UP School of Economics
Discussion Papers

Discussion Paper No. 2018-03 August 2018

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Abstract

The paper examines recent technology enablers as these affect the services sector and are seen to be analogous to developments taking place as Industry 4.0. After briefly summarizing these, we argue that there are important implications to services, particularly their international trade, in terms of challenges to investment, regulation, policy, regional cooperation, and regional agreements, among others. Some of the possible adjustments arising out of these developments are outlined – in the manufacturing sector and in the services (and their trade).

Introduction

A common feature of economic growth in the last century is the increasing share of services as agriculture diminishes in importance and manufacturing settles to sustainable levels. Moreover this has been accompanied by equally increasing trade in services as barriers have come down, as transport and communications reduced the costs of trade, and as technology changed the substance of services. The importance of services to the economy however varies by their weight – many of the ASEAN Member States (AMS) services industries' shares between 39 and 48 percent of GDP; while that of Malaysia, Philippines, Singapore and Thailand, along with India, have exceeded 50 percent. What composes this has also been quite traditional – transportation, storage, communication, finance, real estate, trade and defense, among others. On the other hand, trade in services has hovered around 12-14 percent of GDP for ASEAN constituting mostly of travel, transport, construction, finance, manufacturing services, personal, cultural, and recreational services, and other business services, among others.

After travel, "other business services" constitute the next largest ASEAN exports within the region and outside the region. Most of what these contain is business process outsourcing (BPO) and related services. Financial services, computer and information services follow after transportation services. The importance of these 3 kinds of services is true also for India and account for some of the foreign direct investments into Asia. As the services industry expands, its trade becomes an important source. Whether this is a long-term reliable anchor for development depends on the region's current advantages in these services enabled by digital technologies, labor cost advantages, educational capacities, and investments.

More than a decade ago in the context of offshoring, Blinder (2006) as if foretelling Industry 4.0, argued on the blurring distinction between tradable and non-tradable products and services. While it was useful then to indicate that those that can be boxed and shipped are tradable and otherwise as non-tradable, the advent of digital technology allowed many services to become tradable. Newer distinction was between those that can be delivered electronically without quality diminution and

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otherwise. With a blurring crystal ball, a further distinction is between personal and impersonal services where the former requires face-to-face contact and the latter deliverable electronically allowing for significant shifts in-between but mostly towards impersonal services. With recent developments in technology – hardware and software – these distinctions appear to be losing significance as well.

This brief is a comment on recent developments in technology that likely will affect the services sector, their potential trade, and investments. To the extent that as a result of these developments the profile and substance of the sector changes, it would be of interest to countries which have yet to see shifts in their GDP towards services. In the same vein, it would also be of interest even to those with significant services sector to track where it may evolve in the near future. In both instances, there would be implications for regulations, trade and other policies, regional cooperation and agreement.

Accordingly, the next section identifies what are some of the technology enablers for the development of the services sector. We argue that disruptions of established conclusions have been triggers to a more enabled technology affecting services. Some go against existing paradigms which pioneered in the field. A third section summarizes the challenges that come with substantive reconfiguration of the services sector particularly in specific areas of regulation and policy. Indeed the pace of technological changes that have been taking place indicate how far off regulation and policy have been in ensuring that associated investments, trade behavior, and sector responses provide adequate safeguards and security to the economy. A final section concludes.

Technology Enablers in Services

Industry 4.0 (or a fourth industrial revolution) is supposed to be a new industrial landscape shaped by a slew of digital industrial technologies.[1] Depending on the organizations or authors, the number of technologies driving it varies in number and scope. Around 10 of these (in combination) appear to be critical for transforming manufacturing into a cohesive smart factory utilizing real-time data for production decision-making, using robots to assist in floor operations, vertical and horizontal systems integration, simulations to test and optimize machines in plants, and additive manufacturing – all these aimed at higher productivity, speed, and precision leading to better competitiveness and profitability. Some of these are equally critical to the services industry although it is in the area of Artificial Intelligence (AI) developments that matters more.

First of all is the rise of the super-computers. Not only do these devices and systems have the properties of speed and storage, they are also smaller in physical sizes and may become more mobile relative to what we had a few decades back. Their performance and speed are now measured in terms of the number of floating-point arithmetic calculations per second i.e., floating-point operations per second (FLOPS). GigaFLOPS (GFLOPS) [10^9] are now giving way to TFLOPS (teraFLOPS) and PFLOPS (petaFLOPS) with clock speeds of 1 trillion (10^{12}) and 1 quadrillion (10^{15}) floating-point operations per second, respectively. What this means is quick algorithms in response to queries and a large cache of data. Central Processing Units (CPU) of desktops have given way to Graphics Processing Units (GPU) and Tensor Processing Units (TPU) in super-computers.

[1] Though originally narrowly confined to transforming manufacturing in Germany (hence *Industrie 4.0*) into a smart factory it has since taken off into wider developments.

