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How Data-Driven Technology Can Upgrade Cambodia's E-government

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Abstract

Government departments in Cambodia are increasingly embracing data-driven digitalisation initiatives in order to become more efficient, accurate and accessible to citizens. For example, the National Bank of Cambodia recently adopted blockchain technology to reduce its interbank transaction costs. The Ministry of Public Work and Transport introduced mobile payments and a QR code-enabled vehicle information database to enhance its users' experience. Also the Ministry of Health is overhauling its Data Management and National Hospital Systems to make its services more easily accessible. As the benefits of data grow, so do its risks, including data breaches. Balancing them requires proper governance and democratization of data, good data software and data skills. This article explores the current state of Cambodia's e-governance landscape with a particular focus on data-driven technologies, how they are implemented and how public awareness around data is growing thanks to local communities and organizations, as well as recommendations for better data strategies.

Introduction

It has never been easier to communicate wirelessly, and the way people interact differs dramatically from even five years ago. We can connect with anyone, anytime and anywhere with a mobile device that facilitates a flow of information and communication exceeding the speed of our thoughts. That flow spews millions of pieces of information. Individually they are meaningless but together they form a whole of something useful and valuable. These pieces of information are called “data”, a representation of facts, such as numbers, text, speeches, images, audio and video.

Big data technologies, supported by increasingly cheaper hardware which store and compute data distributed across multiple locations, have enabled the exploration and implementation of many smart day-to-day applications. That changes everything; not only is there a computer in every office. In every pocket, there's a mobile device. In every device, there's an intelligent application that connects our physical selves with the digital world. These new data-driven technologies are the basis of A.I. and the trends encompassed by the term “Fourth Industrial Revolution”.

Governments see this revolution as an opportunity to optimize their operations, improve their image, increase engagement with their citizens and encourage relationships between external organizations and internal agencies in a new way. They aim to build “e-government” and achieve government and public sector objectives using digital technologies, leveraging them to improve their internal and public workings for better service provision while reducing financial and operational costs of the government administration. “The framework of e-government has broadened

to include the use of ICT by government for conducting a wide range of interactions with citizens and businesses as well as open government data and use of ICTs to enable innovation in governance” (United Nations on e-government 2019).²

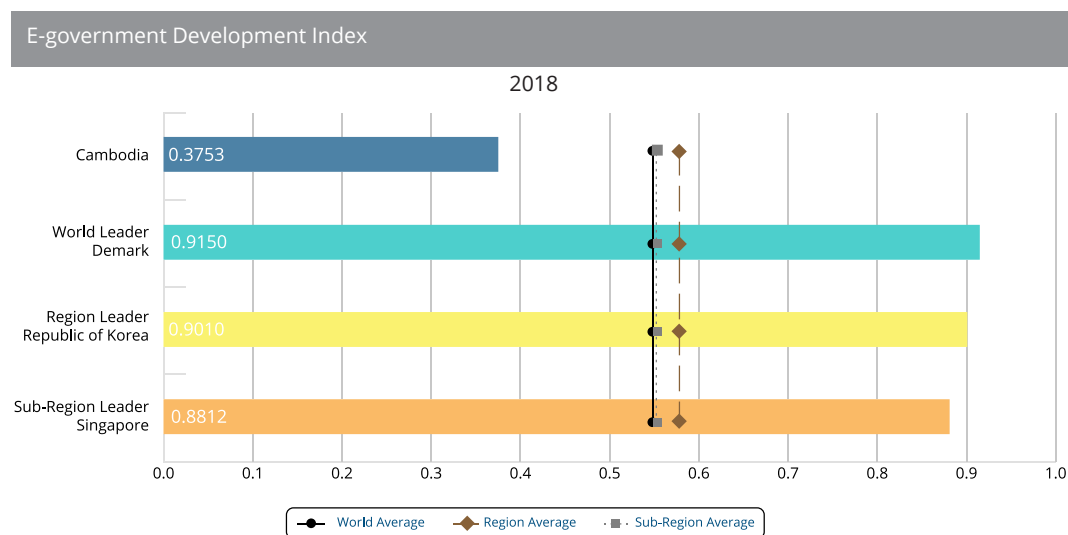
Cambodians are certainly not strangers to the digital world and enjoy both good internet and mobile penetration. If they are not on Facebook, they are on Youtube searching for videos. The younger population spends less time on traditional TV and radio. A whole generation of digital natives skips the web and moves straight to mobile, accessing the entire internet by a smartphone, powered by cloud technology. Major cloud technology providers, which allow storing and computing infrastructure online and on demand, such as Amazon Web Services (AWS), Google Cloud Platform, Microsoft Azure and others, invest millions of dollars to make the technology scalable and highly secured. They allow users, businesses, and governments to meet digital needs on a pay-as-you-use basis instead of a big upfront capital expenditure for website hosting servers.

