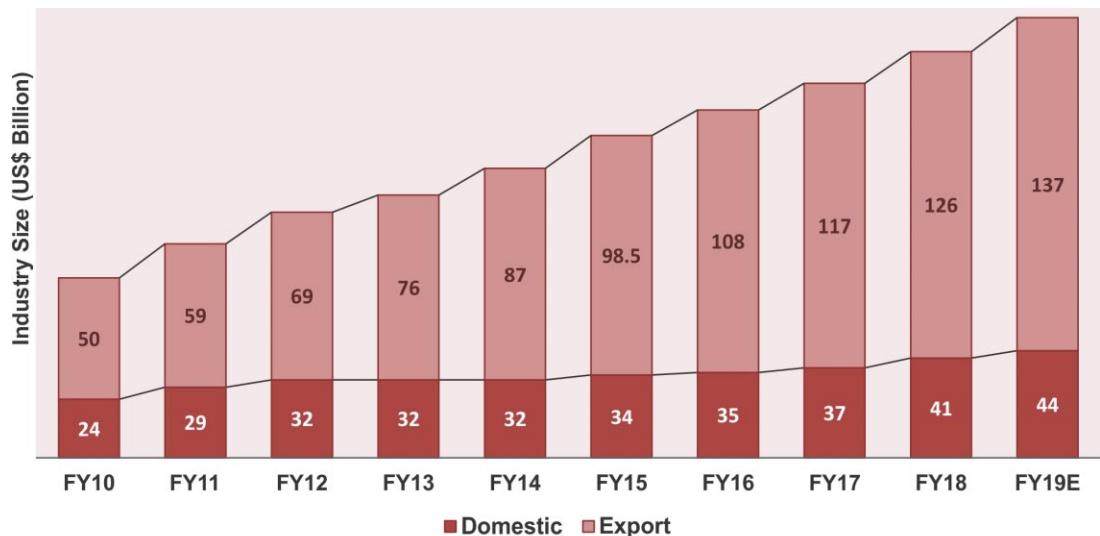
Source: India Brand Equity Foundation

Figure 6: Growth in Export Revenue
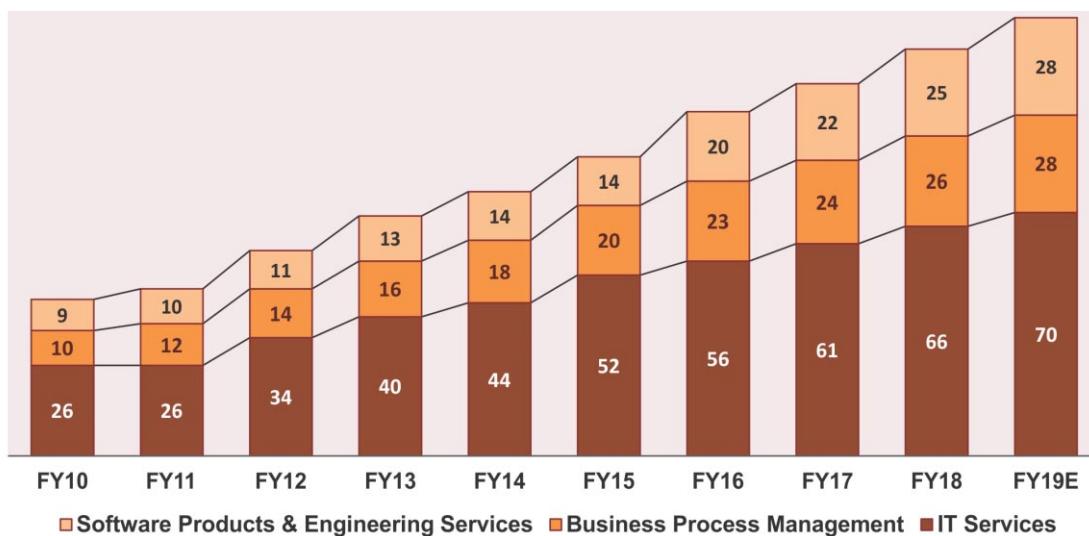
Source: India Brand Equity Foundation

The advancement and significance of IT-BPM industry has also been dependent on the growth of Global Capability Centres (GCCs) in India. Multinationals invested in India have moved from using GCC's as low cost offshore business service centers to now providing significant value-added services to their global operations. These centres are progressively engaging into research, innovation and business transformation. With more than 1,500 GCC in India, these centres account for 20 per cent of total exports from IT-BPM industry and hence also represent the burgeoning opportunities for next-generation GCCs focusing on AI and automation, all of which are based on digital technologies, growth and cross-border services trade.[40]

India is in a strategic position to strengthen its leadership in the IT-BPM sector and further advance its growth from its participation in digital trade using cross-border data flows.

Taken all together, India is in a strategic position to strengthen its leadership in the IT-BPM sector and further advance its growth from its participation in digital trade using cross-border data flows.

India's Digital Services Exports

India is a leading digital services exporter. In 2016, India's share of global IT services exports was 11 per cent, equivalent to US$55bn. The United States and Canada are the top destination for digital services export from India, followed by Europe, Asia and Australia and New Zealand (See Figure 7). The digital services exports from India have seen consistent growth over the years (See Figure 8). IT exports (CAGR 12.26 per cent) have grown at a faster rate than the domestic IT market (CAGR 10.45 per cent) over the past decade.[41] These exports also have a higher share of revenues in the IT sector in comparison to domestic

Figure 7: Top Destination of Digital Services Exports from India

Country	Percentage
USA & Canada	61%
Europe	26%
Asia	7%
Australia & New Zealand	3%
Other Countries	3%
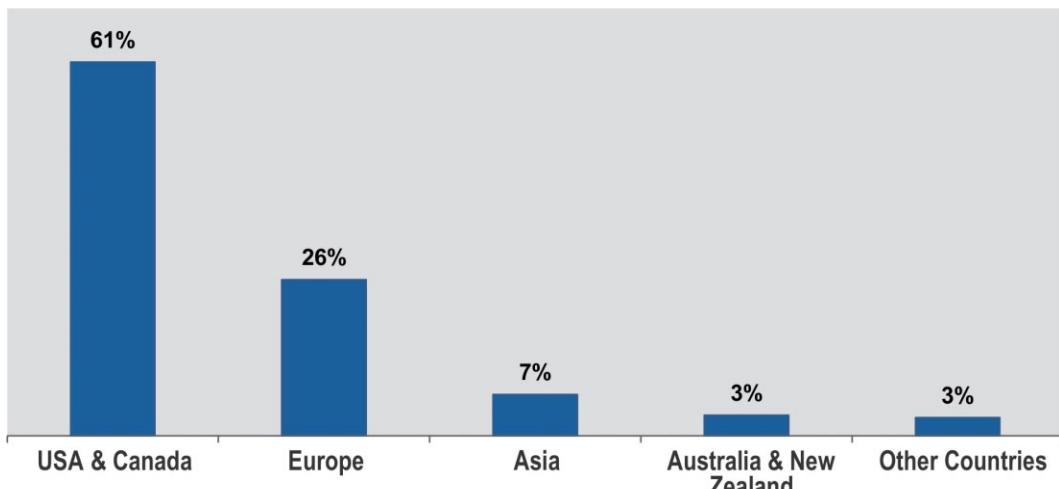
Source: Reserve Bank of India, Survey on Computer Software & IT Enabled Services Exports

Figure 8: Digital Services Exports from India
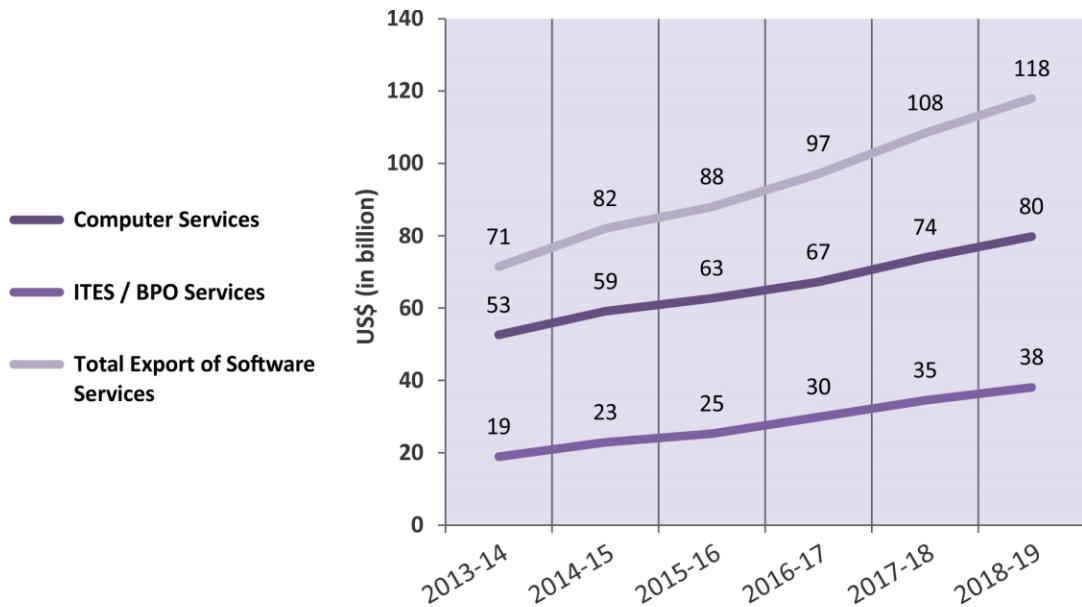
Source: Reserve Bank of India, Survey on Computer Software & IT Enabled Services Exports

demand.[42] This signifies that the growth of the sector is highly dependent and driven by exports.

Digital exports (goods plus services) comprise the second largest export sector of India. Notably, about 81 per cent of IT enabled services are delivered through Mode 1 (See Appendix C), which consists of cross-border supply of services.[43]

India has been able to leverage the growth in digital services exports due to favourable policies domestically and internationally.

It is not surprising then that, in the absence of restrictions on cross-border flows of data, digital trade enabled benefits to the economy, via increased productivity, cost efficiency and greater market access, are estimated to grow by more than 14 fold by 2030 from US$35bn currently.[44]

Digital exports generally rely on the processing of foreign sensitive personal data, including the areas of health, finance and human resources. This data could belong to the citizens, communities or companies and hence the whole ecosystem relies primarily on data transfer policies of foreign governments.

India has been able to leverage the growth in digital services exports due to favourable policies domestically and internationally. These policies enabled market access, free flow of data, growth of human capital and business efficiencies.

Most of the digital services exports from India go to North America and Europe. The United States is the largest recipient of these exports, while the other top importers include United Kingdom and 'Other European Countries', namely France, Italy, Ireland, Spain and Luxembourg. IT-enabled Services (ITeS) exports are also fundamental to India's MSMEs. **Of all companies engaged in ITeS exports, 78 per cent are MSMEs.** (See. Figure 9)

Figure 9: Distribution of Potential IT-Enabled Services Exporting Enterprises by Turnover

- Micro (<= 50 Million INR)
- Small (> 50 Million INR and <= 750 Million INR)
- Medium (> 750 Million INR and <= 2500 Million INR)
- Large (> 2500 Million INR)
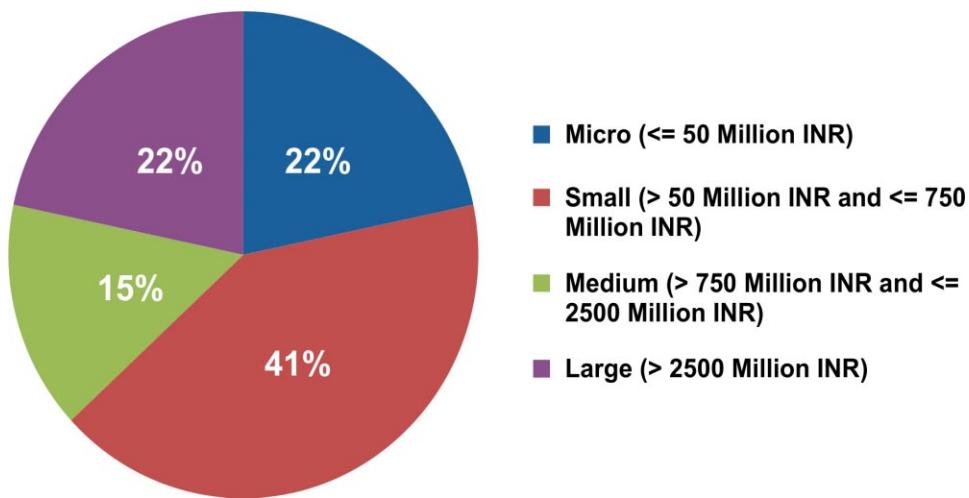
Source: Reserve Bank of India, Survey on Computer Software & IT Enabled Services Exports

Digital Services Exports and the Indian Economy

This section undertakes a correlation and econometrics-based exploration of links between digital services exports, GDP, foreign direct investment and innovation at the national and state level. Although correlation does not mean causation, this analysis gives us a directional understanding of the links and makes the case for a deeper study of these links.

National Level

Digital Services Exports and GDP

A simple correlation analysis between India's GDP and digital services exports reveals a positive and strong correlation between the two. Figure 10 shows that with an increase in digital services exports, India's GDP increases with a positive correlation of 0.78.[45]

Figure 10: Correlation between Digital Services Exports and GDP [46]
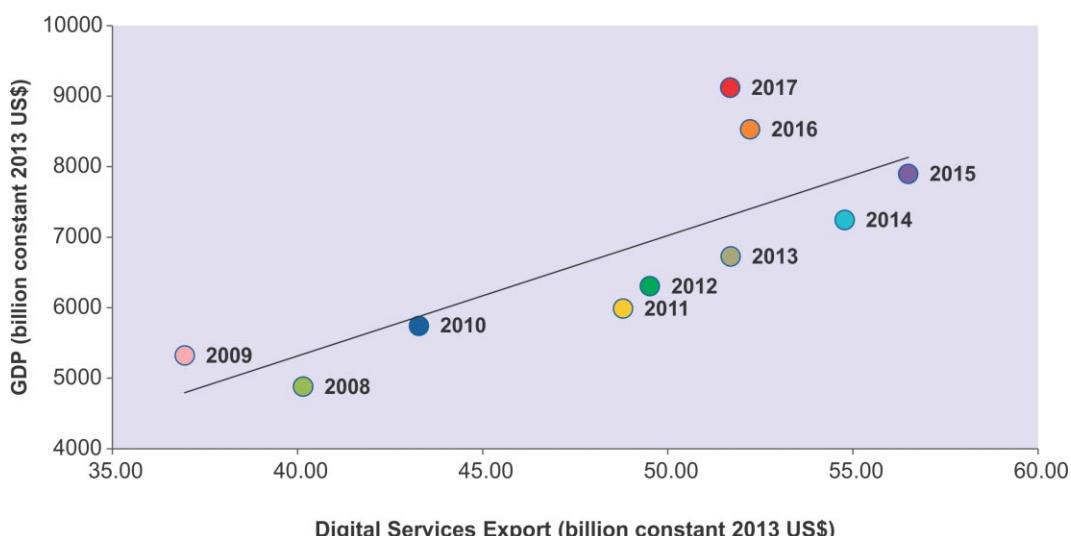
Econometric Analysis Findings

The log-log model[47] created for econometric analysis finds that GDP and digital services exports have a positive relation, and the coefficient for digital services exports is statistically significant. Our findings convey that **if digital services exports increase by 1 per cent, the GDP of the country would increase by 0.02 per cent and vice versa.** This establishes that digital services exports are fundamentally important and benefit the economy.

