Effects of Emerging Technologies on International Business

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Effects of Emerging Technologies on International Business

Various emergent technologies are increasing the efficiency and effectiveness of international business. In this chapter, we address key emerging technologies including big data, analytics, blockchain, 5G, the Internet of Things (IoT), artificial intelligence (AI), robotics, additive manufacturing (AM), and digital platforms and their impact on decoupling and reconfiguration of value chain activities (e.g., Yamin & Sinkovics, 2010). The current period of technological advancement is sometimes called the 'Fourth Industrial Revolution', or Industry 4.0. Organizations are employing Industry 4.0 technologies to maximize effectiveness and efficiency in their global activities.

History has been marked by key intersections between phases of technological development and globalization. In the 19th century, developments in water and steam power led to key advances in manufacturing and productivity. In the late 1800s and early 1900s, commercialization of electricity enabled the development of mass production. Rapid industrialization combined with advances in transportation and communications technologies coincided with the rise of international trade and investment. Since the 1980s, the rise of information technologies has supported massive growth in international business (Chase-Dunn, Kawano, & Brewer, 2000; Schwab, 2016).

Technologies are driving interconnectedness of the world economy and creating significant opportunities for firms based in developed and developing economies to disperse and restructure their value chain activities, and potentially organize production at global scale. Increasingly, digital technologies are the connective networks of the global economy. Cross-border data flows have increased dramatically, and are expected to experience further magnitudes of growth in the 2020s. By 2021, the Internet had penetrated about two-thirds of world population, a growth rate of more than 1,000 percent during the prior two decades. North America and Europe have led the way in Internet usage, with an average penetration rate of about 90 percent. Simultaneously, the largest gains in Internet adoption have occurred in the Middle East, Latin America, and Asia (Internet World Stats, 2021). The number of cellular subscriptions worldwide is now greater than the planet's population (Lund et al, 2019). Rapid expansion of communications and content along global digital pathways is reflected in large part by companies interacting with subsidiaries, suppliers, and customers. Low-cost and instant digital communications have greatly lowered the transaction costs historically associated with international trade.

In this chapter, we first provide theoretical background on technology and international business. We then summarize the key technologies that are driving changes in international business. Finally, we conclude by discussing the implications of such trends for organizational activities and operations around the world.

BACKGROUND

Theory on foreign direct investment (FDI) explains how multinational enterprises (MNEs) undertake value chain activities via production and management of networks around the world (e.g., Dunning, 1981). Historically, firms have internationalized production to profit from factor of production advantages available in other countries (Buckley, 2006). The eclectic paradigm and the monopolistic advantage perspective revealed how MNEs overcome the challenges of internationalization by acquiring ownership-specific and monopolistic advantages (Dunning, 1981; Hymer, 1976; Rugman, 1980). The integration-responsiveness framework stresses the tension between pressures to globalize and to respond to customers in local markets (Roth & Morrison, 1990). Firms develop specific capabilities to manage international production, sourcing, and related management challenges (Buckley, 2009b; Rugman, 1980), and to maximize competitive advantages in these areas (e.g., Tallman & Fladmoe-Lindquist, 2002; Teece, 2014). The "global factory" refers to the international industrial ecosystem in which production of goods and services is undertaken by producers both internal and external to individual firms (Buckley, 2009a, 2009b). Over time, a global ecosystem has emerged comprising suppliers, partners, distributors, and alliances. Partly responding to global competition, MNEs have "fine sliced" and distributed value-chain activities among distinct subsidiaries and affiliates in order to minimize costs at every stage of production (Buckley, 2009a, 2009b; Mudambi, 2008).

Various recent developments are reflected by the concept of 'disruptive technology' (Christensen, 1997) – the emergence of new technologies that foster industrial growth by creating new industries through the introduction of methods, products, and services that are substantially cheaper, better, or more convenient than those available previously (Kostoff, Boylan, & Simons, 2004). For example, the rise of information and communications technologies (ICTs), especially the Internet, triggered the emergence of new industries and redefined existing industries (Kostoff, et al., 2004). ICTs have facilitated development of new organizational forms that replaced more traditional organizational forms in the realm of the MNE (e.g., Buckley, 2009b). In this way, ICTs and successor technologies have contributed enormously to optimizing the management of complex and turbulent international environments.