The Cambodian government is starting to capitalize on these developments to build its own digital ecosystem of public services. Although the willingness and efforts to do so are encouraged in specific government projects and ministries, e-government in Cambodia is still in its infancy and faces many challenges.

The United Nations e-government Development Index (EDGI) measures a nation's readiness to adopt and develop e-government. With a score of 0.3753 for EGDl compared to

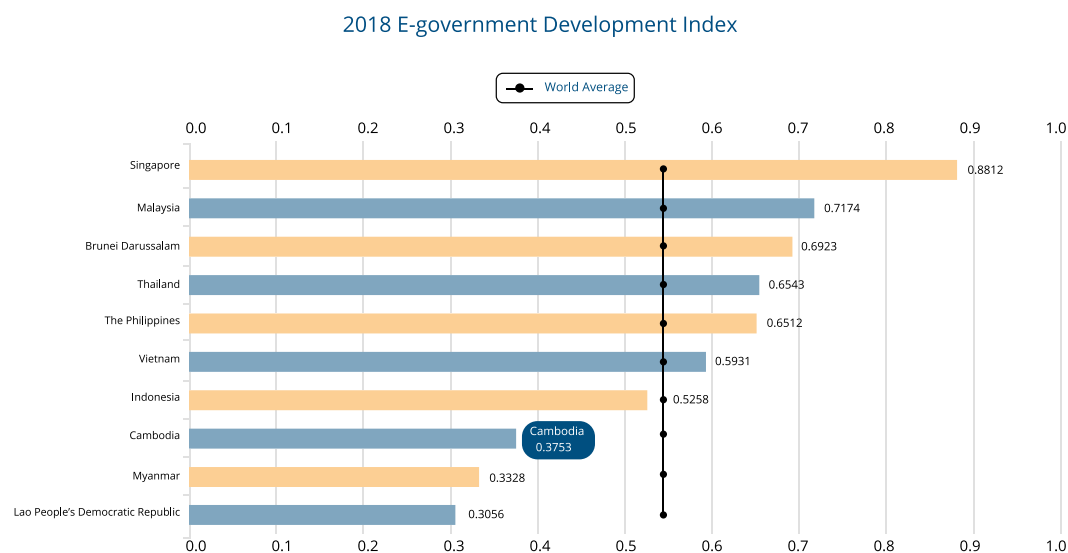
2 “E-government.” United Nations. Accessed June, 2019. <https://publicadministration.un.org/egovkb/en-us/About/UNeGovDD-Framework>.

the Asian sub-region's average of 0.5555, it places Cambodia in the rank of 145 out of 193 participating countries.



Source: UN EDGI 2018

In other words, Cambodia scores below average, meaning it struggles to advance ahead in terms of e-government development.



Source: UN EDGI 2018

Compared to its neighborhood in Southeast Asia, Cambodia ranks in the bottom three, only slightly ahead of Myanmar and Laos. Neighbors such as Vietnam and Thailand which share similar cultural and social characteristics are above average for e-government assessment. The leader in the region is Singapore.

This indicates that despite the willingness to develop e-government in Cambodia, there are many challenges to overcome to implement it successfully, given the complexity and risks resulting from resource, budget and time constraints, mismanagement and other failures. A recent Cambodia Policy Note by the World Bank Group 2018³ found that digital adoption in Cambodia remains low both at firm-level and government due to unclear leadership, low access to finance resources, lack of skilled IT staff and no adequate legal framework. Based on the "Follow-up Study Report on e-government Service Deployment Plan" (NiDA and JICA 2009)⁴ there is low awareness of the use of ICT, no high rank officer specifically responsible for the development of ICT at the time, and low budget allocation for ICT development.

Looking more closely, one finds that there are specific challenges at the data and information management level. "Information is not distributed freely among the units. Information is rarely disseminated actively, especially within the 'Behind' ministries. This leads to a lack of resources for data collection, and creates barriers to construct centralized information systems" (NiDA and JICA 2009).⁵

In other words, data and information sources remain fragmented and not properly governed with data policies. The responsibilities across the data lifecycle, from collection, access, usage and sharing remain unclear. This

is associated with increased costs in working with data. Data and information need to be properly managed, governed and democratised in order to speed up digital transformation and safeguard sensitive citizen's data.