Digital Services Exports, FDI and Innovation

The IT-BPM industry and related sectors have catapulted India as a preferred investment destination.[48] The services sector in India attracts the highest FDI equity inflows and digital services is a major component of this sector.[49] Second to this is the computer software and hardware sector. FDI inflow in this sector has led to technology transfer and diffusion, knowledge and innovation gains due to linkages and spillover effects.[50] The expansion of digital economy is also associated with the expansion of digital infrastructure, which in turn attracts higher FDI inflow. Better infrastructure and technology diffusion effects of FDI provide the innovation ecosystem a boost, new enterprises flourish in a supportive ecosystem.

To further explore the link between digital services exports, FDI and innovation, we calculated the correlation between digital services exports of India and two indicators of innovation: (i) number of start-ups and (ii) number of patents filed.

A positive and significant correlation between digital services exports and indicators of innovation, as is evident from Figures 11 and 12, suggests a positive contribution of the same to the innovation ecosystem. The correlation between digital services exports and number of start-ups is 0.63.[51]

The expansion of digital economy is also associated with the expansion of digital infrastructure, which in turn attracts higher FDI inflow.

Figure 11: Correlation between Digital Services Exports and Startups[52]
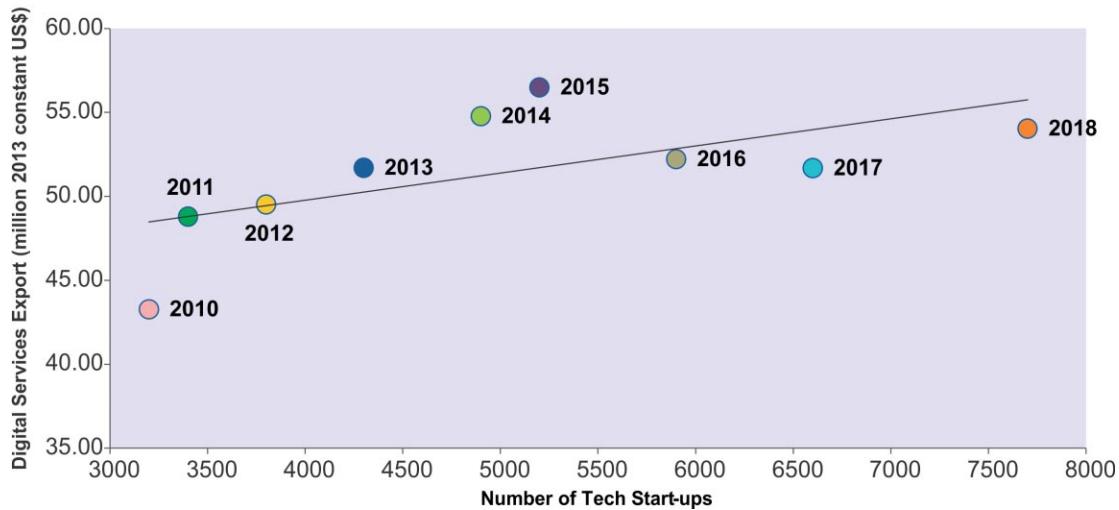
Figure 12 shows a positive trend between digital services exports and patents filed with a high positive correlation of 0.91.[53]

Figure 12: Correlation between Digital Services Exports and Patents Filed[54]
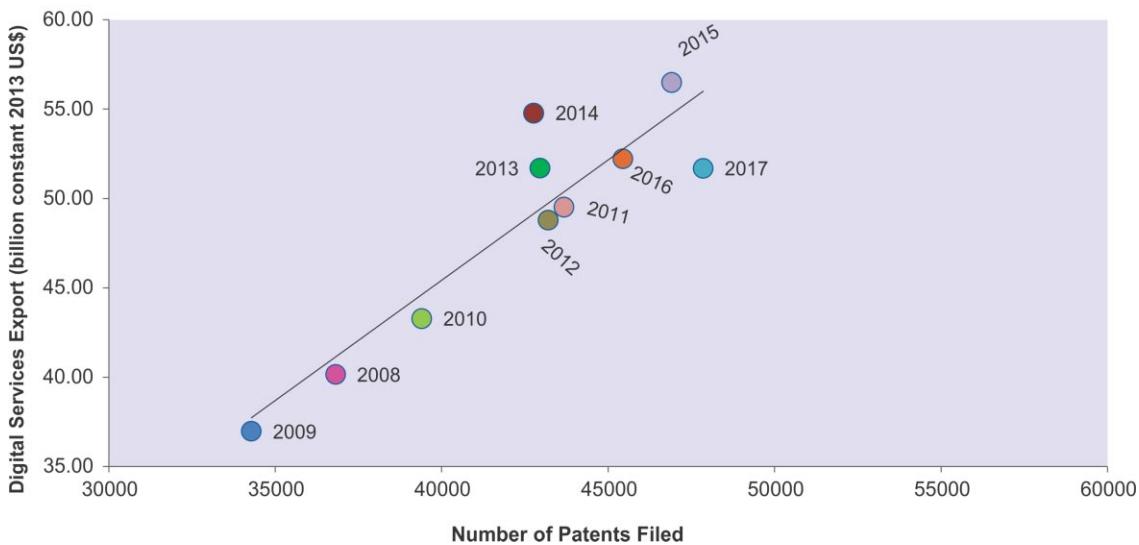
The findings of the econometric model and correlations in this section speak about the importance of digital services exports to the GDP as well as FDI and innovation. The above graphs show that digital services exports are positively correlated with these indicators at a national level.

State Level Scenario

Given our findings at the national level it would also be pertinent to study the importance of digital services exports at a granular level. Hence, the remaining section analyses the importance of digital services exports of major exporting states to their economy. Out of total IT exports from India, about 97 per cent can be attributed to nine states – Karnataka, Maharashtra, Telangana, Tamil Nadu, Delhi - NCR[55], West Bengal and Kerala. (See Figure 13) The economies of these states especially the top ones, depend largely on this sector performing well.

Figure 13: State's Share of IT Exports[56]

- Karnataka
- Maharashtra
- Telangana
- Tamil Nadu
- Delhi - NCR
- West Bengal
- Kerala
- Other States

Source: Niti Aayog, 2019
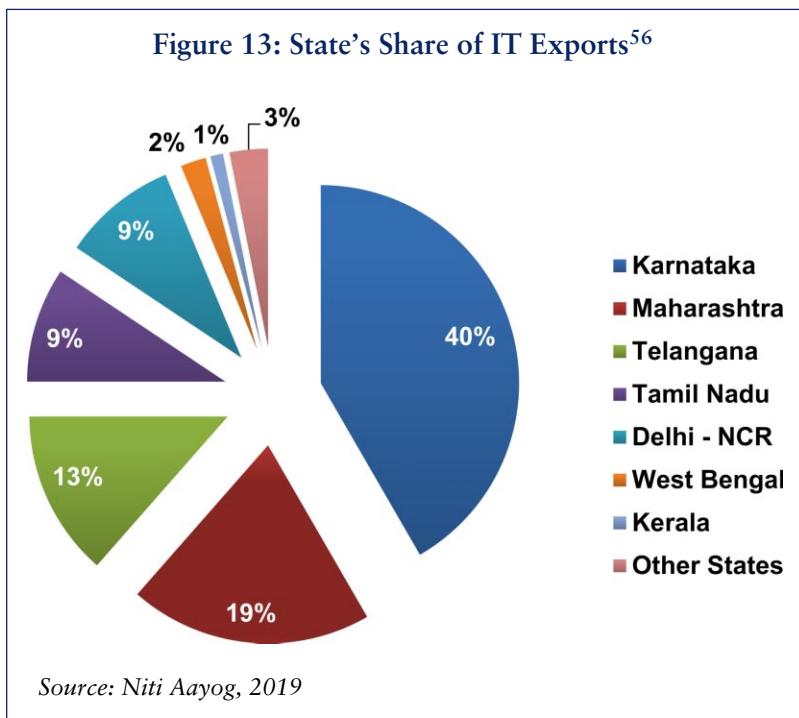
IT Exports and Gross State Domestic Product

A simple correlation analysis shows that Gross State Domestic Product (GSDP) per capita and IT exports have a positive correlation.[57] This means that as the state's IT exports increase, GSDP per capita also increases, thus boosting the state's economy (See Figures 14 to 18). It is important to note that GSDP per capita is often used as a measure of welfare, pointing towards increased welfare in these states with a rise in IT exports.

Figure 14: Correlation between IT Exports and GSDP
– Karnataka showing positive correlation of 0.64[58]

Karnataka

Gross State Domestic Product (US$ million)
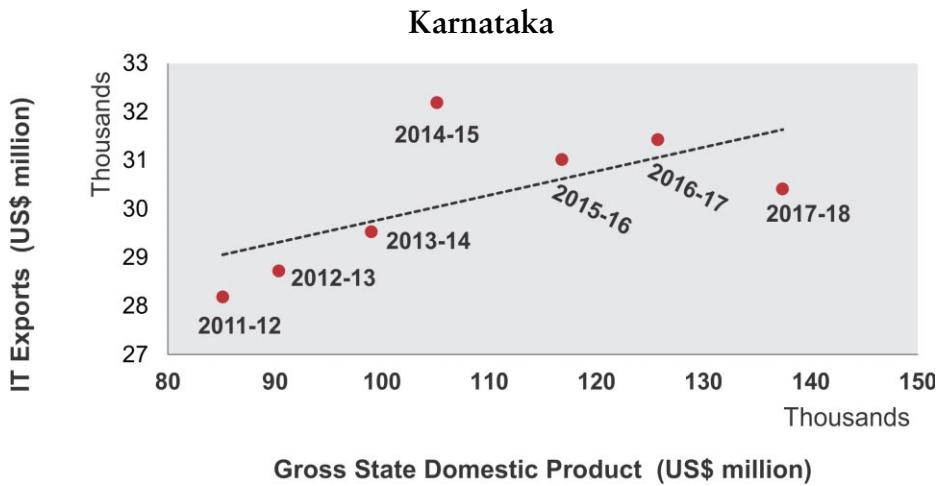
Figure 15: Correlation between IT Exports and GSDP
– Maharashtra showing positive correlation of 0.99[59]

Maharashtra

Gross State Domestic Product (US$ million)
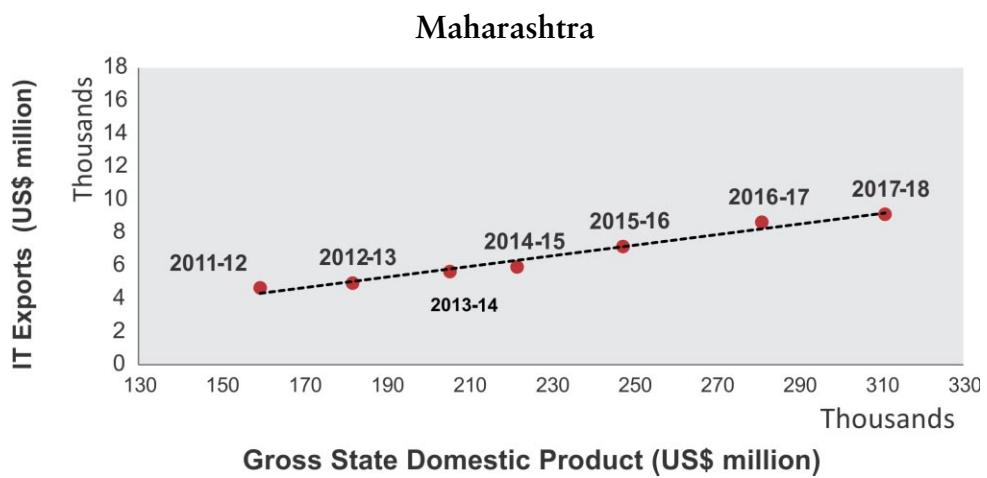
Figure 16: Correlation between IT Exports and GSDP
– Telangana showing positive correlation of 0.99[60]

Telangana

Gross State Domestic Product (US$ million)
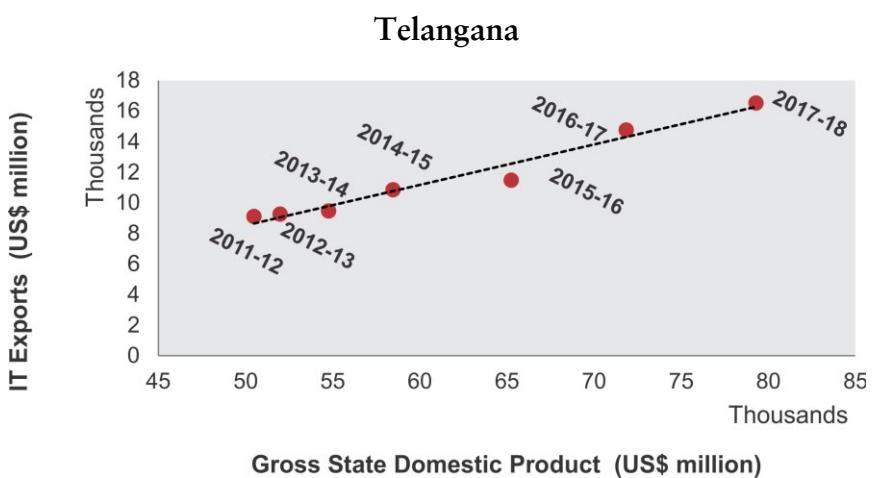
**Figure 17: Correlation between IT Exports and GSDP
– Tamil Nadu showing positive correlation of 0.99[61]**

Tamil Nadu
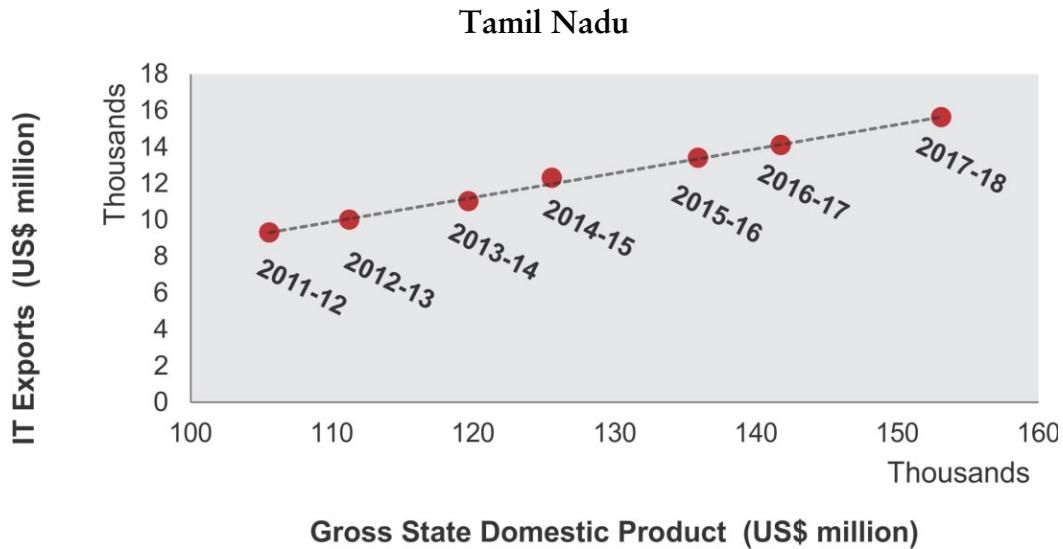
**Figure 18: Correlation between IT Exports and GSDP
– Delhi-NCR showing positive correlation of 0.91[62]**

Delhi-NCR
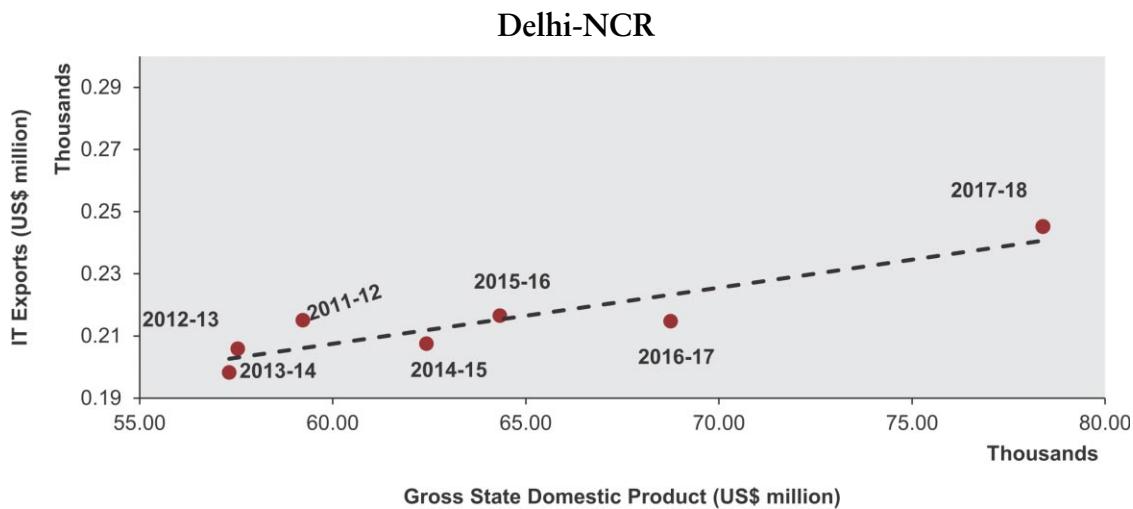
Such high correlation suggests the economy of these states (represented by Gross State Domestic Product) depends on IT exports.