The technology acceptance model (TAM; Davis, 1986, 1989) describes how technological, societal, and human-level factors – including ease-of-use and perceived usefulness – influence the acceptance of new technologies. Scholars have used the TAM to predict acceptance of the Internet (Singh, Fassott, Chao, & Hoffmann, 2006), information systems (Almutairi, 2007), software platforms (Venkatesh & Davis, 2000), and adoption of internet banking (cf. Lai & Li, 2005). The TAM is a useful framework when examining technology in the international context because such factors as knowledge, experience, and resources affect awareness on the utility and comfort of adopting and using advanced technologies (Davis, 1989; Rogers, 2003). Perceived utility of new technologies also has been linked to awareness of existing alternatives or lack thereof (Rogers, 2003). In numerous countries in Africa, for example, growing knowledge of and rising comfort with FIN-tech applications facilitated widespread adoption and use of banking services (Arner, Barberis, & Buckley, 2016). Adoption of the Internet was relatively slow in countries characterized by limited income and education levels (McCoy, Galletta, & King, 2007). In various way, the rise of new technologies will hold substantial implications for productive activities around the world.

THE EMERGING TECHNOLOGIES

In the following pages, we define and summarize, the nature of emergent technologies that are driving shifts in international business.

Big Data

‘Big data’ refers to very large and variable datasets that require highly sophisticated computer programming for efficient storage, manipulation, and analysis. The data can arise from various sources, including from social media and machines. For example, smartphones, sensors, point-of-sale terminals, and organizational databases are all potential sources. Data are generated at an ever-increasing pace – for example, Google receives several million queries every minute. The great majority of big data has little or no utility. A key challenge facing firms is to collect, process, and analyze data efficiently and effectively (Cai & Zhu, 2015; Chen, Chiang, & Storey, 2012). Another challenge is the availability of skilled workers who can process and utilize big data to create value. Most data-related skills are concentrated in developed economies (e.g., Tambe, 2014), which has far-reaching implications for developing economies where appropriate skills are in short supply.

Big data can be structured (typically numeric and easily formatted) or unstructured (relatively free-form and qualitative). The data can be used across the firm to learn, improve, and achieve various goals. For example, big data are used extensively in R&D, market research, sourcing, production, marketing, and customer support. The data typically are stored in databases and analyzed with software specifically designed to handle large, complex datasets. Data analysts examine relationships among different types of data, such as demographic data and purchase history, to identify actionable relationships and other intelligence (Chen, Chiang, & Storey, 2012; George, Osinga, Lavie, & Scott, 2016). The goal of big data typically is to increase efficiency and effectiveness of various organizational operations. Analysts may use descriptive statistics and applied mathematical tools to measure phenomena, detect trends, and forecast future events (e.g., Sheng, Amankwah-Amoah, Khan, & Wang, 2020). The data can be used to infer new guidance and practical findings arising from revealed relationships and dependencies, or to perform predictions of outcomes and behaviors. Organizations can leverage big data analytics to enhance their performance and develop sustainable competitive advantage (Gupta & George, 2014; Sheng et al., 2020).

Analytics

Analytics refers to systematic, computational analysis of data and statistics. While technologies and methods for analyzing data have improved greatly, today most companies lag behind in this area, and are capturing only a small portion of the enormous value available from skillful data analysis (Mulligan, Northcote, Order, & Vesuvala, 2021). Analytics have grown in importance due to abundant data, the ability to tap value by integrating data from multiple sources, ongoing needs for more sophisticated decision-making, as well as limitations on decision-making associated with bounded rationality and other human constraints (Chen, Chiang, & Storey, 2012; Gupta & George, 2016).

Sophisticated analytics has the potential to disrupt industries by providing radically new insights and models. For example, digital platform firms can use analytics to match buyers and sellers in real time. Skillfully managed data can personalize products and services. New analytical techniques can fuel innovative products, services, and processes. Data and analytics enable faster and more accurate decision-making. Enormous advances stand to be gained in the areas of manufacturing, retail, and government, in addition to a wide range of industries such as healthcare and finance. Smart analytics can contribute enormously to the efficiency digital platform businesses, such as ride- and car-sharing, which account for a fast-growing proportion of total vehicle usage. Matching car users and owners is greatly enhanced through smart analytics (Chen, Chiang, & Storey, 2012; Gupta & George, 2016).

However, various barriers impede progress in capturing value from data and analytics. These include limited availability of appropriate technology, the presence of intra-corporate silos that inhibit data sharing, skeptical or unenlightened corporate leadership, and perhaps most importantly, the lack of is the lack of talent – data scientists and other data managers equipped to perform research, analysis, and management tasks are in short supply. Machine learning is an outgrowth of smart analytics and is associated with various capabilities that can greatly expand the volume, scope, and applications for automation. Such advances can greatly increased productivity in manufacturing processes worldwide (Chen, Chiang, & Storey, 2012; Gupta & George, 2016; Mulligan et al, 2021).