Finally, as reported by the U.S. General Accounting Office, aside from gaining a full buy-in from a committed executive leadership, e-governance development requires "uplifting and sustaining citizen's usage of e-service, monitoring performance backed by data and metrics, and maintaining the 'value' of e-service provision to include everyone".⁶

Data is thus a crucial component both of the modern digital technologies it drives, as well as at the heart of the infrastructure of an efficient e-government. Increasing awareness of it and understanding how it can be applied in different ways to improve public services will be essential to the Cambodia's growth.

This article explores the role data can play across different levels or units of government, with some specific examples from Cambodia's current e-government landscape and abroad, and also reports on how awareness of data is growing through tech communities and other organizations in the country.

Data Strategies for Better E-government

According to research by Gartner, digital transformation in governments across the globe occurs in different steps, as represented by the framework below. Operations capture higher value as the level of complexity of the e-government projects

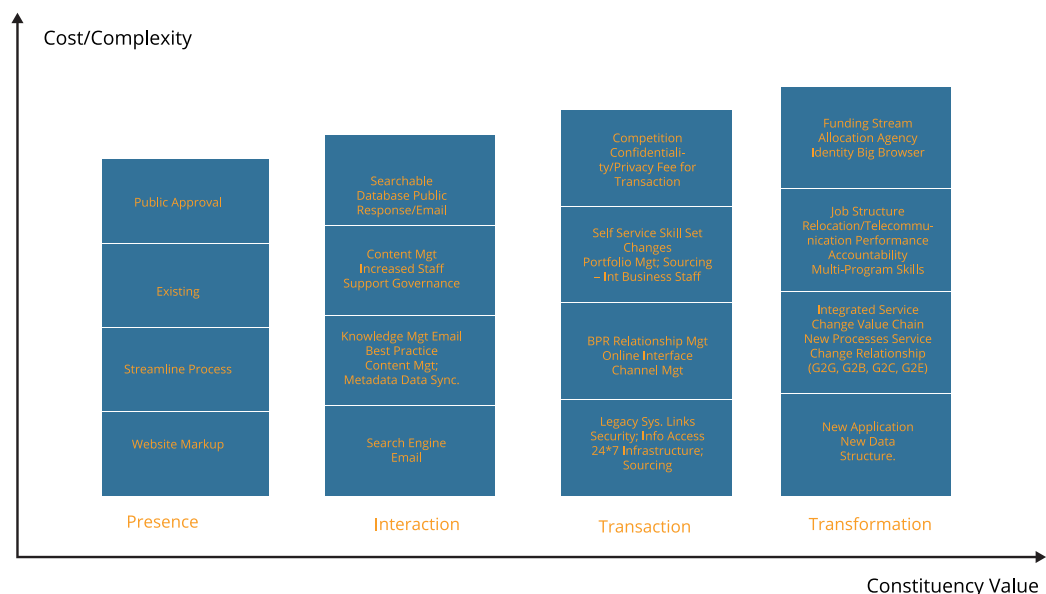
3 Beschorner, Natasha, Neumann James L., Sanchez Martin Miguel Eduardo, and Larson Bradley Robert. "Benefiting from the Digital Economy: Cambodia Policy Note (English)." (Washington D.C., World Bank, 2018). Accessed June, 2019.

4 NiDA and JICA. "The Follow-up Study Report on E-Government Service Deployment Plan for Royal Government of Cambodia." October 2009. Accessed June, 2019. https://www.jica.go.jp/project/cambodia/0609376/04/pdf/05_egov_2009_e.pdf

5 Ibid.

6 Jaeger, Paul T. and Kim M. Thompson. "E-government around the world: lessons, challenges, and future directions." (Florida, Government Information Quarterly, 2003): 389-394.

increases and thereby also its associated costs. At each stage, four key ingredients support the e-government journey: strategy/policy, process, people and technology.



At the very initial phase, the focus is to make information of ministries available through websites and downloads and provide the public with policy and governance information such as laws and regulations, reports, newsletters and events. The second stage introduces some form of interaction. Chat integrations, searchable information backed by a database and metadata, and email/messenger contact enable this. Because data and information is synchronized and content is managed, citizens and businesses can expect up-to-date information and relevant content to consume and meaningfully engage with the government. This is followed by a stage that empowers transactions. Online payments for public services, e-passport, e-business registration and e-vehicle registration are some examples. Because sensitive information of citizens becomes available, such as their finances, detailed data and governance policies are needed in order to protect their confidentiality and privacy, especially considering the grow-

ing threats from cyberattacks. A strong data infrastructure is required to support such needs. At the final stage, the transformation is complete. Government agencies are fully transparent and accountable. Budgets are prioritized to support new and well-integrated processes or services, resulting in new data structures supported by advanced technology and infrastructure.