IT Exports, FDI Inflow and Innovation

The state level calculations show similar patterns as that at a national level. Figure 25 shows that a rise in IT exports increases FDI inflow with a positive correlation of 0.59.[63]

A strong IT sector invites high FDI inflow, which generates innovation and hence allow emergence of new start-ups and businesses, creating a virtuous cycle that contributes capital back to the broader economy.

Similarly, IT exports and start-ups show a positive trend with a high correlation coefficient of 0.73.[65] (See Figure 26). This suggests that at the national and state level, high IT exports paved the way for new businesses to start and flourish. This can also be attributed to the overall rise in innovation.

The number of patents filed, another indicator of innovation, shows a high positive correlation of 0.71[67] with IT exports. This suggests that with a rise in IT exports, the innovation in the state flourishes, which gives impetus to experimenting with new ideas, leading to a high number of patents filed.

It is important to note that Karnataka and Maharashtra are outliers in all of these graphs because they are top two IT exporting states within India. Hence, their FDI inflow, number of start-ups and patents filed are among the highest.

The above figures provide supporting proof of the importance of digital services exports. National level and state level correlations have suggested that the nation/state will prosper with a prospering IT sector. This is because IT exports gives stimulus to FDI inflow and innovation, which ultimately contribute to the economy. **It would be reasonable to conclude that the state's economy thrives with substantial growth in the IT sector. A strong IT sector invites high FDI inflow, which generates innovation and hence allow emergence of new start-ups and businesses, creating a virtuous cycle that contributes capital back to the broader economy.**

Estimating the Impact of Restrictions on Cross-border Data Flow on India's Digital Services Exports

The analysis becomes even more relevant when a country such as India, one of the leaders in digital services exports, intends to implement new data flow restrictions and data localisation measures.

As countries look towards adopting data flow restriction measures, it is imperative to analyse policy and economic implications of such policies. The analysis becomes even more relevant when a country such as India, one of the leaders in digital services exports, intends to implement new data flow restrictions and data localisation measures. The reasons and objectives for such policy measures may vary across the spectrum – data privacy, protection from foreign surveillance, national security and to promote local innovation and business opportunities for local industries. However, it is also pertinent to examine if these reasons and objectives would contribute to the growth of the economy, address market inefficiencies and offset any trade-offs.

Econometric Analysis Findings[69]

This study estimates how the impact of restrictions on cross-border data flow affects the digital services exports of India using an augmented gravity model.[70] The model uses bilateral data on India's digital services[71] exports to 27 countries over a period of six years. An interaction variable that accounts for data flow restrictions[72] in India as well as importing country is used in the econometric model.

The coefficient of the interaction variable of data flow restrictions in the model is positive and statistically significant. A positive relation between this variable and digital services export means that as data flow restrictions get lower, digital services exports increases. This implies that heavier data transfer restrictions have a negative impact on digital services exports.

Based on predictions of the econometric model, this analysis also projects that if India and its trading partners restrict data

flows, it would lead to a loss in India's digital service exports. This translates to a shortfall of US$19bn to US$36bn in achieving US$1 trillion economic value objective for the digital sector in 2025. This result will be discussed in detail in the ensuing section.

It is important to note that like others our study also experienced analytical difficulties in developing estimates for the impact of digital trade barriers. Analytical difficulties of such a study are evidenced by the lack of analysis, even of preliminary steps by government agencies that are best equipped and are directly responsible for such estimations.[73]

Economic Impact of Restrictions on Cross-border Data Flows – Scenario Analysis

The economic costs of restrictions on cross-border data flow and its impact is not limited to a loss on a relevant country's GDP, but also spreads out to a decline in exports, investment, productivity and income loss to workers.[74] Estimates of decline in exports and output of communications and business services, inter alia, because of data regulations have also been reported.[75] Compliance costs are also estimated to have a significant negative impact on micro, small, and medium enterprises (MSMEs).[76] On similar lines, for many Indian SMEs, the lack of a pre-existing data protection law would make this a time-consuming exercise, consequently compounding the costs.

Job growth in India is at an all-time low. In such a situation, any proposed legislation that has the potential to impact firm productivity and the labour market requires careful analysis before it is enacted into law.

There is also the need to understand how cross-sectoral restrictions on cross-border data flow impact employment, job growth, and small businesses, which is crucial for an emerging economy like India. The National Sample Survey Office's (NSSO) job survey for 2017-18 had shown a spike in the unemployment rate to over 6 per cent, a 45-year high. Also, according to data released by the Ministry of Statistics and Program Implementation (MoSPI) joblessness has been pegged at 6.1 per cent.[77] Hence, job growth in India is at an all-time low. In such a situation, any proposed legislation that has the potential to impact firm productivity and the labour market requires careful analysis before it is enacted into law. If the proposed bill does have significant negative implications for small businesses — through increased compliance costs, for example — it could potentially undermine a number of measures that the Indian government has taken to encourage the growth of SMEs in the past few years.

There is an urgent necessity for careful economic analysis of the data localisation provisions, which has been absent so far.

The specific design of the Bill that India adopts for data protection is likely to have a significant impact on India's economy. These consequences could be direct (such as increased compliance costs) or indirect (the potential stifling of innovation, and overall productivity losses). Hence, there is an urgent necessity for careful economic analysis of the data localisation provisions, which has been absent so far.

Box 1

Cross-border Data Flow Restrictions and Data Localisation In India

India already has regulations under implementation and has also proposed policies that mandate various degrees of restrictions on cross-border flow of data and data localisation.[78] These policies include the Information Technology Act and Rules, 2011, Reserve Bank of India Notification on Storage of Payment System Data[79] (RBI Notification) and the proposed Personal Data Protection Bill, 2019[80] (PDP'19).

The RBI Notification mandates that all payment system providers should store payments data only in India. It includes end-to-end transaction details or any information collected, processed or carried out as part of payment instructions. The RBI Notification allows for processing of payments data outside India for 24 hours, however, after this deadline, all such data needs to be stored within India.

The PDP'19 provides a formal framework for data protection and privacy in India. It categorises personal data into three types – personal data[81], sensitive personal data (SPD) and so-called "critical personal data" (CPD). For SPD, the PDP'19 provides for some categorisation of sensitive personal data, although the Central Government may notify more categories of data as SPD. CPD is not defined in the PDP'19 and will be notified by the Central Government.

Under the PDP'19, SPD may be transferred outside of India for processing, provided that data principals explicitly give consent to the transfer and in the conditions when:
1. the transfer is made under a contract or scheme approved by the Data Protection Authority (DPA) or,
2. the transfer is allowed by the Central Government to a country or entity or class of entity subject to satisfaction of certain conditions, or,
3. the transfer is allowed by the DPA for a specific purpose.

A copy of the SPD, however, must remain in India. This requirement, together with the need for data fiduciaries to obtain additional explicit consent from data principals, means that the PDP'19 imposes data localisation on SPD. The restrictions on CPD are even more severe: CPD cannot be processed or stored outside of India. We note that the Central Government may exempt any country or entity or class of entity from the localisation requirements where "where such transfer in the opinion of the Central Government does not prejudicially affect the security and strategic interest of India."

The PDP'19 also enables the Central Government to categorise any kind of data as sensitive and/or critical data, causing ambiguity in the categorisation of data and its implementation. More importantly, the PDP'19 lacks clarity in substantiating its relationship with sectoral regulations such as the RBI notification and compliance structure and scope. Thus, this creates long-term uncertainty for Indian businesses and most importantly global digital trading partnerships.

While it took years for India to consolidate its position as an IT leader, the recent trend by the Indian government towards localising data and restricting the flow of data could undo the country's success story. While data privacy and national security are legitimate public policy objectives, it is important to undertake empirical research in assessing costs of implementing and increasing restrictions on cross-border flow of data. Specifically, given India's lead in digital services export, it is necessary to evaluate these effects and to explore alternative policies that advance both the data privacy and security interests of the Indian government.

The contribution and significance of digital trade to making India a US$5 trillion economy and importantly the role of IT-BPM industry in facilitating that is very crucial. **In bringing policies that restrict the flow of data, India needs to tread carefully and minimise any adverse tradeoffs that could disrupt the industry domestically, as well as invite negative reactions from India's trading partners**.

This paper has so far addressed the importance of digital services exports to India's economy as well as to that of Indian states. The two econometric models have independently estimated digital services exports elasticity of GDP and the impact of restrictions on cross-border data flow on digital services exports. The estimates from these two models have been used to build scenarios to understand the impact of such restrictions on exports of digital services and consequently on GDP.

Scenarios
Independently, estimations were made on seven scenarios that are segregated under three assumptions. These three assumptions reflect on the range of restrictiveness on cross-border data flows from relatively lesser to increasing –
(i) India adopts measures restricting cross-border data flows and implementing data localisation,
(ii) India's top export destination for digital services (United States) retaliates as a result of restricted market access for the US firms, and
(iii) All importers of digital services from India impose retaliatory restrictions on cross-border data flows.

The various scenarios are based on "soft" or "hard" restrictions on cross-border data flows (See Figure 19).

1) To establish soft restrictions on cross border data flow, "Data Policies" rank of India/trading partners has been changed to 21 to match the European Union's General Data Protection Regulation.[82] While the GDPR does not mandate storage of personal data to be within the EU, it restricts the flow of personal data. Personal data can only be transferred outside the EU if the jurisdiction, in which the recipient is located provides an adequate level of data protection or there is another legal basis for the transfer, such as a standard contractual clause or its pursuant to an approved intra-group transfer mechanism.

2) To establish hard restrictions on cross-border data flow, "Data Policies" rank of India/trading partners has been changed to nine to match Vietnam's data policy regime. We have modeled this on Vietnam's Cybersecurity law (2018)[83] which, as written, mandates that analysing or processing personal data of Vietnamese citizens will have to be within the country's borders. Such data should also be stored within Vietnam.

Figure 19: Data Policies Rank[84]
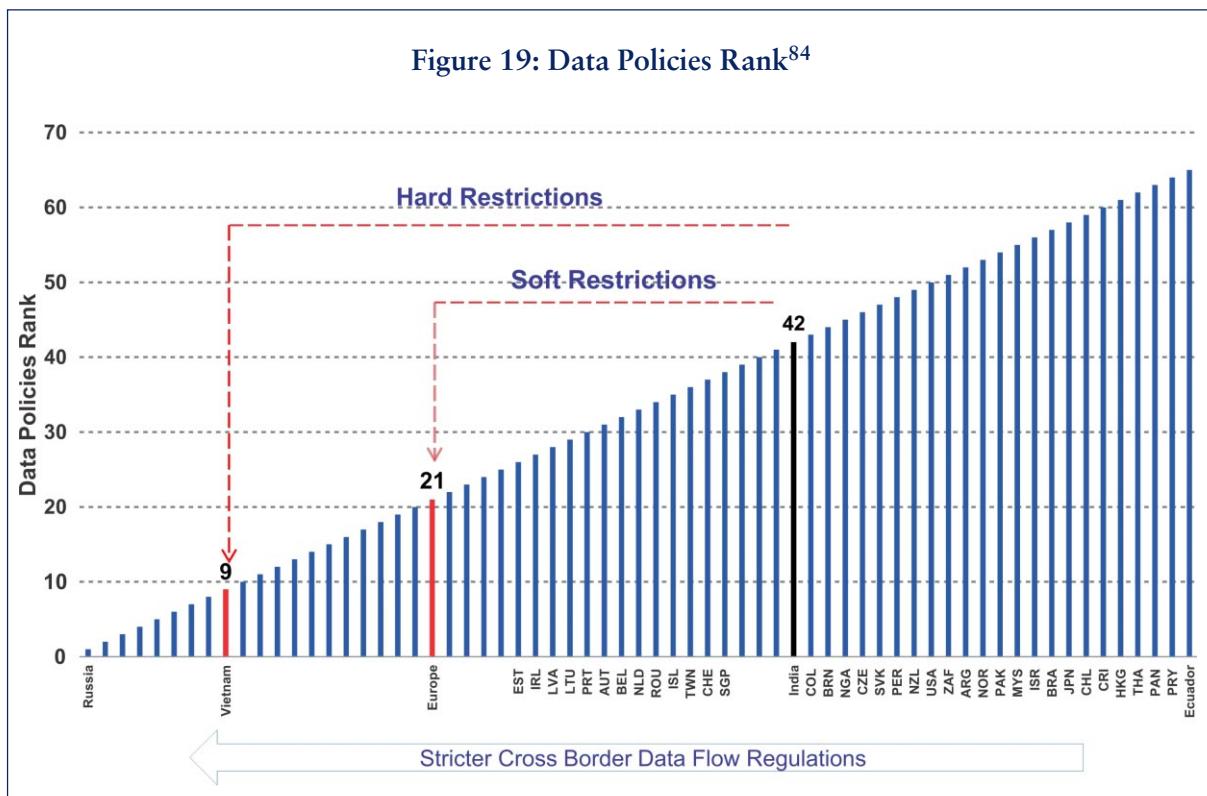
Table 1: Assumptions and Scenarios – CBDF	
Assumptions	**Scenarios**
India adopts CBDF restrictions	India adopts soft restrictions on cross border data flow
	India adopts hard restrictions on cross border data flow
India faces retaliatory restrictions from the US, its top export destination for digital services	In response to India's soft restrictions, US retaliates with soft restrictions on cross border data flows from India
	In response to India's hard restrictions, US retaliates with soft restrictions on cross-border data flows
	US retaliates with hard restrictions on cross-border data flow from India
India faces retaliatory restrictions from all its trading partners	In response to India's hard restrictions on cross border data flow, US retaliates with hard restrictions and all trading partners retaliate with soft restrictions
	All trading partners retaliate with hard restrictions on cross border data flow

Results

Figures 20 and 21 below summarise the impact on GDP and digital services exports under the given seven scenarios.