Blockchain

Blockchain is a type of decentralized digital ledger, a way of recording transactions in which records are spread across various widely distributed authorities. Each authority operates independently, while copying and saving each change to the ledger identically. “Blocks” are the records of transactions that blockchain compiles and are secured cryptographically, with each containing a digital fingerprint of past and present records. When a given block is completed, it is added to the previous block, resulting in a chain of blocks. Blockchain transactions exist simultaneously in widely distributed databases that store the data and execute the transactions. Security of the data and recordkeeping is optimized – hacking, fraud, data loss, and other types of failure are effectively eliminated because the entire system is decentralized and verified through broad-based consensus (Dinh, Liu, Zhang, Chen, Ooi, & Wang, 2018; Loop, 2017; Yli-Huumo, Ko, Choi, Park, & Smolander, 2016). All blocks are recorded digitally, removing the need for reconciliation or paper trails, resulting in greater efficiency, cost savings, and more accurate record-keeping. It eliminates the traditional need for input – identification, authentication, record-keeping, clearing, and settling – from accountants, auditors, banks, lawyers, government entities, legal authorities, and other intermediaries. In total, blockchain constitutes a decentralized, consensus-based, continuously-appended, immutable, and fully secure digital ledger (Dinh et al, 2018; Loop, 2017; Yli-Huumo et al, 2016).

Blockchain enables the use of “smart contracts”, which establish conditions necessary to complete a transaction. When the conditions are met, the contract is executed automatically and is time-stamped on the blockchain. Eliminating intermediaries results in great savings of time, energy, and cost. Blockchain holds great potential to revolutionize international contracting, transactions, accounting, supply chain management, and financial services. By maximizing trust, traceability and security by eliminating potentially harmful intermediary manipulation, blockchain is well suited to international transactions (Dinh et al, 2017; Loop, 2017; Yli-Huumo et al, 2016).

Currently, various functional areas of global commerce – including banking, finance, supply chain, marketing and sales, distribution, and legal – are gradually adopting blockchain and all the potential it holds. Healthcare providers are recording medical data on blockchain to optimize patient care. International remittances can be realized much faster, cheaper, and safer. In international retailing, the removal of third parties between buyers and sellers result in cost- and time-savings and increased security. The transparency that blockchain provides to global supply chains provides for more accurate forecasting, thus optimizing inventory and reducing holding costs. Blockchain provides near real-time data from global supply chains, which enhances service, creates value, and cuts costs. Blockchain can reduce counterfeit goods trade by increasing the transparency, authenticity, and traceability of transactions (Dinh et al, 2017; Loop, 2017; Yli-Huumo et al, 2016).

5G

The fifth generation of wireless technology (5G) refers to the next phase of broadband cellular networks for smartphones and other devices that use mobile technology. Cellular telephone companies began launching 5G technology in 2019, with adoption by about two billion people by the mid-2020s (Barakabitze, Ahmad, Mijumbi, & Hines, 2020;; Shafique, Khawaja, Sabir, Qazi, & Mustaqim, 2020). The technology holds important implications for IoT, through its connectivity to the Internet. When combined with IoT, 5G is greatly increasing the speed and efficiency of smart devices and equipment, such as home appliances, security systems, and infrastructure in energy and transportation. The 5G technology is propelling usage of the Internet and Internet-dependent systems such as intranets, extranets, social media, and email to unprecedented levels of speed. More than 20 billion ‘things’ are expected to join the IoT in the 2020s, thanks in largest part to 5G technology. In the current decade, 5G bandwidth is expected to become 100 to 1,000 times greater than 4G technology, transmitting data at 10 to potentially 1,000 gigabytes per second. Such developments are revolutionizing technology worldwide. Essentially, all industries and sectors that currently benefit from cellular technology and IoT will experience an enormous boost in operational efficiency and effectiveness (Barakabitze, Ahmad, Mijumbi, & Hines, 2020; Shafique, Khawaja, Sabir, Qazi, & Mustaqim, 2020). Simultaneously, 5G is increasing access to the global marketplace by residents of developing economies and by SMEs and other firms that historically lacked sufficient resources to do substantial international business.