Second, and related to these devices are the complements coming from Data Compression, Big Data, Internet of Things, and Cloud Computing. Indeed analytics emerge as critical to Industry 4.0 as well as in the evolution of services industry development. Given the big data capacities of super-computers they can fully function even without cloud computing using the Internet with the exception of data security it provides. In the desire to create mobile super-computers, cloud computing takes over the capacity needs and thus the ability of the technology to be more nimble and retaining its computing and analytical powers.

Third, robotics has progressed at a faster pace than otherwise as part of AI. If 3-D printing is additive manufacturing, robotics is additive services. While mechanical robots have literally been seen for some time, the emergence of other digital technologies has led not only to more applications and related devices but also mimicking humans. These have been used increasingly in medicine as robot-driven targeted radiation for specific diseases with improved success rates even if many are on trial basis such as stereotactic body radiation therapy (SBRT). Nanotechnology robots are employed in orthodontics and other dental services. A robot-arm disc-jockey (DJ) alternates with human DJ in the entertainment services. Tourism services augmented reality brings tourists in virtual proximity to a particular site without actual physical presence. Singapore has pioneered in robot masseuse with more precision than human hands. And of course human-like Lumi dolls in Barcelona, Spain.

In the context of advances in robotics, what was originally perceived as natural limits to the development of humanlike robots have effectively been overcome. Pioneering Robotics Professor Masahiro Mori at the Tokyo Institute of Technology identified an “uncanny valley” in the process of creating a humanlike robot where empathy with robots turns into eeriness and revulsion as they attain lifelike appearance – partly due to texture and coldness (Mori 1970). That may soon be addressed with better material (e.g., silicone, Thermoplastic elastomers [TPE]) and heating system.

Finally, the magnitude of algorithm in any automation in services is larger than in mechanical automation in industry thus within the realm of AI. What this means is that as new data are retrieved, machine learning takes place and may improve the algorithm itself. As big data accumulate in different services (e.g., in medicine and orthodontics as more patient information and results are analyzed) the system becomes more intelligent. Given the speed and storage capacities of super-computers the degree of learning becomes speedier.

These technology enablers, and others as well, are brought to bear on many services – both personal and impersonal – which have implications on economic growth and its character. They also pose serious challenges for country-based policies, international trade and investments, and cross-country understanding, cooperation, and agreements.

Challenges in the Services Industry, Trade, and Investment

It is arguable that the enablers outlined above may come to fruition way down the road and there may even be highly technical barriers that have to be addressed. Yet it is necessary to start reckoning what may be the services industry that would emerge not only from these direct enablers but from developments in the industrial sector particularly manufacturing which appears to be advancing more than services. And as services trade has considerably expanded (in some Asian economies at faster clip than goods trade), it goes without saying that patterns may change and reliance on specific sources such as BPO and computer and communication services may be threatened. Indeed as Blinder (2006)

had pointed out a key distinction is whether a service can be delivered electronically without quality diminution or requiring a personal, face-to-face contact i.e., between personal and impersonal services. Level of education and skill is not a distinguishing characteristic – as for example between a taxi driver and an airline pilot. Yet autonomous vehicles are already here and aircrafts are now fitted with cognitive programs. Although the degree of electronic delivery is essential in a service becoming tradable, its transformation due to technology is necessary before its trade. Perhaps a greater distinction is between a device that can deliver a service that sufficiently mimics its human counterpart by exhibiting intelligence, perceives its environment, and can take actions or decisions that maximizes chances of success at a goal, or an irreplaceable personal service.

What then would the services industry look like globally, regionally, and nationally when these enablers become fully operational using information technology (IT) and operational technology (OT)? Will the services currently thriving and crossing borders continue as before? Will there be a "re-shoring" of services (e.g., BPO, computer services and telecommunications) as machine costs go down? Would investments (domestic and foreign) take different routes? Will there be impacts on other services – transportation, travel, finance, wholesale and retail trade, among others – that have flourished in the region and in each of the ASEAN and Asian economies? And what about the direction of regional cooperation and agreements in these areas let alone multilateral arrangements? It would take a dissertation to respond to these questions that this short note clearly fails. But it is possible to briefly outline challenges to our economies and our trade along 3 inter-related areas – effective adjustments to structural changes in the services industries arising from technology; responsive regulatory practices and policies; and active cooperation bilaterally, regionally, and multilaterally.

On the production side the manufacture of super-computers will continue to rely on integrated circuits, semi-conductors, and other electronics but emphases on nano-technology and improved designs. To the extent that developing countries have acquired these capacities over time and supplied them along the value chain does not give them automatic niche in those markets. Readiness will have to re-boot from mass production in Industry 3.0 to customized production in Industry 4.0, from assembly to design combining IT and OT. Education, skills training, and incubation hubs need further enhancements to become part of the supply chain in the emerging technologies. At the services level many of these are vulnerable to threats of "re-shoring" as AI acquires intelligence and decision making capacities that workers (because of lower wage costs) perform though much will also depend on their eventual costs of maintenance and coordination.