Figure 20: Scenarios on impact of restrictions on CBDF on Digital Services Exports of India

Figure 21: Scenarios on impact of restrictions on CBDF on GDP of India
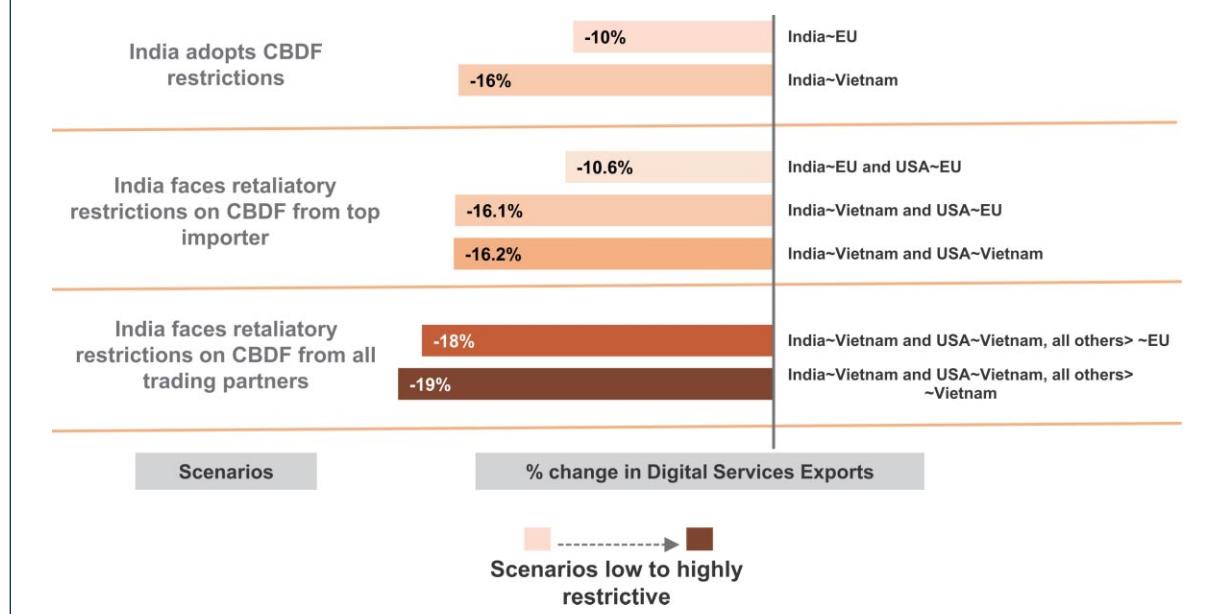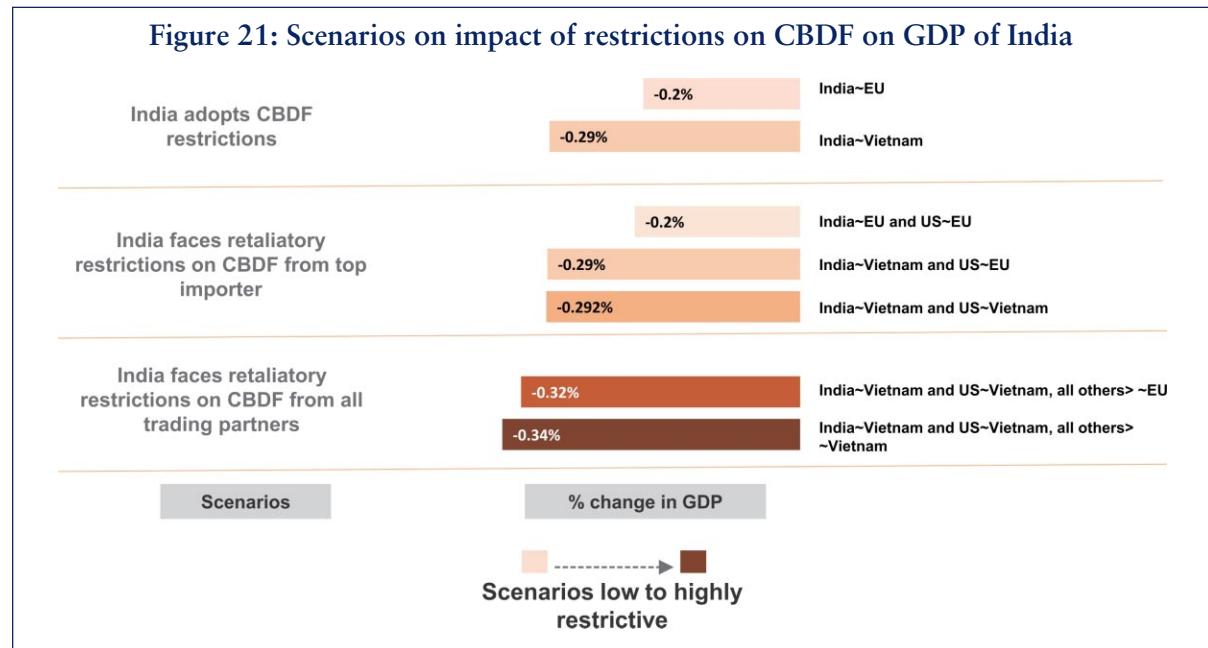
Impact on India's Digital Services Exports

Estimates of the impact of CBDF restrictions range from a decline of 10 per cent to 19 per cent in digital services exports of India. Using the projected size of the IT-BPM sector from "India's Trillion Dollar Digital Opportunity"[85] study by Ministry of Information and Technology these percentages **translate to a shortfall of US$19bn to US$36bn in achieving the US$1tn economic value** potential of the digital sector in 2025. It is important to note that the projected US$1tn digital sector will play a pivotal role in achieving the US$5tn GDP objective by 2024-25.

Impact on GDP

Consequent to decline in digital services exports, GDP is estimated to decline by 0.2 per cent to 0.34 per cent from relatively less restrictive to highly restrictive CBDF scenarios. This translates to a US$9bn to US$17bn gap in India's desired GDP size of US$5tn in 2024-25.

The impact of restrictions on cross-border data flows on GDP would be more pronounced once the impact on productivity, investment, innovation and welfare are factored in. This paper has previously discussed the linkage between digital services exports, FDI, innovation and productivity. In this context, to provide a holistic view of the impact on the economy, this study has further used estimates of decline in investment and welfare from Bauer et al (2014) to calculate projected loss in investment and welfare in the year 2024-25.[86] Since India has set a target of

Digital economy has substantial implications on investment, and investment is crucial for digital development. The impact of the digital economy on international investment patterns concerns the ever-growing importance of digital infrastructure for the ability of countries to attract FDI.

becoming a US$5tn economy by 2024-25 it is relevant to provide estimates of shortfall in achieving this target due to proposed CBDF restrictions.

Impact on Investment and Welfare

Digital economy has substantial implications on investment, and investment is crucial for digital development. The impact of the digital economy on international investment patterns concerns the ever-growing importance of digital infrastructure for the ability of countries to attract FDI.[87] The United Nations Conference on Trade and Development (UNCTAD) estimates that about 50 per cent of all traded services is enabled by innovation stemming from this sector, which includes the facilitation of cross-border data flows. According to 'The Global Information Technology Report 2016', companies with open Internet tend to be more innovative. This is because the free flow of data is itself, a significant driver of innovation. It allows the sharing of ideas and information and the dissemination of knowledge as well as collaboration among individuals and companies.[88]

Impact on Investment

Bauer et al (2014) have estimated a loss of 1.9 per cent in investment if complete data localisation is enforced. Based on our investment projections for 2024-25, this represents a loss in investment of US$18.4bn.[89]

Impact on Welfare

Using the welfare loss of 11 per cent based on Bauer et al (2014), this paper estimates a per worker loss of US$47[90] in average monthly wage in 2024-25. Based on our projections for employment, the welfare loss to the economy is estimated at US$2.4bn.

Since the projections on investment and welfare are based on complete data localisation, the impact could be less since the data localisation provisions in PDP'19 are diluted. Moreover, the impact will be dependent on how the data categories are defined and laws implemented.

The scenarios built with the two econometric models taken together provide insightful information. The paper's model is a new and unique approach to facilitate the discourse on cross-border data flow restrictions by examining the significance of these on the digital services export of the exporting country (in this case India) and then the significance of digital services

exports on the GDP of the country. The model and results provide initial evidence confirming the hypothesis of industry, economists and researchers working in this area that restrictions on cross-border data flow would adversely affect the economy of the country. *Overall, the scenarios present a stark picture of possible outcomes of imposing restrictions on cross-border data flows.*

Industry Perspective on Data Localisation and its Impact

A policy such as Data Localisation (DL) creates a new compliance framework for businesses that would percolate to either improving their processes and efficiencies or affecting them unfavourably. To this end, our stakeholders' interactions with companies sheds light on the opportunities and challenges in complying with data restriction policies. The analysis of industry interactions shows that their outlook and experience is in contradiction to the objectives and reasonings of data localisation informed by governments across the globe. In case of India, the combined findings of industry interactions and econometric models state that data localisation may likely have an adverse impact on the country's economy, innovation, start-ups, global competitiveness and business overall.

Data localisation may hinder India's innovation and start-up ecosystem, contrary to the notion that localised data will help country's innovation and research in AI and advanced data analytics, and thus would help start-ups to compete globally.

To streamline the findings and analysis of industry interactions, we have categorised reasons and objectives for data localisation into two themes –
1. Privacy and Security of Data
2. Growth of Domestic Industry

Privacy and Security of Data

Data localisation may not improve data security or privacy protections. Industry stakeholders unanimously agree that the **security of data is not dependent on its location.** Rather, the security of data is highly dependent on the company's security guidelines and framework, as they are usually uniform across the globe if a company is a multinational operating in multiple jurisdictions. A company would not have a different security parameter for country A and a contrasting security framework for country B. A uniform security framework also helps companies adopt best practices globally, efficiently manage security measures and effectively respond to threats and vulnerabilities.

Although data localisation could improve the ability of law enforcement agencies (LEA) to access data easily, **stakeholders**

"The beauty of a globalised world is that while entering new markets enterprises can replicate their business/ process codes with minor changes to align with local regulatory requirements. As a result, the innovation (in services) that is available at the world level can be efficiently adapted to a local environment."
– E-commerce company

have expressed concerns regarding due process of law being followed by LEAs. Industry feels that clarity on enforcement framework is paramount. **Any abuse of power resulting from incoherence and inconsistency in enforcement could lead to breach of privacy of individuals and security of data.** The demand and reasons in favour of LEA access to data stems from reducing reliance on Mutual Legal Agreement Treaty (MLAT) request regime. The MLAT process is documented to be time consuming and inefficient in addressing data requests[91]. To this regard, it is essential that new framework should be explored, which could address the concerns regarding MLAT. This framework could include but are not limited to CLOUD Act of USA and Data Free Flow with Trust initiative by Japan.

Data localisation may disrupt global efficiencies and business processes. Industry stakeholders have said data restriction policies will impose significant capital and time costs on the companies to establish new business processes and system architectures. Payment systems are an important example of how continuous flow of data strengthens payment network processes globally, in security and preventing fraud. The system architecture under these networks continuously fetches, manages and processes data and warns the system of any fraudulent activity. If data is segregated, stored and processed at different locations, it would alter and undermine the fraud prevention framework. For example, if a card transaction is captured at location A, immediately another transaction at location B, and simultaneously another transaction in a different country, the system won't be able to identify these transactional trends if data is segregated by storage and processing and disconnected from the global data flow network.

Growth & Impact on Domestic Industry

Some of the reasoning for data localisation states that the policy will create an ecosystem of innovation in the country as data will be retained within the territory. The localised data, thus, will aid innovation and research, employment growth in infrastructure and services industry, advanced skill development of human capital and better investment opportunities. PDP'19 empowers the government to direct any data fiduciary or processor to provide any anonymised personal data or non-personal data. The government states that it will help them create evidence-based policies. However, compliance towards such policy would burden start-ups and small businesses in terms of cost, time, and standardisation. Hence, it is important to build an understanding of how industries view data localisation and its compliance related aspects.

"Currently, when data must move fast, artificial barriers such as restrictions on cross-border data flows will break the momentum"
– E-commerce company

"If policies such as data localisation or cross-border data flows restrictions increases innovation and efficiency, companies around the world would have localised the data irrespective of the mandate."

– Global financial services company

"Data localisation will negatively impact the start-ups in India alongside the foreign players, as it will curb their capacity to go global."

– Indian software company

Data localisation may hinder India's innovation and start-up ecosystem, contrary to the notion that localised data will help country's innovation and research in AI and advanced data analytics, and thus would help start-ups to compete globally. The e-commerce company from our stakeholder pool believes that in an ecosystem where data flows freely, collaboration aids innovation and also the ability of start-ups to scale up globally. They also mentioned that while global ecosystem fosters access to technology, any restriction on data flow will disrupt the access and thus, reducing efficiencies of the global value chain. As a result, start-ups would lose out in utilising the available efficiencies and collaboration of the global ecosystem and their ability to scale up and compete internationally will go down. The current data centre ecosystem in India does not possess economies of scale and accounts for only 2.2 per cent of total global data centres.[92] Additionally, the current cost of storage and processing in India is not competitive to foreign pricing, which adds additional operational costs on startups.[93] It is important to note that, for India to reach economies of scale in data centres it would take a substantial number of years and then longer to offer prices and services, which are competitive to global benchmarks (See Figure 22). In the meantime, the country may lose access to global technologies, services and efficiencies.

Global companies during our stakeholder interactions also laid out concerns regarding capital investments. When a company enters a new country/ market, they do so as part of their long-term business strategy. It was stressed that no company invests

Figure 22: Countrywise Share of Hyperscale Data Centres by Number
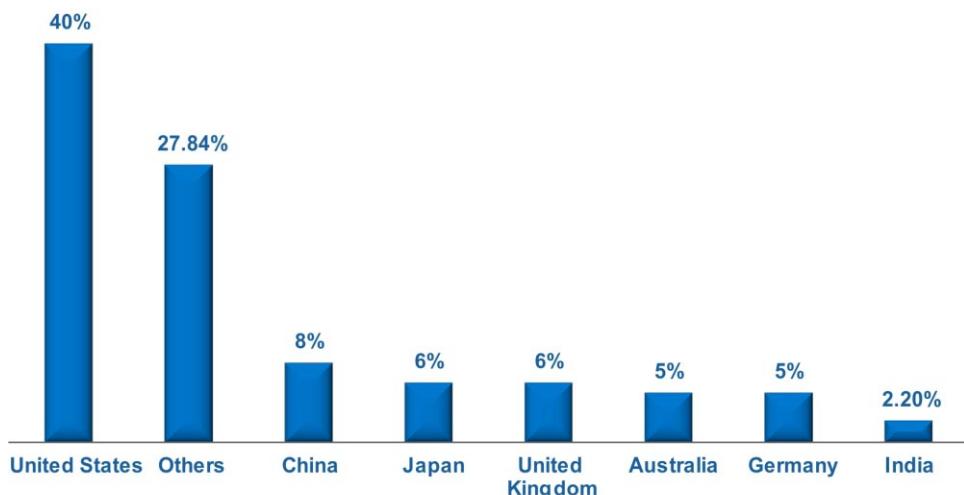
Source: Synergy Research Group, 2018

capital in a new market for a shorter term. In addition to investments, these companies also bring access to technology, management practices and efficiencies, which in turn helps the economy and improve competition in the market.