Internet of Things (IoT)

IoT refers connecting machines and devices to each other online. It reflects the global network of smartphones, tablets, and industrial devices that assemble and share information electronically, and access the Internet. Multiple trends have converged to support progress in IoT, including advances in analytics, machine learning, computing, and sensors. Recent explosive growth of devices that connect to the Internet has been a huge, facilitating trend. Worldwide, mobile telephony and app development are growing enormously (Boston Consulting Group, 2015; Sanou, 2018; Shafique et al, 2020). IoT has applications for consumers, including home automation, wearable technology, and appliances with remoting monitoring capabilities. For example, IoT is a major growing factor in healthcare, where it is used to monitor health conditions, provide emergency notifications, and assist the elderly or those with disabilities. IoT technology supports manufacturing by connecting various devices equipped with sensing, processing, communications, and networking capabilities. IoT is facilitating rapid development, manufacturing, and optimization of new products and services. The technology has applications in infrastructure related to communications, transportation, and energy (Boston Consulting Group, 2015; Li, Xu, & Zhao, 2018; Shafique et al, 2020).

The number of smartphone users now exceeds 50 percent of world population, a dramatic rise in the past decade. The number of connected devices per person has increased from nearly none in the early 2000s to a half-dozen by 2020 (Sanou, 2018; Shafique et al, 2020). Consumers and managers alike connect to a wide range of apps and information sources. Mobile telephones are especially transformative in developing economies, where many people access the Internet by phone. The number of smartphone users is more than four billion, and growing. Some 90 percent of people worldwide now live in range of cellular networks. Many countries, including numerous emerging markets, have made key investments in Internet technology. These include Belgium, Singapore, South Korea, and Sweden, as well as China, Qatar, Romania, and Thailand (Boston Consulting Group, 2015; Li, Xu, & Zhao, 2018; Sanou, 2018).

Artificial Intelligence (AI)

AI facilitates the simulation of human intelligence so that machinery and equipment operate and function much like humans, including the ability to learn and solve problems, all aimed at taking needed actions and achieving specific goals. A higher level of AI involves ‘machine learning’, which refers to computer programs that automatically learn from and take action on new data, without human assistance. AI and machine learning have grown in sophistication due to advances in storage systems, processing speeds, problem analysis, and decision-making. AI functionality ranges from performing simple activities that are single-task oriented to complex activities that entail multiple, complex tasks. Firms may develop algorithms within AI programs that can complete a wide range of tasks (Finlay, 2018; McKinsey & Company. 2020; Morikawa, 2017).

Examples of machines that employ AI include computers that manage supply chains, organize various tasks in a manufacturing process, and undertake complex decision-making in areas like finance, healthcare, and management. AI can substitute for humans in the performance of many functions all along the value chain, along the range of R&D, market research, procurement, manufacturing, marketing and customer interaction, distribution, and technical support. In various ways, AI can support company value chain activities in operations worldwide, particularly in situations where human labor is scarce, costly, or not sufficiently able to undertake needed tasks. When combined with big data, AI provides the means to rationalize operations and analyze consumer characteristics and trends (Finlay, 2018; McKinsey & Company. 2020).

Robotics

Closely related to AI is robotics, which reflects the design, creation, and use of machines to perform tasks historically done by humans. Robots are widely used in industry to perform repetitive or hazardous tasks. Robotics is increasingly integrated with AI. Many robots incorporate human-like senses, including vision, touch, and the ability to sense temperature, and many can undertake simple decision-making. The most sophisticated robots assimilate data and respond to new information so that they improve their operations continuously (International Federation of Robotics, 2018; Smids, Nyholm, & Berkers, 2019). Top areas that are benefiting from robotics include healthcare, defense, public safety, mining, and automotive, as well as various other manufacturing industries. South Korea, Singapore, Germany, Japan, Sweden, and the United States are leading the way in the installation of robots to perform manufacturing and other productive activities (International Federation of Robotics, 2018; Zinser, Rose, & Sirkin, 2015).

New-generation robots collaborate with humans to perform nonroutine and cognitive tasks. The potential application and use of robots is broadening, and managers increasingly will work with robots. Robots generate substantial cost savings, increased efficiency, superior outcomes, and productivity in regions or fields characterized by insufficient workers (Autor, 2015). Robots can work without interruption, including 24 hours per day if need. They do not require lighting, heating, or other ambient conditions needed for humans, which reduces energy usage. Robots perform highly precise and repeatable movements, which improves quality and reduces the need to correct errors. Many firms install robots to perform tasks that otherwise would be outsourced to countries with lower labor costs (International Federation of Robotics, 2018; Morikawa, 2017; Zinser, Rose, & Sirkin, 2015). This tendency facilitates the ability to maintain manufacturing in developed economies like Europe, Japan, and North America with higher labor costs, and helps companies remain sustainable and competitive (Zinser, Rose, & Sirkin, 2015). Robots tend to replace lower-skills workers, but create jobs for managers and higher-skills workers. Robots enhance competitive advantages for large companies and SMEs alike (Autor, 2015; BBC, 2018).