As the services industries embrace all of the enabling technologies significant transformation ultimately takes place. Industries considered to be widely personal may become even more automated displacing substantial employment. Tourism and financial services for example may be robotized – think about tourist guides herding tourists through historic sites with programmed spiels associated with picture recognition. Financial services could be a candidate for a full-blown AI with accumulating machine learning. Hotel front desks could be handled by robots including baggage attendant deliveries and in-room services. At the national level value-added of these transformed services tend to remain significant but employment may suffer. International trade in these kinds of services would still be functions of resource conditions and comparative advantages, but reliance on them for employment will be subdued.

Regulation of these technology enablers or the products and services they create is perhaps one of the more vital challenges in the industry. In fact, technologies have been far ahead in evolution and development of an indispensable regulatory framework. In the absence of socially-based regulations,

technology companies define their own behavior presumably in favor of protecting their stock than of the larger public. Thus Uber considers itself a technology (Internet) company though it deploys transportation services; Air BnB is not in hotel or hospitality services; of course Facebook claims it is not a media company. Crucial regulation is far behind technology. But it is necessary once the technology-driven services enter the marketplace given the need to protect and provide safety to consumers. The European Court of Justice Declaration that Uber is a transportation (taxi) company and thus subject to regulations for the same transportation services is years behind after the technology-driven services had been deployed. Indeed, one author likens these to the evolution and deployment of the motor vehicle in the Wild, Wild West, without speed limits, traffic lights, driver's license, and vehicle inspection as part of the necessary regulatory regime (Avenoso 2017).

Evolving services industry driven by newer technologies usually draws domestic and foreign investments. Those in the technology enablers are not short of investments especially from venture capital. Indeed investors flock to these stocks with the expectation of windfall profits as enterprises make inroads into the markets. For example, TESLA, a 15-year auto company producing mainly electric vehicles with a stock price of USD 311 (12/29/2017), sold 84,000 vehicles in 2016. Ford Motor, a 115-year auto company with a stock price of USD 12.50 (12/29/2017), sold 6.65 million vehicles in the same year. In short, investments are not major constraints but the services produced or the technology for them. In fact it would depend if the services currently traded remain thus attracting additional investments. If adjustments to the services industries structural changes are appropriate investments follow.

Where adjustments take place in individual country readiness to these technology enablers and the ensuing industries, they suggest wide participation and involvement in their structural changes i.e. in the overall international value chain. Where each one fits, and which stage or tasks, is a function of existing and acquired capacities. Some of the legacy know-how may retain their relevance but in general new knowledge may be necessary in the formal and informal senses.

The international environment for the emerging services industry enabled by new technologies pose many challenges and may even enlarge the scope for regional and multilateral agenda including (a) consistent if not comparable regulatory frameworks, (b) further liberalization of trade in services to allow some complementary production bases, (c) strengthened Intellectual Property Rights (IPR) agreements to take into account creativity and innovations the region may develop as part of adjustments to emerging services, (d) regional legal technical assistance for disputes in emerging services industries, and (e) more punctual and quick updating of multilateral identification of emerging services through continuous revisions of the UN Central Product Classification code (CPC).

Most of these items immediately follow from either the technologies themselves as stand-alone products and services, or result from the applications of the identified technology enablers. But the international institutional setting, analogous to the problem of regulations, has to keep up with the pace of the emerging changes in the service industries. For example the ASEAN Framework Agreement on Services can embrace the newer technologies and AI-driven products and services plus the skills required under Mode 4. The previous packages agreed upon by the ASEAN Member States as integral to the ASEAN Economic Community (AEC) may have to be extended to include different configurations of services. On the other hand, as creativity and innovations gain prominence in the services industries, IPR registration and protection take on more prominence as well. But the ASEAN IPR Action Plan 2016-2025 is too narrowly focused e.g., on geographical indications products as long-term foundations for encouragement and support in a regional program. This evolving shape of services would have legal

ramifications for which a regional concerted technical assistance facilitates potential trade particularly as disputes may arise.

Apart from ASEAN, broader cooperation modalities such as the Regional Comprehensive Economic Partnership (RCEP) arrangements, the Asia-Pacific Economic Cooperation (APEC), and a proposed Indo-Pacific cooperation be collectively geared for changes in services driven by the identified enablers. Research and analyses of changes in the services industries across different economies that look beyond their technical nature and into economic and social implications would be constrained if data and metrics are not comparable. What this means is that statistical codes have to be constantly revised to account for new types of services in the same way that there have been revisions to the HS code for goods.

Concluding Words

Automation of manufacturing assembly line in Industry 3.0 and the extensive use of digital technology in Industry 4.0 do not mean humans would be replaced by machines or bots. The purpose of these technologies is to aid humans, not replace them; to foster a symbiotic relationship; to explore and control them. Indeed even while industry and services will see profound changes as a result of exploding technology enablers, there will be spin-offs into related industries and services that are yet to evolve requiring varying levels of education and skills. They range from developing algorithms to machine and AI coordination. And as growth takes place, significant shifts take place in terms of employment, value-added, and trade.

It is important to fully understand the ramifications of technology developments on services in order to acquire new advantages, lay the groundwork for adjusting to them, promote international understanding and cooperation, and ensure that the knowledge and creative capacities needed continue to be accessible in a globalized world.

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