Within this e-government development framework, one could currently place Cambodia at the beginning of the third phase, as it has already started introducing various different transactional services, but still requires solid data strategies and infrastructures to help scale them up and protect them. This leads to the question of how such data strategies can be formed in the context of Cambodian e-government projects and what can be learned from the private sector.

Many businesses from big tech companies to startups realize that their data is an enterprise asset that can be turned into a competitive advantage. Digital technologies and algorithms are increasingly open source, meaning they can be easily adapted by anyone for personal and commercial use, and popular big data technologies like Hadoop, Spark and TensorFlow are freely available to allow storing, processing and gaining insights out of huge amounts of data.

What is not open source, however, is the data itself. For example, Facebook lets a billion of people use its platform for free because that allows collecting so much user data that can be monetized through targeted advertisement services for other companies. Thus, data does not create value until it is used, turned into insights and acted on. As more and more organizations understand how to create value with data, coupled with the right talents and affordable technology, organizations will use data to increase revenues, reduce costs, improve customer experience and mitigate risks while meeting regulatory compliance.

It is the author's view that, for a government that desires to create a safe, secure and knowledgeable society, understanding "data" in a broader context - from data lifecycle to data governance, data management to data quality and data sharing to data security - will be crucial in advancing its objectives. The government should ask itself: what citizen data can be collected that can help improve and personalize public service delivery, without compromising personal privacy and safety? What data can be made public to increase its value? Where should data be stored so that it can be ingested into a centralized system for easier management and internal access and to increase the efficiency of government op-

erations? Which data should be kept private? How can data be used to create new e-government services?

In other words, data and information management can be leveraged to accelerate the government agenda: increase public transparency, raise accountability, improve image, ensure safety and security, upgrade citizen's experience, optimize administration and operations for cost-savings and enhance tax and revenue collection.

1. Forming an institutional strategy in government is necessary to set the stage for e-government projects that drive returns and fit a timeline and budget. This should include detailed action plans and objectives about the collection, storage, access and use of data. It should be aligned with existing institutional objectives and lead to more specific questions such as: what can be done now to meet the government's data objectives in 3-5 years? How should the government deal with citizen and business privacy issues?
2. A data foundation will ensure there's a solid technical infrastructure to support upstream applications and their widespread use by the government and the public. This should include data management, data quality monitoring and security control, to ensure that information is complete, up-to-date, accurate and relevant for the purpose of government and public use, at all times. For example, if all sources of data integrated in one place, it could be accessed more securely and more easily understandable.
3. Publishing performance insights of the e-government projects will ensure that the

project or service is distributed and used optimally across all segments of society. They will enable a discovery of relevant information that generates public value and meets the knowledge needs of the public, internal agencies and external organizations. Performance measurement and monitoring can track the ongoing changes, while operational and functional insights are ready to be extracted from data to improve the administration and operations of the government. It levels up the public knowledge about business and society with a centralized database management and distribution.

Examples of Data-Driven E-government in Cambodia Today

The National Bank of Cambodia (NBC) is among the most ambitious of Cambodia's institutional bodies in terms of technology adoption, regulation and data management. It carries an immense amount of responsibility in ensuring that the flow of money into, out of and across the country is regulated, safe and also auditable for the avoidance of terrorism financing and anti-money laundering. The NBC intends to experiment with the implementation of the blockchain digital ledger technology in the second half of 2019.⁷ Blockchain is a distributed database that can record and track financial information and transactions as immutable data; once recorded, the data is accepted as truth that is auditable and untampered. Blockchain technology connects citizens and businesses securely with banks, microfinance institutions or payment provid-

ers to process fast and cheap electronic payment and settlement. It is regulated by the government body to ensure financial safety and stability. It provides further value by being a decentralized network of participants that facilitate secure transfers.

According to the NBC director-general H.E. Chea Serey "the need to implement the tech is because retail savings and payment systems are fragmented in Cambodia as fund transfers between banks and payment service providers cannot be done currently."⁸ She emphasized that the use of blockchain is a cost-cutting initiative in operating interbank lending, payment and settlement with digital technologies, and not to facilitate any sort of cryptocurrency such as Bitcoin or Ethereum. Therefore, this move seeks to optimize processing times and reducing operational costs while increasing financial inclusion among the unbanked population.