Additive Manufacturing (AM)

AM, more commonly called ‘3D printing’, refers to the use of digital designs in a printer in which liquid or powdered raw material is deposited in thin layers and fused together to create physical objects (Hannibal & Knight, 2018). Manufacturing via AM is relatively slow compared to traditional mass production, but in other ways, the technology provides numerous advantages. For instance, firms can decouple their downstream activities from upstream activities, thus leading to cost savings and better coordination of activities across value chains. AM is expected to increase mass customization and affect the structure of manufacturing around the world, with growing ability to produce goods more locally, as well as enabling firms to vertically organize their value chain activities (Ben-Ner & Siemsen, 2017; Berman, 2012; D'Aveni, 2013). With growing availability of appropriate materials, AM now has application in nearly every industry that produces or benefits from physical products.

AM is facilitating the localization of production (Hannibal & Knight, 2018; Laplume, Petersen, & Pearce, 2016). For example, by using household 3D printers, individuals could produce their own basic home appliances and other tools, spare parts for household needs, certain types of apparel, or other products characterized by relatively high transportation costs, time sensitivity, and demand. City- or region-based print facilities could supply larger and more complex items, replacing the need to import such goods from abroad (D'Aveni, 2013; Hannibal & Knight, 2018).

The aggregate effect of AM likely will be to increase the efficiency or effectiveness of goods production, by producing goods more effectively and in a more customized or desirable form, using a more efficient supply chain of design, raw materials, and final production (Laplume, Petersen, & Pearce, 2016). The full potential of AM can be realized by combining it with other industry 4.0 technologies. Widespread adoption of AM likely will provide substantial economic and competitive advantages in a wide ranges of fields (Hannibal & Knight, 2018).

Digital Platforms

Digital platforms refer to app- or software-based online infrastructure that enables transactions among users. Some digital platforms help users manage and navigate large amounts of information (e.g., Google, Yahoo, LinkedIn). Other platforms function as ‘matchmakers’, facilitating transactions among users (e.g., Amazon, Alibaba, Yandex) (Matzler, Veider, & Kathan, 2015; Sutherland & Jarrahi, 2018).

Emerging technologies have played an important role in the development of the platform economy. Advancements in digital technologies facilitate the connection of sellers and buyers via multi-sided platforms that are spread across the globe (Matzler, Veider, & Kathan, 2015; McKinsey Global Institute, 2016). Many digital platforms combine various features, such as when social media enable both information search and matchmaking between users. Digital platforms can be relatively decentralized, and not tied to any particular country (Sutherland & Jarrahi, 2018). The effect of digital technologies on business has been revolutionary. The cost of computer and digital processing has fallen by more than 30 percent annually in recent decades and continues to fall (McKinsey Global Institute, 2016). Digital platforms facilitate multisided markets and generate direct and indirect network economies by connecting diverse actors to central platforms (Evans & Gawer, 2016; Evans & Schmalensee, 2016; Zeng, Khan, & Silva, 2019). Digital platforms have created a winner-take-all phenomenon (Galbraith, 1995), where a platform with a large number of participants tip the market in its favor (Eisenmann, Parker, & Van Alstyne, 2006). Digital platforms also perform regulatory functions by setting entry rules and transaction mechanisms for network members (e.g., Boudreau & Hagiu, 2009).

Digital platforms create competitive advantages by giving companies new ways to outperform rivals (Sutherland & Jarrahi, 2018). The platforms provide disproportionate benefits to smaller firms, allowing them to market their products and services across the world (cf. Zeng, Tavalaei, & Khan, 2021). Internally-used digital platforms enable firms to interact with foreign partners and value-chain members efficiently and effectively, giving rise to important productivity gains. Digital flows of information and commerce are connecting the world in unprecedented ways. The platforms and related applications facilitate international buying and selling of goods and services (Evans & Gawer, 2016). For example, sharing-economy firms such as Uber and Airbnb use specialized apps and the Internet to facilitate the joint creation of value and services between asset owners and asset users. Worldwide, Uber allows people who need temporary transportation to hire drivers and vehicles owned by others. Airbnb allows travelers to rent other people's homes. Such sharing economy platforms allow a large number of complementors to participate and create value within the ecosystem, and are emerging on a global scale as a new form of organization (Matzler, Veider, & Kathan, 2015; McKinsey Global Institute, 2016). By providing complementary products and services, the complementors are essentially shifting the innovation and production processes outside the firm's boundaries to the level of network partners. A vast amount of data is also created and shared on buyers and sellers connected through platforms, which enable firms to drive significant value by leveraging big data (Eisenmann, Geoffrey, & Van Alstyne, 2011; Evans & Gawer, 2016; Zeng et al., 2021).

