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KEY POINTS

- The range of applications of big data holds immense promise for optimizing public health, social protection, and education services and expediting countries' post-pandemic recovery.
- There is an opportunity for the health care sector to leverage big data from social media and smartphone applications to support policies related to prevention, detection, and treatment of diseases and the rollout of vaccines.
- In social protection, alternative data sources, such as satellite images and mobile phone data, provide granular estimates to better capture the prevalence of poverty. Big data can also be used to improve the effectiveness of social welfare programs.
- In education, the accelerated adoption of online learning solutions has generated insights for education policies.
- Digitizing public sector data and accessing big data is growing and advancement in technologies could facilitate wider application. However, governments need to lay the strategic and technical groundwork to maximize the opportunities of big data and mitigate its risks including protection for data privacy, fraud, and cyber-security.

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Harnessing the Potential of Big Data in Post-Pandemic Southeast Asia

INTRODUCTION

Everyday and everywhere, vast quantities of data from a wide range of sources are being generated at an exponential pace. The increasing use and rapid advancement of digital technology has created a data explosion that can be harnessed to transform critical public sector functions.

Although the potential of big data has long been recognized, the coronavirus disease (COVID-19) pandemic has brought it to the fore. Public institutions have turned to big data because of its analytical power to turn voluminous datasets into actionable insights that can help them respond swiftly to crises, improve their services, and enhance resilience to future shocks.

BIG DATA AND BIG DATA ANALYTICS

"Big data" refers to large datasets that are typically beyond the capability of standard database software to manage and analyze. Other inherent characteristics of big data are the wide range of structured and unstructured data or the combination of both.

"Big data analytics" refers to the process of collecting, organizing, and analyzing large amounts of raw data (big data) to discover trends and patterns that can help make data-informed decisions. The collection and storage of big data have been facilitated by cloud computing, which allows larger storage capacity, faster computing power, and flexible scaling of resources without the need for on-premises hardware. The process of analyzing big data requires new data analysis methods such as data mining, predictive analytics, and deep learning (McKinsey Global Institute 2011). This is enabled by tools and technologies, some of which are open-source and can be leveraged for cost-effective rollouts of big data applications.

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The use of big data requires attention to privacy and security issues. Data privacy is concerned with the use and governance of individual data while security is on protecting data from potential risk of data privacy infringements and unethical usage. The large amounts of data generated by the private and government entities may come at a price, the users' privacy could be violated. While the potential of big data is huge, its applications need to conform to privacy agreements and regulations (Jain, Gyanchandani, and Khare 2016).

DIGITAL ECONOMY TRENDS

While COVID-19 has served as a catalyst for scaling up technological adoption, the upward trajectory of the digital economy was already apparent before the pandemic. In Southeast Asia, the size of the internet economy reached $100 billion in 2019 (Bain & Company 2020). The role of digitalization has gained more prominence amid COVID-19, as evidenced by the surge of e-commerce and deployment of technological solutions by governments for their crisis response measures.

The boost in digitalization puts the spotlight on big data as a valuable resource for public sector management. An evidence-based approach to policymaking is not new, but there is significant value in making use of data effectively at scale, especially in light of COVID-19. Big data can deliver efficiency gains to public institutions, facilitate timely decision-making, accelerate development outcomes, and foster resilience to weather future disruptions.

There are many ways that the application of big data could be instrumental in driving the post-pandemic recovery of countries in the region. In the health sector, the adoption of remote monitoring systems could bring Southeast Asian countries annual cost savings of $9.4 billion by 2030 through reduced hospital visits, shorter patient stays, and more tailored medical procedures. In addition, the use of analytics to direct highly targeted health interventions for at-risk populations could increase gross domestic product by $15.5 billion annually. In the education sector, personalized learning, and online job matching using digital technologies could contribute $77.1 billion annually by 2030.