"Data localisation hinders globalisation and innovation."
– Indian multinational IT company

The stakeholders from our key informant interviews stated that adding substantial costs and barriers in entering new markets would discourage companies to make new investments. (See Figure 23) Also, companies that have already invested in India and are looking for long term business would require additional significant investment to sustain the operations in the country. Global companies and some domestic companies have indicated that their operating costs also increased as a result of compliance with GDPR and implementing privacy by design.[94] This increase in costs was the result of creating and adding new processes to the current business architecture. Accordingly, data localisation would surely have an adverse impact on cost and investments.

Figure 23: Impact on Investment with Full Data Localisation
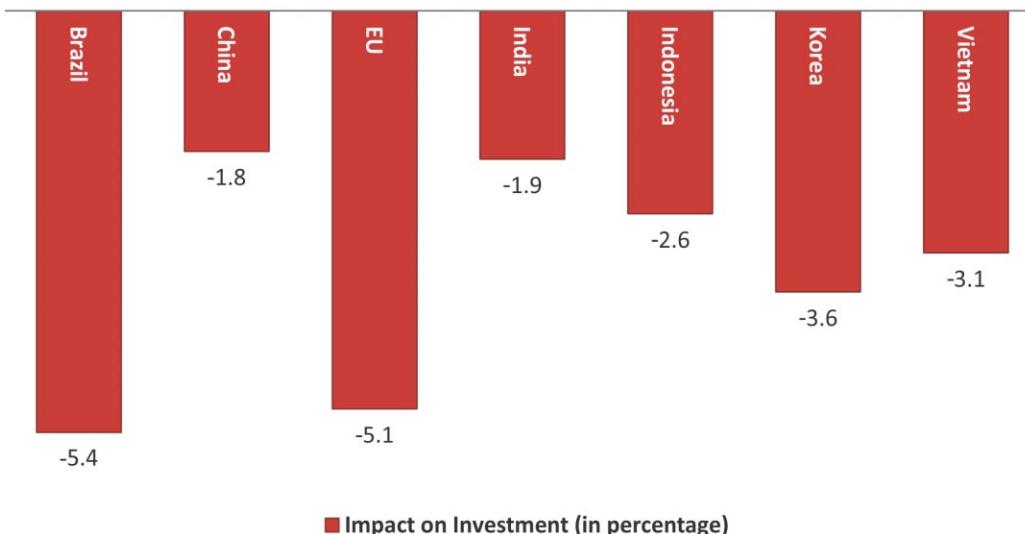
Source: Ecipe, 2014

"If data is localised, innovation will go down, costs will increase, and technology opportunities will decrease"
– Indian multinational IT giant

Data localisation may not create substantial employment as a result of setting up of new data centres. Data centres are largely automated systems, where the number of technical staff associated is less. Initially, there is an expectation that temporary employment would be generated during the construction of data centres and hardware supplies, if not available in India, would be imported. However, the full-time employment generated for operating a data centre would be relatively low. To present some context, in 2011, Apple built a US$1 billion data centre in North Carolina, US, creating only 50 full time jobs and additional 250

jobs in maintenance and security staff. Similarly, another data centre built by Microsoft in Virginia created only a dozen jobs.[95] These findings corroborate the outcome of our interactions with the industry participants. They mentioned a similar theme that technical staff employed to look after a data centre including maintenance and security staff are not very substantial. The employment generation is only temporary and operational data centres do not create large number of additional jobs over a period of time.

<div style="text-align:right">Box 2</div>

Data Localisation - The Carbon Emission Link

The direct consequence of data localisation policies is the proliferation of data centres. Unless supported by low energy needs due to favourable temperature conditions and green energy inputs, data centres have a big carbon footprint. In the case of China about 73 per cent of total electricity consumption by data centres is met by coal power.[96] In 2018, the carbon emissions from data centres in China was equivalent to about 21 million cars on the road (99 million tonnes of CO_2 emissions).

As India wants to take the lead in building data centres, it is also fundamental to highlight that the rate of growth of carbon emissions in India per year is higher than China and the United States.[97] India is also a signatory to the Paris Agreement where it pledged to reduce emissions intensity by 33 to 35 per cent of GDP of 2005 levels by 2030. Although the commitment and targets are laudatory, the country is likely to miss the national clean energy target of 2022 by more than 40 per cent.[98]

All of these implore the fact that given the current dispensation where the energy consumption of data centres are largely met by coal power, and India's target and commitment in Paris Agreement; it is critical for the country to be cognizant of balancing the environmental trade-off. Another ecological concern is the increasing use of water in cooling the data centres.[99] Since India is already experiencing severe water shortages and droughts[100], the country would need efficient water management for data centres. More importantly, in the absence of a strategic roadmap for setting up data centres, their primary source of energy to be renewable and water consumption, the country might set forth an unsustainable development trajectory.

Ease of setting up data centres in India: Industry's experience gathered through interviews and available literature unanimously assert that setting up data centres in India presents numerous challenges. **Both interactions and literature states that as much as 60 different permits are needed to establish infrastructure in India, which could span across 15 governmental departments.**[101] Additionally, industries are discontented with

Data centres require uninterrupted supply of electricity and water for operations and cooling and these services are still in its nascent stage in India.

the present availability and quality of infrastructure and land acquisition. Data centres require uninterrupted supply of electricity and water for operations and cooling and these services are still in its nascent stage in India. Also, the process of land acquisition is a fundamental challenge for the industry. Keeping all of these in purview, in addition to the bureaucratic red tape, the whole method extensively slows down the process and undervalues the ease of doing business in India. Although, the Finance Minister of India in her 2020-21 Budget speech called for a policy to enable and facilitate private industry to set up data centre parks across the country[102].

The contra-effect of these hurdles makes industries hesitant to deploy capital in setting up data centres because of the significant cost, time and bureaucratic hurdles involved. An important point made by stakeholders was that for India to compete with data centres globally, they must conduct structural and policy reforms in simplifying the process of setting up of data centres.

Conclusion

Indian businesses benefit from greater innovation, efficiencies in business processes, voluntary technology transfers and a reduction in their transactional costs.

India is among the leading beneficiaries of the digital transformation of international trade. Having consolidated its leadership in the IT-BPM sector, India has enjoyed continued export-driven growth in its digital economy, with many of India's most economically dynamic states capturing a significant portion of this growth. Consequently, Indian businesses benefit from greater innovation, efficiencies in business processes, voluntary technology transfers and a reduction in their transactional costs.

As the country marches towards becoming a US$5tn economy by 2025, India's digital sector has the potential to grow to almost US$1tn. **This study found that India's digital services exports have a significant correlation with country's GDP. An increase in digital services exports by 1 per cent advances country's GDP by 0.02 percent and vice versa.** Additionally, digital services exports also have a positive correlation with indicators of innovation such as growth of startups and patents filed.

Data localisation, however, is a threat to India's digital global competitiveness.

This study found that India's digital services exports have a significant correlation with country's GDP.

India has been a proponent of data localisation, in the financial sector, through the RBI notification, and is currently proposing in the PDP'19 to expand these restrictions across a broad swathe of the economy. India's digital services exports, however, are dependent on favorable policies abroad that ensure open market access, including the ability to transfer data across borders. By erecting barriers to market access for digital firms, India may be inviting its largest trading partners, including the United States, to institute similar measures, thereby closing their markets to Indian digital service exports.

Under various scenarios, ranging from low to high data restrictiveness, we estimate a decline in India's digital services exports ranging between 10 to 19 per cent. This decline would

Data localisation may force companies to restructure business process and system architecture, which would add unnecessary and significant costs on their ability to do business.

translate to a shortfall of US$19bn to US$36bn on government's target size for the IT-BPM by 2025.

A decline in digital services exports would also translate to a decline in GDP by 0.2 per cent to 0.34 per cent based on extent of restrictiveness, which would lead to a shortfall of US$9bn to US$17bn in India's desired GDP size of US$5tn by 2025. Similarly, complete data localisation may negatively impact investment and welfare in India with a loss of US$18bn and US$2.4bn, respectively.

The study was significantly informed by interviews with industry stakeholders on multiple issues, including privacy, data security, and the growth of India's domestic industry in the context of data localisation. First and foremost, data privacy and security are not dependent on server's location. Even if data localisation were to improve access of data to law enforcement agencies, in the absence of due process of law or checks and balances, it may become a tool to exercise abuse of power. Most importantly, data localisation may force companies to restructure business process and system architecture, which would add unnecessary and significant costs on their ability to do business. Financial services industry would see a significant negative impact on fraud prevention.

On the domestic industry side, data localisation may negatively impact India's innovation and start-up ecosystem, as both of these are primarily fueled under an ecosystem of seamless flow of data, collaboration, and the ability to scale up globally. While localisation would necessitate the construction of more data centres in India, given bureaucratic, infrastructural and land acquisition hurdles, reaching economies of scale would be a very difficult path forward. This, in turn, would require additional investment from companies that have already invested substantially and may act as a chilling factor for foreign investors. Lastly, localisation will only create temporary employment that is expected during construction of data centres and supplies of hardware, however, full-time employment requiring maintenance would be very few.

India has a vested interest in maintaining an open digital economy and in promoting the free flow of data across borders as these support its own position as a global leader of digital services.

Overall policies that restrict the cross-border transfer of data, such as those put in place by the RBI and those being contemplated in the PDP'19, will have a counterproductive impact on India's digital services export, GDP, welfare, investment, innovation and start-ups. Consequently, India has a vested interest in maintaining an open digital economy and in promoting the free flow of data across borders as these support its own position as a global leader of digital services. In other

words, data localisation measures at home and abroad are a threat to India's global digital competitiveness.

Issues for Further Discussion and Research

Considering the scope of this research study to inform the economic impact of data localisation or cross-border data flows restriction on India's digital services export and the GDP, there are related issues that can be of empirical research interest in the future –

- Once India adopts regulations for addressing issues regarding cross-border data flow, it will be important to deep dive and understand their impact on the sectors associated with the Fourth Industrial Revolution including big data analytics.
- Post-implementation of PDP'19, a detailed empirical study of the actual impact on India's digital services exports and GDP.

Appendixs

Appendix A
Study Overview: Objective and Methodology

This research study undertaken by CUTS evaluates the economic and policy implications of implementing data localisation[103] (DL) in India. Although the paper's focus is on detailing effects of DL on India's digital services exports and in turn on India's economy, the scope of the analysis is not just limited to only evaluating PDP'19 and RBI notification and their impact on India. To make this study more holistic in its approach, the paper not only evaluates regulatory scenarios with CBDF restrictions ranging from mild to stringent in India, but also looks at scenarios where trading partners impose retaliatory restrictions.

Objective of the Study

The objective of the study is broadly categorised into two parts, to comprehensively understand and analyse -
1. Importance of digital services exports to the Indian economy.
2. Impact of restrictions on CBDF on India's digital services exports and consequently on the Indian economy.

The study examines these objectives by engaging quantitative and qualitative research tools. These are literature review, key informant interviews, statistical and econometric analysis.

Literature Review

We begin by reviewing existing and evolving literature on digital trade, services exports, regulations and experiences of countries with data localisation and non-tariff barriers across the globe. In addition, the review also examines the relationship between digital services exports and macro-economic indicators such as GDP, employment and income.

Statistical and Econometric Analysis

The core of this paper is its econometric analysis, specifically two models that cumulatively address the two objectives of the study. The first model (Model A) determines the significance of digital services exports to an exporting country's economy.[104] Random effects model was used to estimate Model A. The second model (Model B) analyses the impact of data localisation on digital services exports of India. The method of estimation for Model B was simple Ordinary Least Square (OLS) estimation.

Both these models conclusively explore the objectives of this paper and establish empirical evidence on the impact of restrictions on CBDF and data localisation mandates on the Indian economy. Additionally, to explore the nature of relation between the economy and digital services exports at both the national and state level, Pearson's correlation[105] has been used. This analysis also explores probable links between digital services exports and innovation.

The methodology and findings of the correlation and econometric analysis will be detailed in the relevant sections.

Key Informant Interviews

Key informant interviews were undertaken to understand the perceptions, experiences and challenges of industry stakeholders on data protection and localisation. To this end, we engaged with a range of companies working in diverse sectors, namely, application development, e-commerce, infrastructure, financial services and payment networks, digital process, information technology and aerospace.

The industry stakeholders (See Figure 24) in our key informant interviews represent a mix of global and domestic entities. All of the interviewee companies have operations in India. A semi-structured questionnaire helped facilitate in-depth interactions on parameters such as data management practices and associated costs, relevance and importance of cross-border data flows to their businesses and implications of data localisation on domestic industry and innovation. In addition, our study probed their experience on compliance with data policies in other jurisdictions and the extent of impact on their businesses. The interviews were carried out before the Personal Data Protection Bill, 2019 was introduced in the Lok Sabha on December 11, 2019.

Figure 24: Profile of Industry Stakeholders

Appendix B

ECONOMETRIC MODEL 1

GDP_it= α+ βGFCF_it+ γemp_people_it+ θICTgoods_imp_it+ ρICTgoods_exp_it+ ϑNon ICT goods_imp_it+ ωNon ICT goods_exp_it+ εICTservices_imp_it+ πICT services_exp_it+ σNon ICT services_imp_it+ δNon ICT services_exp_it+μ_it

Where,
i equals 1 to 100, top digital services exporting countries
t is time period from 2000 to 2017
in the equation above,

GFCF is Gross Fixed Capital Formation, which represents the net increase in fixed capital. Simply put, it is the net investment. A holistic model for the economy cannot be drawn without taking GFCF as a control variable.

emp_people_it which is the employment to people ratio has been included as another control variable for the model as consumption and employment share a positive correlation.

ICT goods_imp and ICT goods_exp measure the overall trade in ICT goods.

Non ICT_goods_imp and Non ICT_goods_exp represent the amount of trade in Non ICT goods. This with the above mentioned two variables cumulatively provides the entire trade scenario for goods.

ICT services_imp and ICT services_exp represent the overall trade in ICT services.

Non ICT services_exp and Non ICT services_imp represent the amount of trade in Non ICT services. These four categories together sum up the entire trade for services.