A World Economic Forum (WEF) white paper recognizes that "the National Bank of Cambodia will be one of the first [in the world] to use blockchain technology in its national payments systems for use by consumers and commercial banks".⁹ The WEF adds that many central banks explore the use-case and implementation feasibility of the distributed ledger technology to modernize the system of financial transactions and clearing process. Examples include the Bank of Canada, the Bank of England, the Monetary Authority of Singapore (MAS), the Bank of Lithuania, the Bank

⁷ Kimsay, Hor. "NBC Set to Lead Blockchain Use." Phnom Penh Post. April 10, 2019. Accessed June, 2019. <https://www.phnompenhpost.com/business/nbc-set-lead-blockchain-use>.

⁸ "NBC among First Central Bank Globally to Implement Blockchain Tech." CapitalCambodia. April 29, 2019. Accessed June, 2019. <https://capitalcambodia.com/nbc-among-first-central-bank-globally-to-implement-blockchain-tech/>.

⁹ World Economic Forum. "Central Banks and Distributed Ledger Technology: How Are Central Banks Exploring Blockchain Today?" (Geneva, World Economic Forum, 2019): 160-84. doi:10.1002/9781119506515.ch5.

of Thailand, the Central Bank of Brazil and the German Central Bank (Deutsche Bundesbank) to name a few. In a more practical and advanced case, the Bank of France has already completely replaced an existing manual and time-intensive process with a decentralized, blockchain-based solution that enables automatic transactions among financial service participants using predetermined terms.¹⁰

Given its small population and low dependence on legacy systems, Cambodia is in a position to innovate and integrate a blockchain-based financial system without incurring too many risks. When the NBC implements and deploys blockchain technology successfully, the country's financial process will be enhanced to be more seamless, efficient and automated, and eventually solve the issue of fragmentation and save costs. This would be revolutionary in terms of improving interactions with citizens and businesses and in general for the financial lives of Cambodians.

One of the most interesting applications of data-driven e-government in Cambodia is the embedded QR code on citizens' vehicle plates to allow easy access to vehicle identity information from a mobile device. After scanning the car or motorbike plate with a QR code supporting mobile device connected to the internet, a result returns basic vehicle identity information including plate number, owner name, type of vehicle and license among others. Without this innovation, finding ownership and identity details of a vehicle takes much time and effort; one may need to reach out to the right vehicle officials, ask for information, pay for the information request and then wait in queues. It can take days, if not weeks, to get the right answer.

QR code technology reduces the time from weeks to mere seconds. Once scanned, data flows immediately in a secure protocol from a centralized database to the mobile interface. Potential benefits include a reduction in crime and stolen vehicles because of the ability to quickly track a vehicle and link it to a citizen's identity. Potential buyers of used vehicles may be able to verify and validate owner identity, and the legal tax responsibilities before making a purchase. The electronic vehicle registration also keeps record of vehicle safety inspections and tax validation.

One major potential drawback, as with other data risks, is the exposure of citizens' private data and safety. Ill-intentioned people and potential criminals may try to use the same technology to find, track and stalk potential victims. This should again raise questions about how to create better institutional strategies, policies and practices that can protect citizens. For example, personal data could be masked or turned into a code in order to ensure that only essential information is revealed.

In addition to providing quick and easy access to public vehicle information, the Ministry of Public Work and Transport (MPWT) now also accepts mobile payments from citizens who wish to pay for vehicle registration, inspection, licensing and tax fees. This is possible thanks to collaboration between government and private sector. The MPWT has partnered with local mobile payment companies like Pi Pay, Wing and DataPay to facilitate electronic payments, thereby upgrading citizens' user experience, speeding up the service provision and again removing fragmentation issues in the processes of registration, fee payment and tax collection. According to the CEO of Pi Pay "the partnership with the MPWT will make Cambodians' lives more efficient, more trans-

¹⁰ Ibid.

parent and more convenient”.¹¹

Given the high availability of mobile phones and cheap internet access in Cambodia, this kind of acceptance and integration of electronic transactions on top of public service provision could be further developed and rolled out to other government departments, and normalize cashless payments in the country.

Moving to examples of better data management, the Ministry of Health (MoH) built a National Health Information System (NHIS) back in 1993 to collect and store health data from routine health service activities in various provincial and local branches. This national database project was fully completed in 1995. The information is aggregated and supplied to the Ministry website for online dissemination and public access, and is also used internally by other departments.