LEVERAGING BIG DATA FOR PUBLIC SERVICE DELIVERY

Health

The COVID-19 pandemic has prompted a substantial increase in health sector spending and reinforced the importance of health care for many aspects of development (Figure 1). To strengthen the quality and efficiency of health services and optimize costs, big data can be applied in key areas such as strengthening surveillance systems for infectious diseases, preventing and detecting noncommunicable diseases, improving health system capacities, and supporting vaccination programs.

Because the pandemic has underscored the importance of infectious disease control and prevention, governments need to consider the scope for big data analytics in monitoring the health condition of populations and detecting the emergence of epidemics. Examples include the use of data from smartphone-connected thermometers and social media for real-time tracking of influenza activity and the application of mobile phone data in outbreak response such as contact tracing and identifying infection hot spots. Similarly, development of predictive models based on data from social media and search engines can identify risks of developing noncommunicable diseases, thereby informing early interventions for prevention.

In the area of treatment, remote patient monitoring holds promise in addressing health capacity constraints. The use of devices to monitor health conditions generates data instantaneously to provide the status of a patient, boosts health workers' productivity, and minimizes hospital visits.

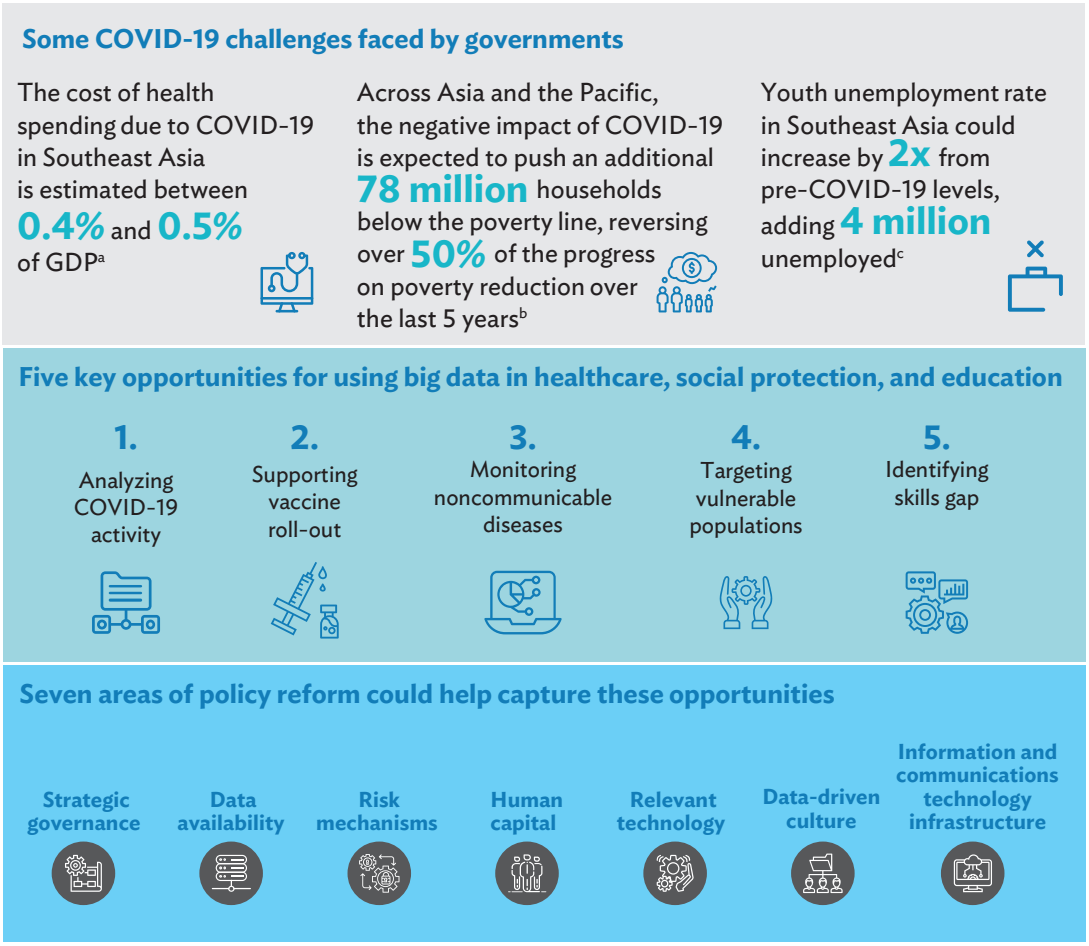
Finally, big data solutions can support countries' vaccine distribution efforts. For instance, big data can help ensure that vaccines are stored within a precise temperature range, preserving their quality along the distribution chain. Machine learning can produce analyses of populations with health vulnerabilities that can be used to prioritize vaccine delivery. In addition, the large amounts of information that can be drawn from social media channels can be analyzed to gauge public sentiment on immunization and shape communication strategies to address vaccine concerns and overcome hesitancy.