MODEL 1
Hypothesis :	H_0: ICT services export does not has significant impact on GDP
		H_1: ICT services export has positive significant impact on GDP

Equation:
$$logY_{it} = \alpha + \beta\, logX_{it} + \beta_1\, log\, logX_{it}^1 + \beta_2\, log\, logX_{it}^2 + \beta_3\, log\, logX_{it}^3 + \beta_4\, logX_{it}^4 + \beta_5 log\, X_{it}^5 + \beta_6 logX_{it}^6 + \beta_7 logX_{it}^7 + \beta_8 logX_{it}^8 + \beta_9 logX_{it}^9 + \mu_{it}$$ ------------------------ (i)

Where,

Variables			
1.	Y	GDP in billion USD	
2.	α	Intercept term	
3.	X	GFCF in billion USD	
4.	X^1	Employment to people ratio	
5.	X^2	ICT goods import	
6.	X^3	ICT goods export	
7.	X^4	Non ICT goods import	
8.	X^5	Non ICT goods export	
9.	X^6	Total ICT services import	
10.	X^7	Total ICT services export	
11.	X^8	Non ICT services import	
12.	X^9	Non ICT services export	
13.	μ	Error term	
14.	i	i = country, top 100 ICT Service exporting countries were considered based on the volume of trade in 2017	
15.	t	t = time , 2000 to 2017	

Results:

Variables	Coefficients and P-value	
	Estimate	Pr (>z)
Intercept	0.4136100	4.986e-08
GFCF (Bn USD)	0.2197690	< 2.2e-16
Employment to people ratio	0.0817298	0.106179
ICT goods import	0.0019308	0.907830
ICT goods export	0.0022886	0.246906
Non ICT goods import	-0.0018914	0.690109
Non ICT goods export	0.0476416	< 2.2e-16
Total ICT services import	0.0680652	1.370e-11
Total ICT services export	0.0184416	0.065181
Non ICT services import	0.0697235	0.007971
Non ICT services export	0.0178615	0.473158

Total Sum of Squares	4.2465
Residual Sum of Squares	0.6429
R-squared[106]	0.84863
Adj. R-squared[107]	0.84749
P-value[108]	<2.22e-16

The results indicate that the model is a good fit with a R-squared value of 0.85. This means that 85 per cent of the variation in independent variable (GDP, in this model) can be explained by the dependent variables. Total ICT services export, which includes ICT services and IT enabled services derive a coefficient of 0.0184416. This goes on to imply that a 1 per cent increase (decrease) in ICT services export will increase (decrease) the average GDP (average over time and countries taken into model) by 0.0184416 per cent. Since the p-value of total ICT services export is less than 0.01, we reject the null hypothesis.

					Table 2: Data Source and Definition of Variables used in the Model	
Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
GDP (current US$)	Gdp	World Bank national accounts data, and OECD National Accounts data files via WDI database	Current US$	PPP adjusted constant 2013 US$[109]	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.	2000-2017
GDP per capita (current US$)	gdp_per_capita	World Bank national accounts data, and OECD National Accounts data files via WDI database	Current US$	PPP adjusted constant 2013 US$	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars.	2000-2017
Gross fixed capital formation (current US$)	Gfcf	World Bank national accounts data, and OECD	Current US$	PPP adjusted constant 2013 US$	Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant,	2000-2017

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
		National Accounts data files via WDI database			machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. Data are in current U.S. dollars.	
Foreign direct investment, net (BoP, current US$)	Fdi	International Monetary Fund, Balance of Payments Statistics Yearbook and data files via WDI database	Current US$	PPP adjusted constant 2013 US$	Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows total net FDI. In BPM6, financial account balances are calculated as the change in assets minus the change in liabilities. Net FDI outflows are assets and net FDI inflows are liabilities. Data are in current U.S. dollars.	2000-2017
Employment to population ratio, 15+, total (%) (modeled ILO estimate)	empl_to_ppl_ratio	International Labour Organization, ILOSTAT database via WDI database	% of population	% of population	Employment to population ratio is the proportion of a country's population that is employed. Employment is defined as persons of working age who, during a short reference period, were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period (i.e. who worked in a job for at least one hour) or not at	2000-2017

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
					work due to temporary absence from a job, or to working-time arrangements. Ages 15 and older are generally considered the working-age population.	
Computer and Information services – exports/ import	—	UNCTAD	US Dollars at current prices and current exchange rates in millions	Constant 2013 US$ (in millions)	(1) Computer services consist of hardware and software-related services and data processing. (2) New agency services include the provision of news, photographs and feature articles to the media. (3) Other information services cover database services: database conception, data storage and dissemination of data. Direct non-bulk subscriptions to periodicals regardless of means of information transmission also belong to this service category There are two separate sub-categories, namely, computer services and telecommunication services under UNCTAD's Services (BPM6): Exports and imports by service-category and by trade-partner, annual database. Country-wise export and import flows data with world for the available years 2005 onwards under these two categories are aggregated to get the variable: Computer and Information services-exports/imports. However, only one category computer and information services is these under UNCTAD's Services (BPM5): Exports and imports by service-category, value, shares and growth, annual, 1980-2013	2000-2017

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
					(Discontinued) data series. Country-wise export and import figures of this category are taken for the year 2000 to 2004.	
Telecommuni-cationns services - exports/ import	—	UNCTAD	US Dollars at current prices and current exchange rates in millions	Constant 2013 US$ (in millions)	Covers the transmission of sound, images or other information by telephone, telex, telegram, radio and television cable and broadcasting, satellite, electronic mail, facsimile services, teleconferencing, business network services, and related support services. It further comprises cellular phone services and on-line (Internet) access services. It does not include the value of the information transported, nor telephone network installation services	2000-2017
—	ict_serv_exp	UNCTAD	—	Constant 2013 US$ (in millions)	This is the sum of Computer and Information Services, and Telecommunications services export	2000-2017
—	ict_serv_imp	UNCTAD	—	Constant 2013 US$ (in millions)	This is the sum of Computer and Information Services, and Telecommunications services import	2000-2017
—	ict_enabl_serv_exp	UNCTAD	US Dollars at Current prices And current exchange rates in millions	Constant 2013 US$ (in millions)	These two variables indicate ICT-enable services export and import, respectively. Following sub-categories are considered as ICT-enable services.[110]: • Sales and marketing services, not including trade and leasing services • Insurance and financial services • Management, administration, and back office services • Licensing services	2000-2017
—	ict_enabl_serv_imp					

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
					• Engineering, related technical services and R&D • Education and training services After conversion of export and import figure under each of these six categories from current to constant 2013 US$ (in millions), sum of these six are computed and define as ICT-enable services export and import figures, respectively.	
— —	ict_good_exp ict_good_imp	WITS	US Dollars at Current prices And current exchange rates in millions	Constant 2013 US$ (in millions)	Products under these five categories are defined according to the OECD's Guide on Measuring the Information Society 2011 as ICT goods: • computers and peripheral equipment • communication equipment • consumer electronic equipment • electronic components • miscellaneous Under these categories, total 112 HS six digit products according to HS 1996 product classification have been identified as ICT-good in this document.[111] One product group has been prepared on these 112 products. Country-wise aggregate on these products' export and import figures with world at different times are taken to define these two variables, respectively.	
Total Services export/ import	total_serv_exp total_serv_imp	UNCTAD	US Dollars at Current prices And current exchange	Constant 2013 US$ (in millions)	This is the country-wise sum of export / import flow with world of all service categories available under UNCTAD's Services (BPM5): Exports and imports by service-category, value, shares and growth, annual, 1980-2013 (Discontinued) data series for the years 2000 to 2014,	2000-2017

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
			rates in millions		and UNCTAD's Services (BPM6): Exports and imports by service-category and by trade-partner, annual database for the years 2005 to 2017.	
—	non_ict_serv_exp	UNCTAD		Constant 2013 US$ (in millions)	These two variables are computed by author using following formula: non_ict_serv_exp/imp = total_serv_exp/imp – (ict_serv_exp/imp + ict_enabl_serv_exp/imp)	
—	non_ict_serv_imp					
—	total_good_exp	WITS	US Dollars at Current prices And current exchange rates in millions	Constant 2013 US$ (in millions)	These two variables contain observations of total gross export/import figures of country and year wise.	2000-2017
—	total_good_imp					
—	non_ict_good_exp	WITS	—	Constant 2013 US$ (in millions)	These two variables are computed by author using following formula: non_ict_good_exp/imp = total_good_exp/imp –ict_good_exp/imp	2000-2017
—	non_ict_good_imp					

Sl. No.	Variable Name	Variable definition	Data source
		Table 3: State Level Data Source and Variable Definition	
1.	ICT export	State wise exports done by STPI (Software Technology Park of India)-registered IT/ITeS units	Annual Report 2016-17 of STPI
2.	FDI inflow	State-wise FDI inflow as per RBI's regional office received FDI inflows. However, some RBI regional offices cover more than one state and RBI Mumbai publishes data region-wise, not by further segregating state-wise. In this case, state's share in the concerned region's total GDP is considered as weight to get the FDI inflow for this particular state from this state's belonging region office data.	Information retrieved from Fact Sheet on Foreign Direct Investment (FDI) from April, 2000 to June, 2019; published by Department for Promotion of Industry and International Trade (DIPP)
3.	Number of Patent Filed	Number of State-wise applications for Patent filed.	Annual Report 2017-18 of The Office of the Controller General of Patients, Designs, Trademarks and Geographical Indications, Government of India
4.	Number of Start-ups	State-wise number of start-ups. Start-ups are normally identified as a newly emerged, fast growing business that aims to meet a marketplace need by developing a viable business model around innovative product, service, process or a platform.	Information retrieved from States' Startup Ranking 2018 report. Published by Government of India, Ministry of Commerce & Industry, Department of Industrial Policy & Promotion
5.	GSDP	Gross State Domestic Product at current prices in crore INR	Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India data extracted using RBI database platform
6.	Population	State Wise Population Data	India's Economic Census data extracted using RBI database platform
7.	Exchange Rate	Reserve Bank of India' (RBI) published annual average exchange rate of Indian rupee with US dollar for the period 2016-17 is used to convert data in INR into USD	Reserve Bank of India
8.	GSDP per capita	This is the ratio of GSDP at USD and population	Not Applicable

Variable name (as in database)	Database	Original Unit	Converted Unit	Definition	Years available
ICT service export	UNCTAD	US Dollars at current prices and current exchange rates in millions	Constant 2013 US\$ (in millions)[112]	This is the sum of services export of India to world under two sub-categories, namely, Computer and Information Services, and Telecommunicationns services	2008-2018
FDI inflow in ICT sectors	Quarterly Factsheet published by Department For Promotion of Industry and International Trade	US Dollars at current prices and current exchange rates in millions	Constant 2013 US\$ (in millions)	This is the aggregate of FDI inflows in two sectors, namely, Computer Software & Hardware, and Telecommunications.	2008-2017
GDP (current US\$)	World Bank national accounts data, and OECD National Accounts data files via WDI database	Current US\$	PPP adjusted constant 2013 US\$[113]	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.	2008-2017
Number of Patents Filed	Annual Report 2017-18 of The Office of the Controller General of Patients, Designs, Trademarks and Geographical Indications, Government of India	NA	NA	Year-wise cumulative numbers of patent filed by residents and non-residents through various routes.	2008-2017

Variable name (as in database)	Database	Original Unit	Converted Unit	Definition	Years available
Number of Tech Start-ups	Information on number of tech start-ups in India retrieved from NASSCOM's Indian Start-up Ecosystem reports 2017 & 2018 edition.[114]	NA	NA	Year-wise number of tech start-ups in India. A company is recognized as tech start-up if that company has the following basic features: a) Companies incorporated in the last five years; b) one or more funding members should be of Indian origin; c) Company headquarters in India or outside with product development centre largely in India; and d) IP-backed technology product or technology platform or eCommerce or aggregators considered.	2010-2018

ECONOMETRIC MODEL 2

$$\text{ICSE}_{ijt} = \alpha + \beta\left(GDP_{jt} * GDP_{it}\right) + \gamma FDI_{it} + \theta IIB\_O\_D_t + \rho Human\_cap\_O\_D_t + \vartheta lagged\ REER_{i(t-1)} +$$
$$\omega language_{ijt} + \varepsilon\ data\ flow\ restrictions + \mu_{ijt} \quad \text{------------------------- (ii)}$$

where,
i represents India,

j equals 1 to 27 and represents the digital services trading partner of India

t is time period from 2011 to 2016

In the equation above,

GDP_jt*GDP_it represents the product of GDPs of India and trading partner and is a measure of combined economic mass as per the gravity model of trade.[115] Higher the mass, higher would be the expected trade between countries.

FDI_it is the Foreign Direct Investment in Computer Software & Hardware and Telecommunications in India. It is expected to have a positive coefficient.

language_ijt measures linguistic affinity, which is taken as a proxy for cultural affinity between India and trading partner. In the context of this model greater affinity in language would enhance services trade between nations.

IIB_O_D_t is an interaction variable of international Internet bandwidth of India and trading partner. International Internet bandwidth has been taken as a proxy for digital infrastructure and is expected to have a positive coefficient.

Human Cap_O_D_t is an interaction variable of tertiary enrolment ratio of India and partner country. This is a measure of skilled human capital within India, which is the provider of services exports and partner country, which is a consumer of services exports from India.

laggedREER_i(t-1) measures real effective exchange rate with a one-time period lag.

data flow restrictions this variable captures the impact of CBDF restrictions in India and trading partner. It is constructed as an interaction variable between data policy rank[116] of India and destination country. A lower ranking (higher numerical value) of data policy rank depicts lesser restrictions; hence this variable is expected to have a positive sign. Higher the numerical value of this variable, lower the ranking, which means lower restrictions, which could lead to higher digital services exports.

MODEL II

Hypothesis:

H_0: Data flow restrictions do not have a significant impact on digital services exports
H_1: Data flow restrictions have a significant impact on digital services exports

$$ICSEijt = \alpha + \beta\left(GDP_{jt} * GDP_{it}\right) + \gamma FDI_{it} + \theta\ IIB\_O\_D_{it} + \rho\ Human\ Cap_{it} + \vartheta laggedREER_{i(t-1)} + \omega language_{ijt} + \varepsilon\ data\ flow\ restrictions + \mu_{ijt}$$

------------------ (iii) i = India and j = partner country, t = time[117]

Variables taken into account[118]:

	Variables	
1.	ICSE	Digital service exports (USD)
2.	IIB_O_D$_{it2}$	International Internet bandwidth interaction variable between origin and destination country
3.	HumanCap$_{it}$	Tertiary enrollment ratio interaction variable between origin and destination country
4.	GDP$_{it}$*GDP$_{jt}$ (for bilateral partner countries)	Represents the product of GDPs of India and trading partner and is a measure of combined economic mass as per the gravity model of trade.
5.	FDI	FDI inflow in ICT sector.[119]
6.	Lagged REER	Real effective exchange rate t-1. REER[120] is a product of relative prices (export and world price) and nominal exchange rate. World price data would be world import value index and unit value index of export can be taken as export price.
7.	Data flow restrictions	Interaction variable of data policy ranks of origin and destination country as a proxy.[121] [122]

Results:

Variables		
	Estimate	Pr (>z)
Intercept	-1.994e+03	7.30e-11
FDI ICT sector	9.082e-02	0.0122
Lagged REER	-1.868e+00	0.3235
Combined GDP	1.211e-10	< 2e-16
Language	8.505e+03	2.40e-12
International Internet Bandwidth interaction variable	4.854e-12	0.01210
Tertiary enrollment ratio interaction variable	2.785e-01	0.0103
Data flow restrictions	4.132e-01	1.46e-05

R-squared	0.9459
Adj. R-squared	0.943
P-value	< 2.2e-16

The results indicate that the model is a good fit with R- squared value of 0.95. This suggests that 95 per cent of independent variable (ICT services export in this model) can be explained by the dependent variables. With a p - value of 1.56e-05, which is less than 0.05, we reject the null hypothesis.