NHIS used the Microsoft Access System, a database management system which brought several strengths and benefits to the Ministry.¹²

One centralized system which integrated nearly 20 recording and reporting tools, preventing duplication and reducing staff workload; templates and definitions standardized for ease of use and understanding; and information entry that was computerized securely for easy access and usage.

Improvements could be made as the data acquisition process in the early days remained manual.¹³ For example, data was collected and compiled on paper from different health centers and referral hospitals before the hard copy was sent to the operational district health office and the provincial health department. It was then consolidated and entered into the Access System. The data was not computerized at the point of collection. As it is known today, manual paper-based processes can be fragile, prone to error, inconsistent, risky, and can result in operational inefficiency, tedious workloads and the deterioration of staff productivity.

Thanks to an initiative with USAID Better Health Services in 2010, a major change was introduced that led to the upgrade and advancement of the database management and reporting process. A new web-based database system was developed to migrate data and information from the existing one; this enabled employees to input and access data at the point of information collection. For example, a staff member could use a web-based application to read or write data to a relational MySQL database. MySQL is a high-performance open source database technology to manage structured data with records and fields both in retrieval and update. This technology integration appeared to improve the speed, reliability and accuracy of the data.

The data is collected nationwide from 990 health centers, 55 referral hospitals, 24 provincial hospitals, eight national hospitals and two NGO supported hospitals as of today using the web-based system.¹⁴ A monthly health report is also accessible on the website with

11 Foo, Desyre. “PI PAY BRINGS CASHLESS TO GOVERNMENT SERVICES WITH MINISTRY...” Geeks in Cambodia. October 16, 2018. Accessed July, 2019. <http://geeksincambodia.com/pi-pay-brings-cashless-to-government-services-with-ministry-partnership/>.

12 “MOH Health Information System.” Ministry of Health. Department of Planning and Health Information. Accessed June, 2019. http://www.hiscambodia.org/public/aboutthis_en.php?m=c.

13 Ibid.

14 Ibid.

the data generated and aggregated for visual analysis.

More recently, the MoH formally launched the new Peth Yoeng system, an innovative web-based hospital management system.¹⁵ The system is developed and maintained by the First Womentech Asia company to support patient information tracking, capture electronic medical records and share data across departments. The author met and interviewed Pong Limsan, Founder and CEO of the company, for a data discovery session conducted by Mekong Big Data for SmartScale, an acceleration programme for the most promising start-ups in Cambodia. Pong Limsan says that she wants to improve patient experience by providing hospitals and clinics across Cambodia with a modern hospital management system that digitalizes end-to-end operations, from computerizing test results at the doctor's office to integrating payments at the reception and managing medical inventories. The digitalisation process is efficient, cheap and fast. Limsan adds that there is an initial challenge for staff in operating the system, but after they are trained and understand the value of the technology, the staff prefers not to go back to the old ways of manually handling patient information because all information is now captured and synced in real-time.

It appears that the emphasis on people, change management, transformation of attitudes, training and communication is critical in ensuring that the technology is adopted successfully. The e-government journey of the

MoH reached its current state thanks to how it started; everything that follows is continuous optimization.

An Example From Abroad: Biometric Big Data in India

The world's largest biometrics database was implemented in India by storing and authenticating identity information of a population of over a billion citizens from birth to death. "Intended as a unique identifier for Indian citizens, the aim of Aadhaar, the word roughly translated as 'base' or 'support', is to eliminate the issue of false identities and prevent resulting fraud in financial transactions".¹⁶

It uses the open source technology Hadoop, which originated and spun out of Google to handle petabytes of data points at a scale of Google infrastructure. Powered by a well-coordinated, massively-parallel processing servers,¹⁷ the technology enables the cheap storage of all kinds of files and the fast computation of workloads by distributing data across many cheap hardware computers at rest or motion. This coordination of multiple computers forms a powerful force to keep and process a huge amount of data and, as a result, yields a higher performance that is more cost-effective than traditional technology. Moreover, when one computer got interrupted, it would not affect the operations of the others because of smart coordination and a distributed framework.

¹⁵ Kimmarita, Long. "Hospital System Launched, National, Phnom Penh Post." June 07, 2019. Accessed June, 2019. <https://www.phnompenhpost.com/national/e-hospital-system-launched>.