Social Protection

COVID-19 has accentuated the weaknesses of social protection programs in various countries that could be linked to failures to address critical gaps in delivery systems, data management, and targeting mechanisms. The pandemic has highlighted the need for cost-effective data collection approaches and innovative datasets that can support poverty reduction efforts.

Big data solutions can derive insights from various data sources to provide more granular poverty estimates. For example, complementing traditional analytical approaches with machine learning from satellite imagery has proved useful in mapping poverty levels in the Philippines and Thailand (Figure 2). In the context of COVID-19, poverty maps from satellite data have supported food programs in the Philippines by identifying and targeting vulnerable households (ADB 2020). In addition, cell phone usage data has generated insights into migration patterns in Indonesia and provided a sound basis for disaster response and recovery efforts in Mexico by pinpointing affected communities (UN Global Pulse 2014).

Figure 1: Potential Areas for Big Data in Southeast Asia



[a] Asian Development Bank (ADB). 2020. *An Updated Assessment of the Economic Impact of COVID-19*. Manila.

[b] ADB. 2020. *Asian Development Outlook 2020 Update: Wellness in Worrying Times*. Manila; ADB. 2020. *Key Indicators for Asia and the Pacific 2020*. 51st ed. Manila.

[c] ADB and International Labour Organization. 2020. *Tackling the COVID-19 youth employment crisis in Asia and the Pacific*. Manila/Bangkok.

Social welfare programs can also benefit from big data to assess their effectiveness and improve their design. In particular, governments can analyze records of past beneficiaries and the results of the interventions and use these insights to develop tailored programs. Moreover, big data analytics can serve as a vital tool to improve transparency and reduce the risks of errors and fraud in identifying beneficiaries. This can be achieved by using algorithms to analyze a large set of data from a variety of sources to detect inconsistencies. Big data can also be used to integrate various social protection databases and systems to ensure more effective targeting of beneficiaries by the government.

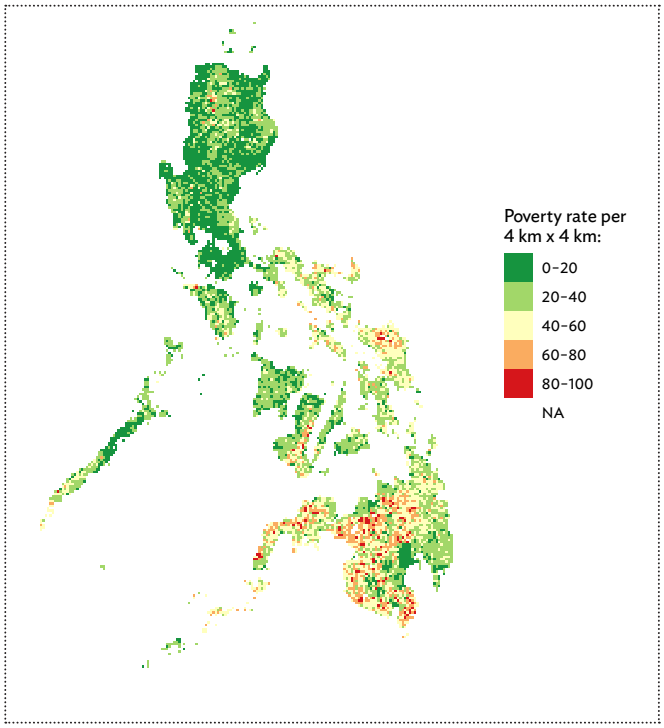
As COVID-19 threatens to erode gains in poverty reduction, it is imperative for governments to tap into the power of big data to strengthen social protection programs, which are even more critical in the face of a protracted economic slowdown (Figure 1). Investments in digital transformation and big data applications will address the shortcomings of social welfare systems and will also continue to pay dividends long after the current pandemic.