DISCUSSION AND IMPLICATIONS

In various ways, the technologies examined in this chapter hold important implications for both theory and practice.

Theoretical Implications

Emergent technologies will enhance the broader performance of MNEs. They are improving coordination and knowledge-sharing across network partners, and reducing traditional costs and barriers associated with manufacturing, distribution, logistics, and other such activities. Emergent technologies will substantially affect value chain activities of MNEs. For instance, analytics, blockchain, 5G, IoT, AI, robotics, and digital platforms will increase productivity and the efficiency of manufacturing. In various ways, the technologies can reduce the benefits long associated with locating productive activities in countries that feature lower labor costs, superior productivity, and other advantages. Efficiencies and falling production costs will justify locating manufacturing in more developed economies. For example, the use of robots has reduced the costs of manufacturing and invigorated industrial production in Germany and Japan (e.g., Ranasinghe, 2015; Zinser, Rose, & Sirkin, 2015). AM is shifting the nature and pattern of production in almost every industry (Ben-Ner & Siemsen, 2017; Hannibal & Knight, 2018).

In these and other ways, current technological trends hold implications for traditional views on the global production ecosystem. Shifts underway may necessitate enhancements to extant views on the ‘global factory’ (e.g., Buckley, 2009b) and related explanations on international production (e.g., Dunning, 1981). Firms that embrace emergent technologies are obtaining increased monopolistic and firm-specific advantages, while simultaneously, some traditional location-specific advantages are declining (cf. Buckley, 2006; Dunning, 1981; Hymer). MNEs that embrace the new technologies will need to acquire specific capabilities that facilitate performance-enhancing management of production, sourcing, and related activities.

In various ways, recent developments highlight the emergence of ‘disruptive technologies’ (Christensen, 1997) – technical advances that promote industrial growth through the introduction of methods, products, and services that are cheaper, better, or more expedient than those available previously (Kostoff, Boylan, & Simons, 2004). For example, the rise of digital platforms is triggering the emergence of new industries and redefining existing industries. Amazon, Spotify, and similar firms reflect the rise of new business models that are challenging the extant paradigm in retailing.

Emergence of revolutionary technologies can be examined within the technology acceptance model (TAM; Davis, 1986, 1989), which explains how nation-level technological sophistication, as well as societal and human-level factors, affect the acceptance of new technologies. Available knowledge, experience, and resources in individual countries will affect the capacity to adopt and exploit new era technologies (Davis, 1989; Rogers, 2003). While developed economies are likely to perform well in new technology acceptance, developing economies may experience lower average levels of connectedness and technological development, and also lack critical skills in creating value through emerging technologies. In the public policy realm, action will be needed to reduce the ‘digital divide’, to help developing economies adopt and utilize the latest technologies. Alongside the usual advantages that technology brings, countries that adopt leading technologies will be better positioned to integrate more efficiently into international flows of information and trade.

Practical Implications

In large part due to emergent technologies described in this chapter, the nature of international business, country-based business models, and indeed national borders themselves are evolving rapidly. The cost of transmitting and handling data and information globally has fallen to essentially zero. Companies now enjoy much greater ability to interact, collaborate, obtain, and utilize information worldwide than ever before. Technologies are facilitating the codification and sharing of knowledge on a global scale. Companies are profiting from substantially lower costs of international interactions and transactions. Digital tools are improving the effectiveness of value chains worldwide. Technologies are reducing costs of logistics and transportation. The Internet facilitates the ability to find new opportunities worldwide, and e-commerce is driving global buying and selling.

New technologies are increasing the productivity of local manufacturing. This tendency reduces firms' cost of domestic operations and increases the attractiveness of homegrown, local manufacturing (UNCTAD, 2019). Technological breakthroughs in IoT, artificial intelligence, robotics, and AM are blurring the lines between the physical and digital spheres. Novel technologies signal a new era in global production because they portend the digitalization of many physical goods. AM technology is altering the pattern of global production. Thanks to AM and technologies that facilitate automation, much manufacturing is "de-globalizing" and shifting away from China, Mexico, Eastern Europe, and other historically popular locations characterized by low-cost labor. Digital distribution and increasingly localized manufacturing of physical goods are bringing production closer to the end-user. AM technology is likely to engender smaller-scale production organized at the level of individual countries, municipalities, and even individual households. The rise of AM will push firms to rethink planning and strategy on the configuration and coordination of value chains (Hannibal & Knight, 2018; Strange & Zucchella, 2017), and necessitate novel thinking and new business models on the development, organization, and management of company value chains. Such shifts likely will engender a revolution in production and consumption, perhaps similar to transformations that ensued from the industrial revolution.