¹⁶ Behal, Ambika. "MapR And Big Data In The World's Largest Biometric Database Project." Forbes. November 25, 2015. Accessed June, 2019. <https://www.forbes.com/sites/abeהל/2015/11/25/mapr-and-big-data-in-the-worlds-largest-biometric-database-project/#5e1d003b2035>.

¹⁷ Wang, Lizhe, Jie Tao, Rajiv Ranjan, Holger Marten, Achim Streit, Jingying Chen and Dan Chen. "G-Hadoop: MapReduce across distributed data centers for data-intensive computing." (Future Generation Comp. Syst., 2013): 739-750.

The registry database facilitates digital fingerprints, digital photos and text-based data for every Indian resident - each within 200 milliseconds for real-time authentication. "The amount of biometric data that is collected per person is approximately three to five megabytes per person, which maps to a total of 10-15 petabytes of data".¹⁸

The database is also used to monitor school attendance, issue natural gas subsidies to India's rural poor and to send wages directly to people's bank accounts. Because this citizen data is very sensitive and highly classified, much needs to be done to avoid cybercrime, security breaches and manipulation.

That being said, this unprecedented example of a data-driven e-government project proves how technology can record, store, and use information at a massive scale in order to advance the government's capabilities in identity verification, fraud prevention and security protection, while enabling the efficient and effective provision of social services.

Cambodia may also explore and experiment with this new technology as it is cost-effective, scalable and high-performing and thus can support large-scale e-government projects across a range of applications.

Data Literacy in Cambodia: Open Data and Meetup Communities

Having discussed the different opportunities that data-driven technologies present to developing e-government in Cambodia as well

as some applied example in the country and abroad, this section explores what can be, and is being, done to improve data literacy and skills among Cambodians.

For example, the government could make more open data available to the public and promote increased activities of data communities in Cambodia.

Open data is defined as "non-privacy-restricted and non-confidential data which is produced with public money and is made available without any restrictions on its usage or distribution"¹⁹ Major perceived political, social, economic, technical, and operational benefits of open data are the improvement of citizen participation and satisfaction, equal access to the right data, economic growth and stimulation of competitiveness, and optimization of administrative processes, which lead to more financial savings, more tax revenues, and more transparency and democratic accountability.²⁰

Enabling open data will facilitate the transition from a traditionally closed-system to open-system society, enabling the general public to access public data and information in an easy way and without legal or copyright restrictions. Data should be catalogued and searchable in a friendly user-interface, such as a mobile or web portal. It should be understandable and have important information about the data itself, such as how the dataset is collected, its sources, its creator, the different types of details, and what each detail means. The data may be downloadable and shareable for public use in a flexible format

¹⁸ King, Rawlson. "World's Largest Biometrics Database." biometricupdate. December 1, 2015. Accessed June, 2019. <https://www.biometricupdate.com/201512/worlds-largest-biometrics-database-leverages-big-data-architecture>

¹⁹ Janssen, Marijn, Yannis Charalabidis and Anneke Zuiderwijk. "Benefits, Adoption Barriers and Myths of Open Data and Open Government." (IS Management, 2012): 258-268.

²⁰ Ibid.

such as PDF, Excel or comma separated files as needed.

In Qatar, Open Government Data (OGD) is created by state institutions for public consumption and is considered to be an important component of e-government, because it encourages citizens to participate in the analysis and decision-making around public matters.²¹ Because public data is openly accessible, it can improve the relationship, image and outlook of the institutions providing them as their operations appear more transparent and accountable, thus creating public value and increasing public knowledge about their society. Additionally, when government data is published, the reaction and feedback from citizens may provide new insights about the operations and the performance of the state and public institutions, which may lead to new ideas on new services or agencies to create.

In the Cambodian context, all this should be implemented thoughtfully and strategically, as data can also mean risks. A leak of highly confidential information can severely damage to the image and operations of government. Principles and best practices about opening up governmental data to the public can be leveraged, including lessons from the International Open Data Charter, to ensure the success of the e-government project.

Aside from the government, Cambodia also has several non-profit organizations and informal online and meetup communities set up by professionals who promote interest and knowledge in data as a subject, as well as provide actual open data. These communities desire to improve the development of data skills,

and the knowledge and experience necessary to address the digital needs of society.

Open Development Cambodia (ODC) is a one-stop hub for online information on environmental and economic development, compiling data to give free public access without restrictions via its website after a careful vetting and verification process. It removes the barrier to public datasets about development issues that people care about. As an open data platform, it focuses on open access, usage and sharing for everyone to get value and knowledge from development data.