Table 4: Data Source and Definition of Variables used in Model 2						
Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
—	Service export	OECD Stat	US Dollars at current prices and current exchange rates in millions	Constant 2013 US$ (in millions)[123]	This is mirror data. India's direct export in service trade categories to each of the destination country considered into the model is not available in the OECD stat. Hence the destination countries' reported import in service trade category from India has been treated as India's export to the respective countries. In OECD stat, service trade has been categorized by following EBOPS 2010 definition. According to EBOPS 2010 description, four categories of service trade have been classified as ICT service trade and there are seven categories are classified as ICT-enable service.[124] This variable is created by summing over import has done under each of these total eleven categories by destination country from India.	2011-2016
—	FDI ICT Sector	Quarterly Factsheet published by Department For Promotion of Industry and International Trade	US Dollars at current prices and current exchange rates in millions	Constant 2013 US$ (in millions)	This is the aggregate of FDI inflows in two sectors, namely, Computer Software & Hardware, and Telecommunications.	2011-2016
Real Effective Exchange Rate based on CPI	Lagged REER	Reserve Bank of India	NA[125]	NA	Effective exchange rates are summary indicators of movements in the exchange rates of home currency against a basket of currencies of trade partner countries and are	2011-2016

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
					considered to be an indicator of international competitiveness.This REER is based on 36 currencies with export as weight and 2004-05 is considered as base year. One year lagged of this variable is taken into the model.	
GDP (current US$)	—	World Bank national accounts data, and OECD National Accounts data files via WDI database	Current US$	PPP adjusted constant 2013 US$[126]	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.	2011-2016
—	Combined GDP	World Bank national accounts data, and OECD National Accounts data files via WDI database	Current US$	PPP adjusted constant 2013 US$	This variable is created by multiplying India's GDP with its services export destination country.	2011-2016

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
Common Spoken Language (CSL)	Language	CEPII	NA	NA	This is country-pair wise data. This variable indicates the commonality in at least one spoken language in which at least four per cent people of India and each of its services export partner use to communicate. If there is more than one common language between them, and existence of each common-language count as one, then, those countries having more than one common languages would have the CSL value greater than one. This would result in dual counting. To overcome this, change in methodology to compute the value and also some adjustments have been taken into account. First, Common-language specific multiplication of percentage share of population spoken in that particular language in India and its counter-part percentage share of the population of other country has been computed. For those country pairs having only one common spoken language, this multiplication value of this particular language is taken as final value for CSL. Otherwise, one adjustment has made to restrict the value of CSL which lies between 0 and 1.[127]	2011-2016
International Internet Bandwidth	—	ITU	Mbit/s	NA	International Internet Bandwidth is meant to account for maximum quantity of data transmission (Rate) of data transmission (Rate) from a country to the rest of the world.	2011-2016

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
	International Internet Bandwidth interaction variable	ITU	Mbit/s	NA	This is the interaction of International Internet Bandwidth of India with each of its services export destination countries taken into the model.	2011-2016
Tertiary enrolment ratio	—	UNESCO Institute for Statistics via World Bank's WDI database	%	NA	Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Tertiary education, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level.	2011-2016
—	Tertiary enrolment ratio interaction variable	UNESCO Institute for Statistics via World Bank's WDI database	%	NA	This is the interaction of enrolment ratio of India with the ratio of its ICT services and ITeS export destination countries.	2011-2016
Data Policy Rank	—	European Centre for International Political Economy (ECIPE)	NA	NA	ECPIE has computed a comprehensive index named Digital Trade Restrictiveness Index and under it has four clusters, namely, (A) Fiscal Restrictions and Market Access; (B) Establishment Restrictions; (C) Restrictions on Data; and (D) Trading Restrictions. Each of these four clusters further covers more than one segment. This Data Policy restriction is one of the segments under Cluster C. This index has been computed over 64 countries around the world. India's services export destination	2011-2016

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
					countries are subset of these 64 countries. Rank of these selected destination countries as well as of India under data policy has been taken to create this variable.	
—	Data flow restrictions	European Centre for International Political Economy (ECIPE)	NA	NA	This is an interaction variable computed by multiplying rank of India with the rank of its ICT services and ITeS export destination countries.	2011-2016

Table 5: Computation of Data Policy Index[128]		
S.No.	Items covered	Weighting
1	Cross-border flow restrictions	50%
2.	Data retention	15%
3.	Subject rights on data privacy	10%
4.	Administrative requirements for data privacy	15%
5.	Sanctions for non-compliance	5%
6.	Other restrictive practices related to data policies	5%

APPENDIX C

I. Impact on Domestic Investment

As shown in Table 5, GFCF is used to calculate the percentage annual growth rate in investment. Then, the growth rate is used to calculate moving average, which gives us the multiplier and generates investment projections till 2025.

Based on Bauer's estimation, investment loss due to data localisation would be 1.9 per cent. Using this investment loss, it has been calculated that by the year 2025, data localisation would cause investments to drop by US$18,439 million (Table 6).

Table 6: Projected Investment in 2025								
Year	GFCF_total (In mn INR)	Exchange rate	GFCF_total (In mnUSD)	Annual Growth (in %)	Simple_moving Average (in %)	Multiplier	Year	Projected Investment (in mn USD)
2011-12	29977320	47.92	625532.26				2018-19	786769.59
2012-13	33249740	54.41	611097.25	-2.31			2019-20	814774.56
2013-14	35156210	60.50	581076.13	-4.91			2020-21	843776.36
2014-15	37503920	61.14	613374.42	5.56	3.56	1.04	2021-22	873810.48
2015-16	39570930	65.47	604427.01	-1.46			2022-23	904913.67
2016-17	43350140	67.07	646322.46	6.93			2023-24	937123.96
2017-18	48968140	64.45	759727.19	17.55			2024-25	970480.78

Data Source: "GFCF_total" is author's calculation. It is the sum of GFCF (Gross Fixed Capital Formation) made under each of by industries for public sector, for private corporations and for households. This data on GFCF under these three sub-headings for the period 2011-12 to 2017-18 are collected from the National Accounts Statistics 2019, published by the Ministry of Statistics and Programme Implementation, Government of India. Reserve Bank of India's (RBI) published annual average exchange rate of Indian rupee with US dollar for the period 2011-12 to 2017-2018 are used to convert data in INR into USD.

Here GFCF is considered as Gross Fixed Domestic Investment. According to the World Bank's World Development Indicator database definition on the variable GFCF, "*Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation.*"

Table 7: Calculation of Loss in Investment in 2020-2025					
Year	Projected Investment (in mnUSD)	Investment loss (in %) (Based on Bauer et al (2014))[129]	Multiplier	Projected investment (in mnUSD)	Investment loss (in mnUSD)
2018-19	786769.59			—	—
2019-20	814774.56			—	—
2020-21	843776.36			—	—
2021-22	873810.48	1.9		—	—
2022-23	904913.67			—	—
2023-24	937123.96			—	—
2024-25	970480.78			956894.05	18439.13

II. Impact on Welfare

Annual growth rate of average monthly salary till 2017 has been calculated as shown in Table 7. Using the growth rate, a simple moving average was established. This gave the multiplier, which was utilised to project average monthly wage till 2025, conforming to the prevalent trend.

Bauer, in his paper has estimated a welfare loss of 11 per cent. Using his estimation, this paper has calculated a welfare loss of US$47.05 by 2025 (Table 8).

Table 8: Projected Average Monthly Wage Rate in 2025							
Year	avg_monthly _wage (in INR)	Exchange rate	avg_monthly _wage (in USD)	Annual Growth (%)	Simple_ moving _average	Multiplier	Year	projected_avg_ monthl _wage (in USD)
2010	9672.71	45.7262	211.54	—			2018	306.58
2011	11297.29	46.6723	242.06	14.43			2019	321.51
2012	12408.07	53.4376	232.20	-4.07			2020	337.18
2013	14223.55	58.5978	242.73	4.54			2021	353.60
2014	15521.75	61.0295	254.33	4.78	4.87	1.05	2022	370.82
2015	16858.83	64.1519	262.80	3.33			2023	388.88
2016	17930.40	67.1953	266.84	1.54			2024	407.82
2017	19037.83	65.1216	292.34	9.56			2025	427.69

Data Source: Author's own calculation using data from different sources. To compute "avg_monthly_wage", data on two variables: Avg No of Persons Worked; and wages/salary are extracted from Central Statistics Office' (CSO) Annual Survey of Industries database for the period 2009-10 to 2016-2017. Reserve Bank of India' (RBI) published exchange rate data at annual average on calendar year for the period 2010 to 2017 are used to covert data in INR into USD.

Table 9: Calculation of Welfare Loss per Worker					
Year	projected_avg _monthly_wage (in USD)	Welfare loss (in %) Based on Bauer et al (2014)[130]	Multiplier	projected_avg_ monthly_wage (in USD)	Welfare loss (Per worker) (in USD)
2018	306.58			—	—
2019	321.51			—	—
2020	337.18			—	—
2021	353.60			—	—
2022	370.82	11	0.89	—	—
2023	388.88			—	—
2024	407.82			—	—
2025	427.69			380.64	47.05

Table 9 estimates the annual growth rate of employment till 2017, which has been used to calculate the moving average. Further, the multiplier calculated from the moving average gives an overview of projected employment by 2025. Finally, using the results from Table 8, a total welfare loss of US$2.41 billion has been calculated.

Table 10: Calculation of Total Welfare Loss								
Year	Employment	Annual Growth	Simple Moving Average	Multiplier	Year	Projected Employment	Welfare loss_USD (Per Worker)	Total loss Welfare (In bnUSD)
2010	25334000				2018	36844352		
2011	27193831	7.34			2019	38614541		
2012	28983211	6.58			2020	40469779		
2013	29595524	2.11	4.80	1.05	2021	42414152		
2014	31188026	5.38			2022	44451943		
2015	32393881	3.87			2023	46587639		
2016	33728201	4.12			2024	48825945		
2017	35155313	4.23			2025	51171790	47.05	2.41

APPENDIX D

Table 11: GATS Modes of Supply of Services
GATS Modes of Supply of Services[131]

|	
Mode 1 (Cross-border supply)	Supply of services from one country to another.
Mode 2 (Consumption abroad)	Supply of services from one country to consumers of another country.
Mode 3 (Commercial presence)	Supply of services through business establishment of one country to another country (FDI).
Mode 4 (Presence of natural person)	Supply of services by nationals of one country in the territory of another country.

APPENDIX E

As on date, the following cross-border data flow restrictions and data localisation requirements are applicable in India:

Table 12: List of Policies in India with Cross Border Data Flow Restrictions and Data Localisation Mandates – Current

Sect./Clause	Description
1. License Agreement for Unified License[132]	
39.23 (viii)	The Licensee shall not transfer the following to any person/place outside India: - a. Any accounting information relating to subscriber (except for international roaming/ billing) (Note: it does not restrict a statutorily required disclosure of financial nature); and b. User information (except pertaining to foreign subscribers using Indian Operator's network while roaming and IPLC subscribers).
2. The Public Records Act 1993[133]	
4	No person shall take or cause to be taken out of India any public records without the prior approval of the Central Government: Provided that no such prior approval shall be required if any public records are taken or sent out of India for any official purpose.
3. Information Technology (Reasonable security practices and procedures and sensitive personal data or information) Rules, 2011[134]	
7	A body corporate or any person on its behalf may transfer sensitive personal data or information including any information, to any other body corporate or a person in India, or located in any other country, that ensures the same level of data protection that is adhered to by the body corporate as provided for under these Rules. The transfer may be allowed only if it is necessary for the performance of the lawful contract between the body corporate or any person on its behalf and provider of information or where such person has consented to data transfer.
4. Companies (Accounts) Rules, 2014[135]	
3(5)	Provided that the back-up of the books of account and other books and papers of the company maintained in electronic mode, including at a place outside India, if any, shall be kept in servers physically located in India on a periodic basis.
5. Indian Government's Guidelines for Government Departments for Contractual Terms related to Cloud Storage 2017[136]	
2.1(d)	The terms and conditions of the Empanelment of the Cloud Service Provider (CSP) states that all services including data will be guaranteed to reside in India.
6. RBI notification on Storage of Payment System Data 2018[137]	
2(i)	All system providers shall ensure that the entire data relating to payment systems operated by them are stored in a system only in India. This data should include the full end-to-end transaction details / information collected / carried / processed as part of the message / payment instruction. For the foreign leg of the transaction, if any, the data can also be stored in the foreign country, if required.

Table 13: List of Policies in India with Cross Border Data Flow Restrictions and Data Localisation Mandate - Proposed	
Sect./Clause	**Description**
1. Draft Digital Information Security in Healthcare Act (DISHA) 2018	
	Empowers the proposed National Electronic Health Authority to impose localisation requirements with respect to digital health data. The draft statute itself, however, does not mandate localisation of data.
2. Proposed Amendments to the Drugs and Cosmetics Rules, 1945	
67K(3)	The e-pharmacy portal shall be established in India through which they are conducting the business of e-pharmacy and shall keep the data generated localised: Provided, that in no case the data generated or mirrored through e-pharmacy portal shall be sent or stored, by any means, outside the India.
	CUTS submission to its consultation is available here.
3. The Personal Data Protection Bill 2019[138]	
33 & 34	(1) Subject to the conditions in sub-section (1) of section 34, the sensitive personal data may be transferred outside India, but such sensitive personal data shall continue to be stored in India. (2) The critical personal data shall only be processed in India. Explanation.– For the purposes of sub-section (2), the expression "critical personal data" means such personal data as may be notified by the Central Government to be the critical personal data.
	Conditions for Cross-Border Transfer of Personal Data have also been given under Clause 34.
	CUTS submission to its consultation is available here.