Education

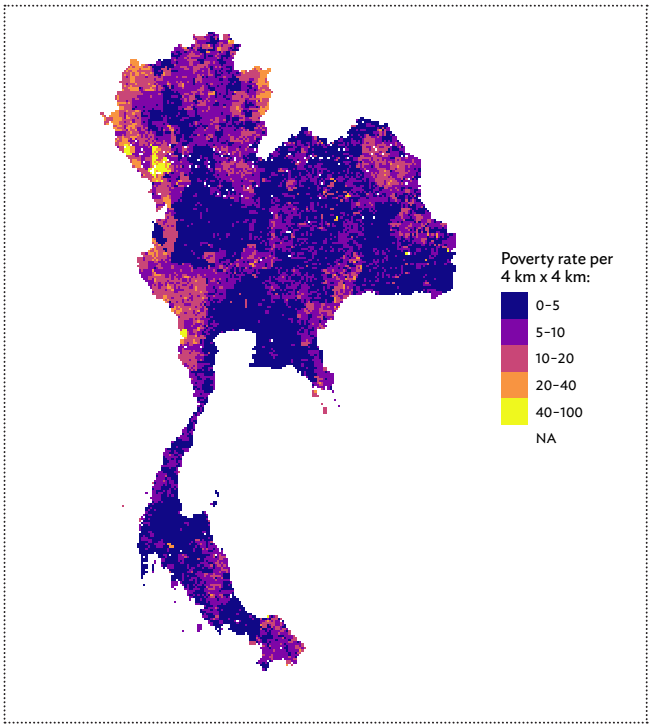
Even before the COVID-19 crisis, the governments of developed and developing economies alike were confronting workforce issues, such as skills gaps and the threat of automation. The pandemic has further disrupted labor markets across industries and heightened the vulnerabilities of workers (Figure 1).

Figure 2: Calibrated Machine-Learning Poverty Predictions

Philippines 2015



Thailand 2015



km = kilometer, NA = not available.

Source: Asian Development Bank. 2020. *Mapping Poverty through Data Integration and Artificial Intelligence: A Special Supplement of the Key Indicators for Asia and the Pacific 2020.*

Against this backdrop, it is crucial to explore data-driven applications for education and skills development to facilitate the reskilling of affected workers, and improve the long-term effectiveness and resilience of the education system. Application of big data could address existing and emerging gaps in digital skills, which are increasingly becoming a basic requirement across sectors. For example, datasets from online job portals can provide insights to gain a better understanding of employment trends and skills demand and inform the development of training courses that respond to industry needs.

Big data also offers great potential to improve learning outcomes. Education institutions can analyze student records to identify early warning signs and provide targeted support to those in need, thereby helping increase graduation rates and preventing students from dropping out.

As many students have shifted to online education amid COVID-19-related school closures, big data can help increase the effectiveness of their remote learning experience. Because interactions between teachers and students in a virtual setting may be challenging, big data can be harnessed to analyze students' learning styles, areas of interest, abilities, and progress to customize pedagogical practices. For example, schools can gain a better understanding of their students' abilities and learning styles if they collect and analyze data on how students interact with the virtual learning environment, what online sources they use for research, how they participate in chats and forums, which areas they struggle with, and how they present information.