ODC also develops open data skills by providing capacity building trainings in the country.²² Because it enables the exploration and discovery of development data in an easy and interactive user interface on its website portal, the public may be able to gain more general knowledge about economic development from that data. The ability to find the information in different formats including raw data may enable developers to build some data applications and improve their data skills. Civic organizations, NGOs and businesses also benefit as they use advanced capabilities such as map visualizations that can add value to their organization.²³ The information available covers a range of topics: agriculture and fishing, aid and development, disasters and emergency response, economy and commerce, energy, environment and natural resources, government and labor.

The Cambodia AI Community is an open-source AI community that seeks to develop AI skills in Cambodia. In addition to organizing

²¹ Al-Kubaisi, Ali Selham. "Enhancing the Adoption of E-Government Systems through Open Government and Open Government Data (OGD) Initiatives in Qatar." (2018).

²² Michael P., Canares, Andrew Young and Stefaan Verhulst. "Open Development Cambodia: Opening Information on Development Efforts." (odimpace, 2007).

²³ Ibid.

community events, it focuses on the real-world application of AI as well as skills in researching, developing and applying machine learning algorithms on data to create human-like intelligence. In simple terms, machine learning is the ability to discover and predict information or patterns based on huge amounts of data or historical examples, rather than writing rules over and over again. One may also use machine learning to predict customer behavior and forecast their demand. A well-known example is Amazon's recommendation engine to personalize e-commerce shopping offers to Amazon website visitors.

One project of the Cambodia AI Community is KhmerML, a set of machine learning algorithms to help solve complex problems. KhmerML is open source based on Python general-purpose programming, which is one of the world's most popular languages in machine learning and data science.

Data Residents Cambodia is a meetup community. Its stated aim is to connect data enthusiasts and analytics professionals to share knowledge around data and its potential to improve organizations and society in Cambodia and Southeast Asia. Inspired by data science communities worldwide, the data-focused community was founded in December 2018 by data enthusiasts from Cambodia and abroad, including this article's author. It is volunteer-run, open to the public and free for participants. Many free workshop events were held with partners like Phnom Penh Facebook Developer Circle, the University of Puthisastra and the Emerald Hub coworking space.

Topics covered so far by local and international speakers includes visualizing complex data with Microsoft Power BI, AI-driven marketing

on digital platforms with Google Analytics and Facebook, guidance on a data scientist's career and skill set, and data analytics for social good.

The Data Science Club was created to bring together like-minded youths in Cambodia who are interested in learning more about data science through workshops, online courses and technical applications so that they will have the technical skills and knowledge to work with data and build useful intelligent software.

Overall, meaningful communities bring valuable knowledge and connections. Government, the public sector and the private sector may assist in promoting and financing more of these activities to inspire a new generation of Cambodians.

Conclusion & Recommendations

Despite Cambodia's unique characteristics and development issues, its government appears to recognize the opportunities presented by its young, evolving and tech-savvy society, where deep mobile phone penetration, cheap internet access and high social media adoption are mostly in place, and aims to build an ecosystem of digital public services.

Applied examples of data-driven technology in e-government include the initiative to integrate blockchain technology to support the financial inclusion of unbanked Cambodians, the use of QR code technology for vehicle identification, mobile payments to enable fast, easy, and efficient service provision, the increased online presence of government ministries, and the deployment of data management systems to improve healthcare services. Moreover, data communities and the open



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data movement are growing and aiming to increase public knowledge and engagement, while promoting and disseminating data technology skills. However, e-government in Cambodia is in its early days and has to overcome many implementation challenges.

To reach the next phase, public services that are high-value and relatively low-effort to digitally transform should be looked at first, and these often revolve around data-driven technology. Leadership roles and budgets need to be prioritized. Sound data strategies should be formed to ensure project success and ef-



for the country. While data communities and the open data movement are ambitious citizen-led initiatives, proactive effort from state institutions to provide more public sector data and relevant education will further increase and solidify public knowledge. Government, public and private institutions should also assist through funding and support to foster more of these initiatives and thereby inspire and develop digital talent in Cambodia.

Transforming the government across local, provincial and national levels also requires ensuring that everyone takes part in order to prevent the formation of “digital divides” across different segments of society.

Finally, as new e-government services are introduced, their existence and availability needs to be repeatedly communicated to the public to ensure that they reach as many citizens as possible, because technologies are valuable only when people use and adopt them.

efficient operations. Well-architected technical infrastructures, from cloud services to cybersecurity tools, should be set up to support the new services.

Improving the technology and data skills of Cambodian citizens should be a top priority