Digital technologies are boosting the efficiency and growth of international trade in services, which is growing faster than that of trade in merchandise. Blockchain, 5G, IoT, and digital platforms have been especially instrumental in this trend. For example, 5G wireless networks are accelerating the delivery of services as well as the repair and maintenance of machinery from remote locations. One interesting outcome is the free movement, at zero cost, of various digital services, such as email and social media. Wikipedia is a widely-used information source worldwide and provides such services for free. Every day, worldwide millions of consumers access songs and playlists on Spotify. Facebook provides free services to billions of users. Historically, most services had to be delivered in person by local suppliers. That trend is shifting where various services – including insurance, banking and finance, media, and professional services – are now provided globally on a massive scale. India and several other countries provide medical transcription, healthcare, technical support, accounting, engineering, and various back office services via the Internet. Digital platforms and 5G are playing a key role.

The intersection of digital technologies with international business is shifting the structure of global trade. From Africa to Asia to Latin America, as people become digitally connected, they consume more international services. Retailing has been revolutionized by giant digital platform firms that sell their offerings worldwide through online sites and drive enormous value through direct and indirect network effects. Retailing is increasingly dominated by digital platform companies. The national origin of major players – Alibaba, Amazon, eBay, Jingdong, Rakuten, and Suning – holds less relevance today than that of earlier, large brick-and-mortar retailers.

New technologies are also affecting logistics and transportation. For example, IoT increases the efficiency of goods delivery through advance shipment tracking and inventory management. AI improves transportation efficiency by optimizing trucking, rail, and even ocean shipments. Automated document processing accelerates the passage of goods through customs. Blockchain is reducing transit times and accelerating international payments. Relatedly, robotics, AM, IoT, AI, blockchain, and digital platforms are reducing barriers of complexity and distance in supply chains worldwide. The collective effect of various technologies on logistics and transportation could increase overall merchandise trade in the coming decade.

Some technologies – especially big data, analytics, and blockchain – are facilitating greater transparency in value chain activities. For example, companies like RiskWatch International and Red Canary leverage such technologies to provide services to analyze and alert firms about emergent or potential risks in supply chains, distribution channels, and other value-chain functions. Blockchain can resolve challenges facing firms that engage in exporting related to information asymmetry between buyers and suppliers. Information asymmetries present in typical international buyer-seller transactions increase risk and arise in the areas of payment, accounting, and logistics, among others. Buyers and sellers typically reside in different legal jurisdictions, which complicates the resolution contractual conflicts. Blockchain can address such issues by reducing information asymmetries while eliminating redundant intermediaries in the exporting process.

Other technologies, such as AI, robotics, and AM, are lowering the cost of manufacturing in ways that are shifting the locus and pattern of global production. Such technologies make manufacturing in developed economies like Japan, Europe, and North America viable again. For example, by allowing many goods to be produced on site, additive manufacturing is reducing the need to import various products. Various goods, such as music and books, that were formerly produced in physical form, can now be streamed around the world using digital platforms. As automation and additive manufacturing reduce the costs of local production, manufacturing increasingly will be relocated near key consumer markets worldwide. Such technologies are likely to shift the location of manufacturing for some goods, and eliminate the need to manufacture others.

Many digital platform firms operate in highly dynamic industries that are undergoing massive change and technological disruption. Such firms gain substantial value through their base of users and complementors, and are expanding operations across multiple industries and geographies (Eisenmann et al., 2011). These firms are changing the dynamics of competition and value creation – they are shifting the rules of the game. Such trends represent a new era in international business in which commerce is conducted on a global scale with lower cost and better coordination, while leveraging the assets and capabilities of complementors and other participants. Much can be learned from the global operations of digital platforms and their mechanisms for value capture and creation.

A key challenge relates to how firms will respond to all the emergent changes. Technological advances are occurring faster than firms can comprehend, manage, or profit from. Organizations that adopt and master the latest technology gain competitive advantages over rivals – firms need to develop and implement planning aimed at maximizing their uptake and utilization of the most relevant technologies.

Most of the technologies highlighted in this chapter relate to the management and use of information. Big data, smart analytics, blockchain, IoT, AI, and digital platforms all refer to the management and leveraging of information and knowledge. Firms need to incorporate analytics and data-driven insights into their day-to-day processes and activities. All along the value chain – R&D, product design, supply chain, manufacturing, marketing and sales, distribution, finance, and general decision-making – enormous gains can be won from developing advanced analytical capabilities. Skillful management of information translates into various competitive advantages arising from enhanced innovation, market targeting, capacity to customize products and services, added-value of offerings, supply chain management, and productivity, as well as increased transparency of governance and operations. Superior capabilities in the latest technologies foretell countless opportunities to market products and services around the world, targeting consumers, firms, and governments.