After the crisis, technology will remain an essential means for delivering education. It is therefore important for governments to (i) ensure access to smart devices and online learning platforms to generate big data and (ii) maximize the data amassed from the spike in technological utilization to extract deeper insights into student behavior that could be useful in charting personalized learning paths. Evidence on how these efforts translate to learning outcomes and work opportunities would enrich post-pandemic interventions for skills development.

Policy Enablers and Recommendations to Support Government Usage of Big Data

Policy Enabler	Policy Recommendations
Strategic governance	Governments should create a clear plan, road map, or national strategy to foster the digital transformation of public services and promote the use of big data applications in public service delivery. Commitment from senior leadership is a key ingredient to successful implementation of big data. The designated official should have decision-making powers to effectively oversee the utilization and application of big data across agencies and ensure sharing of information between government ministries. The involvement of a multisector group of stakeholders, including the private sector, is also important to collaboratively explore big data solutions that can be used in public services. A critical function of this group is to ensure that national big data ambitions are coordinated and aligned with sector road maps.
Availability and quality of data	Improving the availability and quality of data is essential to enable meaningful big data applications. This entails adopting open data policies, improving data collection processes, creating an integrated data platform to facilitate data sharing between government agencies, and strengthening collaboration mechanisms for private sector engagement. Open data efforts could strongly benefit from forums to engage with and crowdsource data from the private sector and citizens to identify the most relevant data that need to be collected and analyzed and avoid investing in data that stakeholders would not find useful.
Risk mechanisms	Mechanisms are needed to protect data from misuse. Governments must strike a balance between safeguarding data and the need to facilitate data sharing, especially in times of crisis. To address these concerns, comprehensive data protection laws must be developed and effectively enforced to address the risks associated with using big data while allowing for efficient sharing of data during crises that require timely and actionable insights. Governments must also cooperate with the international community on common standards and approaches to ensure minimum safeguards for data security and to facilitate the provision of open data.
Human capital	Building the capacity of public sector employees is fundamental to realizing the potential of big data. Governments must put in place education initiatives to increase the pipeline of graduates with the right skills to join the civil service. In addition, it is crucial to provide training for existing civil servants to equip them with the necessary skills required to make data-driven decisions. Governments may consider incentives to encourage public servants to engage in upskilling activities and establishing mechanisms to recognize training efforts as key milestones for career progression.
Access to relevant technologies	To enable big data adoption, government agencies must be provided with access to technologies to store, process, and analyze big data. Deficiencies of analytical tools in the public sector can be addressed by establishing mechanisms to crowdsource innovations and technologies from the private sector, academia, and citizens. When introducing innovations, governments should conduct pilot studies to understand the implications of these new solutions and help minimize risks. The findings from these pilots should be incorporated in subsequent iterations and further refined before large-scale implementation.
Data-driven culture	A data-driven culture is an integral aspect of big data implementation. Ministries need to promote evidence-based policymaking, which refers to establishing policies grounded on objective and scientific research and ensuring they are designed and implemented based on concrete data. Introducing incentive schemes to link promotions and career progress to data-driven decision-making is one way to address this. Similarly, encouraging government agencies to develop big data solutions through competitions can help promote innovation in the public sector.
Information and communication technology infrastructure	It is necessary to invest in information and communication technology infrastructure, especially for improving governments' cloud computing capabilities, to provide a cost-effective and scalable way to store big data and enable efficient cloud-based big data analytics.

Source: Authors.

KEY ENABLERS AND POLICY ACTIONS TO MAXIMIZE POTENTIAL OF BIG DATA

Realizing the benefits of big data hinges on (i) putting in place the foundational elements that create the right conditions for enhancing the availability and quality of data, and (ii) encouraging the application of big data analytics in government services. The table describes the policy enablers to support government usage of big data and the recommended policy reforms to capture the opportunities big data offers.

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