APPENDIX F

Figure 25: IT Exports and FDI Inflow show a positive correlation[64]
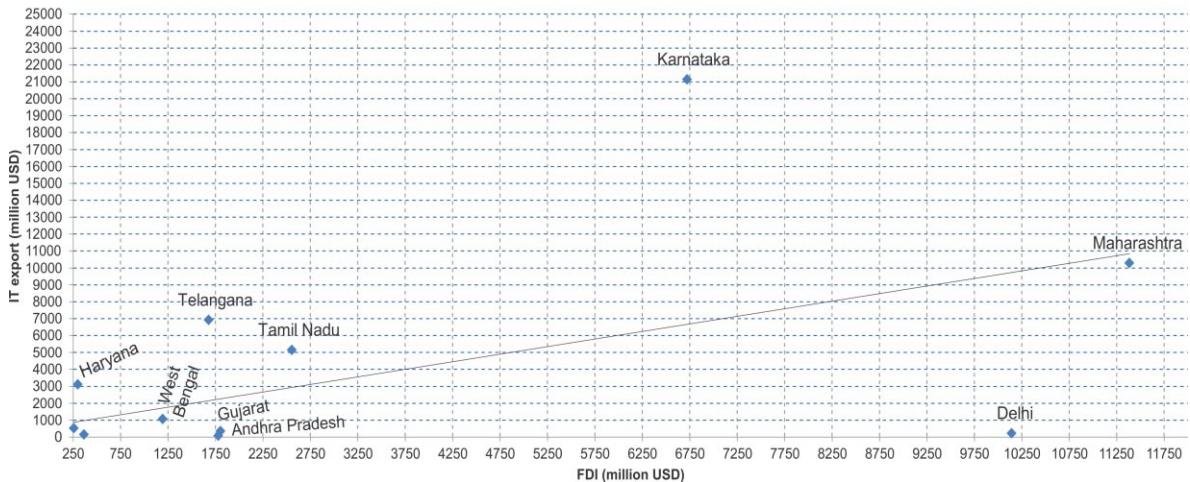
Figure 26: IT Exports and Startups show a positive correlation[66]
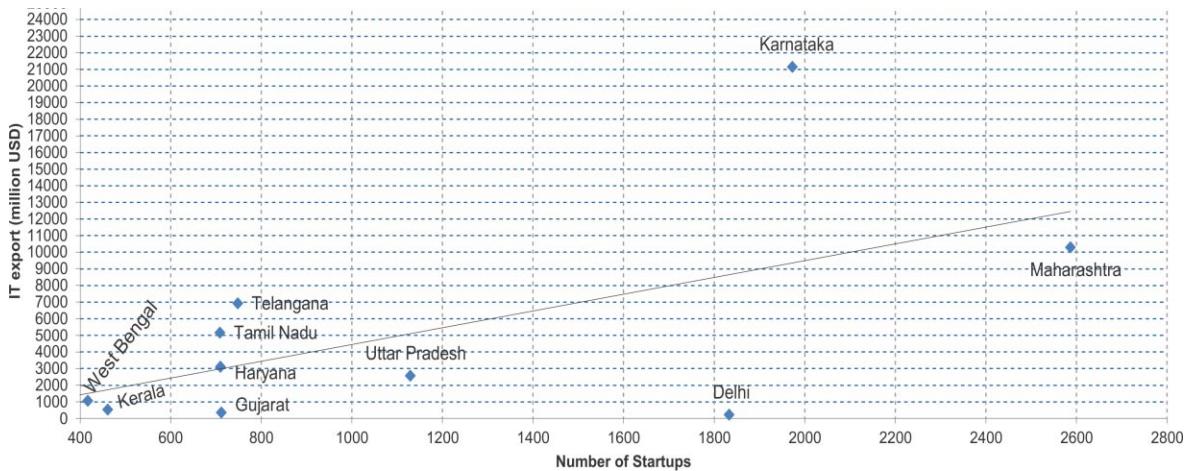
Figure 27: IT Exports and Patents Filed show a positive correlation[68]
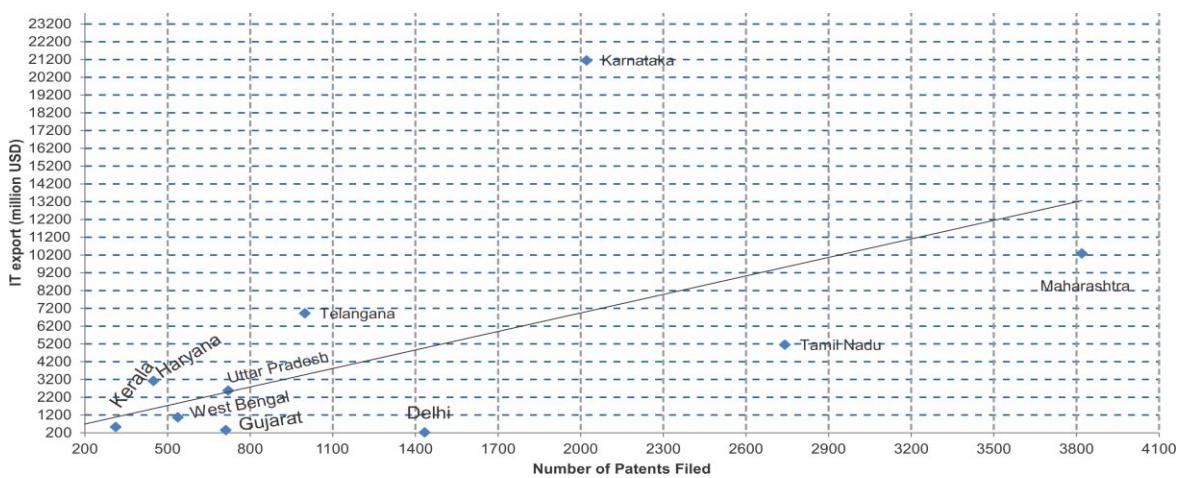
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58.   Details in Appendix B

59.   Details in Appendix B

60.   Details in Appendix B

61.   Details in Appendix B

62.   Details in Appendix B

63.   Details in Appendix B

64.   Author's own calculation, details in Appendix B

65.   Details in Appendix B

66.   Author's own calculation, details in Appendix B

67.   Details in Appendix B

68.   Author's own calculation, details in Appendix B

69.   Details in Appendix B

70.   The gravity model of international trade predicts bilateral trade flows based on the economic sizes and distance between the two units. An augmented gravity includes additional variables besides size and distance.

71.   According to EBOPS 2010 description, four categories of service trade have been classified as ICT service trade and there are seven categories are classified as ICT-enabled services. This variable is constructed by aggregating trade in these eleven categories. Details on the categories in Appendix B

72.   For this analysis, "Data Policies" rank from Data Trade Restrictiveness Index (DTRI) is taken as a proxy variable for data flow restrictions. DTRI measures the restrictions on digital trade across 64 countries in the world. The index ranges from 0 (completely open) to 1 (virtually closed). This is based on the Digital Trade Estimates database developed by The European Centre for International Political Economy (ECIPE). The index has four distinct clusters of digital trade policy measures - 'Fiscal Restrictions and Market Access', 'Establishment Restrictions', 'Restrictions on Data', and 'Trading Restrictions'. For the purpose of this study, the cluster on 'Restrictions on Data' which includes policy areas like 'Data Policies', 'Intermediate Liability', and 'Content Access' has been taken into account. Among these policy areas, only "Data Policies" rank has been considered for the econometric model. Restrictions on cross-border flow of data constitutes 50 per cent weight in the construction of this rank. The "Data Policies" rank signifies the range and extent of restrictions on data flows. A higher rank means higher restriction and a lower rank means lower restriction. For example, in the data policies index, Russia with a high data policies rank of one is most restrictive and Ecuador with a low rank of 65 is least restrictive. While, India's rank on "Data Policies" is 42.

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81. Section 3(28) of PDP'19 defines personal data as data about or relating to a natural person who is directly or indirectly identifiable, having regard to any characteristic, trait, attribute or any other feature of the identity of such natural person, whether online or offline, or any combination of such features with any other information, and shall include any inference drawn from such data for the purpose of profiling

82. GDPR 2018, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679.

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103. Data localisation restricts flow of data and mandates data storage within territorial border. DL may vary depending upon the scope of restriction. This will be addressed in relevant sections of this paper.

104. GDP has been taken as an indicator of the economy

105. A Pearson correlation is the widely used test statistics that measures the statistical relationship, or association, between two continuous variables. Simply put, it is a number between -1 and 1 that indicates the extent to which two variables are linearly related.

106. R-squared measures the proportion of the variation in your dependent variable (Y) explained by your independent variables (X) for a linear regression model.

107. Adjusted R-squared adjusts the statistic based on the number of independent variables in the model.

108. The P value, or calculated probability, is the probability of finding the observed, or more extreme, results when the null hypothesis (H0) of a study question is true – the definition of 'extreme' depends on how the hypothesis is being tested. P is also described in terms of rejecting H0 when it is actually true, however, it is not a direct probability of this state.

109. To convert the variable into constant 2013 US$, two step methodology has been followed:
    Step I: Data has been adjusted for PPP (Purchasing Power Parity) by using the following formula:
    GDP (PPP adjusted current US$)it= GDP(Current US$)itPPP conversion factor, GDP (LCU per international $)it ;
    Where, i indexes for country observation and t indexes for time observation. Data source of PPP conversion factor, GDP (LCU per international $) is World Bank, International Comparison Program database via WDI database.
    Step II: PPP adjusted GDP at current US$ figures at different times have been converted to constant 2013 US$ by using the following formula:
    GDP constant 2013 US$it=GDP PPP adjusted current US$it?CPIUS,2013CPIUS,t ;
    Where, CPI is the Consumer Price Index of all urban consumers of US.

110. For more details about ICT-enabled services, please see the following documents UNCTAD. (2015). *International Trade in ICT Services and ICT-enabled Services: Proposed Indicators from the Partnership on Measuring ICT for Development.*

111. OECD. *OECD Guide to Measuring the Information Society 2011*, 2011, https://www.oecd.org/sti/ieconomy/oecdguidetomeasuringtheinformationsociety2011.htm.

112. To convert the data into constant 2013 US$ (in millions), following adjustment has been made:
    GDP constant 2013 US$it=GDP PPP adjusted current US$it?CPIUS,2013CPIUS,t ;
    Where, i is the index of countries of observation, t is the index of year, and CPI is the Consumer Price Index of all urban consumers of US.

113. To convert the variable into PPP adjusted constant 2013 US$, two step methodology has been followed:
Step I: Data has been adjusted for PPP (Purchasing Power Parity) by using the following formula:
GDP (PPP adjusted current US$)it= GDP(Current US$)itPPP conversion factor, GDP (LCU per international $)it ;
Where, i indexes for country observation and t indexes for time observation. Data source of PPP conversion factor, GDP (LCU per international $) is World Bank, International Comparison Program database via WDI database.
Step II: PPP adjusted GDP at current US$ figures at different times have been converted to constant 2013 US$ by using the following formula:
GDP constant 2013 US$it=GDP PPP adjusted current US$it?CPIUS,2013CPIUS,t ;
Where, CPI is the Consumer Price Index of all urban consumers of US.

114. NASSCOM. *Indian Start-Up Ecosystem - Traversing the maturity Cycle*. Edition 2017, 2017; NASSCOM. *Indian Tech Start-Up Ecosystem - Approaching Escape Velocity*. Edition 2018, 2018.

115. Thomas Chaney, "The Gravity Equation in International Trade: An Explanation," *Journal of Political Economy* 126, no. 1 (2018): 150-177, https://www.journals.uchicago.edu/doi/pdfplus/ 10.1086/694292.

116. This has been computed by ECIPE. Data policy index is a sub component of restrictions of data index, where 50 per cent weightage has been given to cross-border data flow.

117. 2011 to 2016

118. Pravakar Sahoo, Ranjan K. Dash, and Prabhu P. Mishra, *Determinants of India's Services Exports*, (IEG, 2013), http://www.iegindia.org/upload/publication/Workpap/wp333.pdf.

119. FDI inflow taken only within telecommunication and computer services

120. Gupta, S. D., Raychaudhuri, A., &Haldar, S. K. (2015). *Determinants of Exports of Information Technology in India: An Empirical Analysis*. South Asia Economic Journal, 16(1), 64–81. https:// doi.org/10.1177/1391561415575128

121. Martina Francesca Ferracane ,Hosuk Lee-Makiyama,and Erik van der Marel, *Digital Trade Restrictiveness Index*, ECIPE, https://globalgovernanceprogramme.eui.eu/wp-content/uploads/ 2019/09/Digital-Trade-Restrictiveness-Index.pdf
In this paper, they calculate restrictions on data by taking data policy, intermediary liabilities and content access as indicators using weights given on page 98. Data policy has been calculated by giving 50 per cent weightage to cross-border data flow (Page 98). And ranking of countries is based on restrictions on data (table A4 : page 126). This will enable building scenarios for India by increasing the ranking to estimate stricter regulations and gauge the impacts.

122. Please refer to appendix Table 5 for weights used in calculation of data policy rank.

123. To convert the data into constant 2013 US$ (in millions), following adjustment has been made:
GDP constant 2013 US$it=GDP PPP adjusted current US$it?CPIUS,2013CPIUS,t ;
Where, i is the index of countries of observation, t is the index of year, and CPI is the Consumer Price Index of all urban consumers of US.

124. To see the detail of sub-categories under ICT and ICT-enable service category, please see the following document: UNCTAD, *International Trade in ICT Services and ICT-enabled Services: Proposed Indicators from the Partnership on Measuring ICT for Development*, 2015.

125. NA means Not Applicable.

126. To convert the variable into PPP adjusted constant 2013 US$, two step methodology has been followed:
Step I: Data has been adjusted for PPP (Purchasing Power Parity) by using the following formula:
GDP (PPP adjusted current US$)it= GDP(Current US$)itPPP conversion factor, GDP (LCU per international $)it ;

Where, i indexes for country observation and t indexes for time observation. Data source of PPP conversion factor, GDP (LCU per international $) is World Bank, International Comparison Program database via WDI database.
Step II: PPP adjusted GDP at current US$ figures at different times have been converted to constant 2013 US$ by using the following formula:
GDP constant 2013 US$it=GDP PPP adjusted current US$it?CPIUS,2013CPIUS,t ;
Where, CPI is the Consumer Price Index of all urban consumers of the US.

127. To see the detail of this adjustment and computation methodology, please refer to Jacques Melitz and Farid Toubal, "Native language, spoken language, translation and trade," *Journal of International Economics* 93, no. 2 (July 2014): 351-363, https://doi.org/10.1016/ j.jinteco.2014.04.004.

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131. Directorate General of Commercial Intelligence and Statistics, *India's Export of ICT-Enabled Services*, 2018, Ministry of Commerce and Industry, Government of India, http://dgciskol.gov.in/ Writereaddata/Downloads/IctExportReport.pdf.

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134. Information Technology (Reasonable security practices and procedures and sensitive personal data or information) Rules 2011, https://www.meity.gov.in/writereaddata/files/ GSR313E_10511%281%29_0.pdf.

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136. Guidelines for Government Departments on Contractual Terms Related to Cloud Services 2017, http://meity.gov.in/writereaddata/files/Guidelines-Contractual_Terms.pdf.

137. RBI notification on Storage of Payment System Data 2018, https://rbi.org.in/Scripts/ NotificationUser.aspx?Id=11244&Mode=0.

138. The Personal Data Protection Bill 2019, http://164.100.47.4/BillsTexts/LSBillTexts/Asintroduced/ 373_2019_LS_Eng.pdf.

About the Study

India is a leader in the global IT-BPM industry built primarily through consistent growth of digital services export to other countries. Digital trade more broadly benefits the Indian economy by increasing productivity, connecting Indians to best-in class digital goods and services and reducing the cost of engaging in international trade for Indian micro, small and medium enterprises. More importantly, India's success as a global leader in digital exports is the result of favorable public policies at home and abroad, including the open market access granted to Indian digital exports by its foreign trading partners. Worryingly, we are now seeing a rise in global digital protectionism including a series of policies restricting the international processing, storage, and transfer of data, often referred to as "data localisation" (DL). While India benefits significantly from its digital exports, including the processing of sensitive personal data of foreign citizens, India has a number of existing and proposed policies that impose data localisation requirements or that restrict the flow of data across borders.

This research study measures the economic importance of digital services exports for the Indian economy and analyses the implications of foreign and domestic data flow restrictions on the economy. The study builds seven scenarios, each varying in the level of restrictiveness imposed on cross-border data flows by the Government of India and by its major trading partners in retaliation. The scenarios estimate retaliation from India's top export destination for digital services (United States) due to restricted market access for the US firms, and lastly, when all importers of digital services from India impose retaliatory restrictions on CBDF. The study also includes views and experiences of industry stakeholders, collected via in-depth interviews, which details the impact of data localisation on India's domestic industry, innovation, compliance and more.

CUTS International

Established in 1983, CUTS International (Consumer Unity & Trust Society) is a non-governmental organisation, with its Mission: Consumer Sovereignty in the Framework of Social Justice and Economic Equality and Environmental Balance, within and across Borders. For details, please visit: http://www.cuts-international.org.

CUTS International