Implementing Strategy

Initially, implementing appropriate strategy for embracing and exploiting the new technologies requires strategic vision. Senior management must take steps to create a digital culture across the organization, through such initiatives as investing in the latest technologies, recruiting digital talent, and embedding Industry 4.0 in organizational processes. The most successful firms will possess an action orientation and technological competency. They will co-opt solutions with partners and customers.

The path forward will come with challenges. Various factors will impede the adoption of key technologies on a global scale. Initially, infrastructure and capabilities vary substantially by country. For example, lack of skills impedes Internet access, especially in developing economies. Few countries possess a substantial cadre of workers skilled in smart analytics. Experience, knowledge, and other human factors affect acceptance and facility with new technologies. MNEs may struggle to implant the latest systems in countries characterized by inadequate skills and lower technological development.

Many technologies are tinged with controversy. Adopting the latest systems will provoke resistance. In manufacturing and other productive activities, automation, robotics, and AI are associated with job loss. For example, McDonald’s is installing digital kiosks to take food orders, leading to job loss in the restaurant industry. The auto industry has embraced robots to perform many productive tasks. Just as occurred in earlier technological revolutions, there will be significant shifts in the nature and location of jobs. In most cases, however, the adoption of automation, AI, robotics, and related technologies mainly affect lower-skill jobs and less-educated workers. Historical experience reveals that such technologies will not make humans redundant. Earlier industrial revolutions were disruptive too, but resulted in countless new, higher-quality jobs. Consistent with the ‘creative destruction’ view (Schumpeter, 1975), new industries will be created, leading to new and better jobs. For example, invention of the automobile eliminated the carriage industry; the rise of personal computers wiped out the typewriter industry; video streaming technology terminated the DVD player, which itself had eliminated the VCR.

Education holds perhaps the greatest potential to provide a path forward. Many schools are developing new curricula to educate the workers of tomorrow. The jobs least vulnerable to automation and digitalization include creative or technical positions, or jobs that require interpersonal skills and emotional intelligence. Education, especially in key fields, can insulate workers from threat of job loss.

In terms of manufacturing strategy, managers may need to re-evaluate and revise established models of international production. De-globalization of production arising from AM and increased automation, for example, suggests how much production can be re-located to more developed economies characterized by higher, human-based productions costs. Firms are achieving better control over supply chains. Labor productivity is rising. In some ways, the technologies are making developed economies (characterized by relatively costly labor) viable again as production platforms. The technologies are also helping to mitigate rising average age and demographic trends in which the proportion of productive workers in some countries is falling.

Firms need to leverage the new technologies to enhance innovativeness and innovation capabilities. Managers need to make key technologies central to organizational architecture, strategy development, and processes. AI, robotics, and IoT in particular serve to improve the efficiency of processes and routine activities, and help make firms become more agile and flexible. Management needs to leverage the new technologies to increase the benefits of the firm's offerings and enhance the organizational value proposition. Firms need to be proactive and entrepreneurial to embrace Industry 4.0 and manage rapid technological change.

The rise of new technologies heralds a new, exciting era in strategy and management related to global value chains. Identifying, understanding, and seizing the opportunities associated with such shifts will be key to organizational performance, especially among MNEs. Managers need to undertake planning and develop appropriate strategies to leverage revolutionary technological developments. Skillful adoption and use of the latest technologies, alongside associated firm-level innovations, should provide important competitive advantages. Advanced preparation is needed by conducting appropriate research to decide which technologies to adopt, and how best to integrate them in company operations. Technology acquisition is beneficial when the firm invests through its value chain to improve various organizational activities.

Conclusion

Technological advances are increasing the pace of globalization. International trade has become more efficient. Emergent technologies can reduce country risk by increasing transparency, access to information, and the ability to coordinate, control, and monitor global operations. The technologies are reducing the transactions costs of international business and making internationalization easier for all firms. Companies are enjoying greater control and flexibility of international operations by connecting with the digital ecosystem. Emergent technologies and the rapid pace of change are disrupting business models. Innovation is transforming lifestyles, organizations, and nature of competition. The rise of the connected ecosystem presents enormous new opportunities. The implications of the new technologies are as significant as the invention of electricity or development of the modern containerized shipping. In both cases, globalization and international business experienced major structural shifts, leading to the emergence of huge opportunities that propelled early adopters to leadership positions in their respective fields. Such major technological can shift the trajectory of the world economy, by driving new business models and positive societal evolution.

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