

Sabah Geo Hub – Driving the Modernised SDI

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Key words: SDI, Geo Hub, Data Exchange

SUMMARY

The state government of Sabah is aspired to creating a new sustainable model for service delivery through the various digitalisation initiatives. In 2020, the Digital Government Division (DGD) was established to drive and oversee the implementation of various initiatives under the digitalisation roadmap for the state government of Sabah. DGD made a revision for the digitalisation roadmap and put together a revised 5-year plan to move the government from the focus of digital automation to digital transformation and lastly, digital innovation between 2020 and 2024.

Data is the primary enabler of a digitalisation initiative. With the efforts and experience in operating the state Spatial Data Infrastructure (SDI) since mid-1990s, it has laid a foundation for the digitalisation of public service. The state SDI of which was not designed for the modern digital age and data requirements will be upgraded and rebranded as Sabah Geo Hub. Concurrently, the government will put in place another two Hubs – Business Hub and People Hub to work alongside Sabah Geo Hub to form the Data Integration and Interchange Platform (DIIP) that aims at pooling together data, technology, intelligence, standard, and capability under the same roof.

Under the Sabah Geo Hub, there are new concepts and implementations to be carried out in the aspects of ‘4C’ – content creation, contextualisation of data, capacity building, and Connect-and-Collaborate. Sabah Geo Hub is developed with the third dimensional (3D) in the centre of design. The 3D-ready environment will ease the government in dealing with the management and analytics of 3D data, and the development of digital twin for Sabah as well as initiation of metaverse related research. The topics of 3D-ready operating environment, digital twin, metaverse, artificial intelligence (AI) assisted solution, and smart state initiatives will be the focus of Sabah Geo hub in the next two years for paving ways for the state government to embrace digital innovations.

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1. INTRODUCTION

In the near future, digital world will become the default go-to channel for everyone to reach out to others and connect with opportunities of all kinds. Hence, the government, being the largest service provider for citizens, needs to step up its digitalisation agenda to better respond to the requests of citizens, businesses, other users of government services.

The state spatial data infrastructure (SDI) that was started in two and a half decades ago has been one of the core initiatives supporting the digitalisation journey of the Sabah government until today. In the past two decades, a diverse range of the typical government services such as land administration, town planning, and transportation development have already been digitalised and relevant resources are made accessible online. Many of the initiatives are powered by geospatial data and technology. Although the state SDI is being maintained till date, both of the strategic and functional roles of it must be expanded and adjusted over time to cater for the evolving and dynamic needs of the citizens, businesses, and government.

Sabah Geo Hub is an initiative under the notion of modernising the state SDI by adopting consensus frameworks such as the United Nations Global Geospatial Information Management (UN-GGIM) Integrated Geospatial Information Framework (IGIF) to ensure the development aimed at the fast-emerging digital world rather than the old reality as the global SDI conceptual model that was developed in early 1990s when much geospatial data including aerial photography, elevation data, and placenames were prohibitively costly to create for any organisation other than a large government body (Coetzee et al., 2021).

2. THE JOURNEY OF SABAH STATE SDI

The state SDI of Sabah has been operating since the mid-1990s and over the years, it has gone through several upgrades and changes. The motivation for the early generation of SDI was about provision of unified base maps as the references for government agencies and businesses to start converting data into geospatial formats and aligning the outputs to create continuous as well as interoperable geospatial datasets.

Lately, the focus of state SDI has been on improving data readiness, which means in the form of complete, correct, current, and consistent prior to sharing with the permitted parties. This sets the precondition to ensure that the data are interoperable and follow consensus standards. Ultimately, data in different domains collected at different times, at different scales, and in

different formats can be easily and seamlessly re-used and integrated. The state SDI provides a basis on which to achieve these aims through best practice guidance, and sometimes policy. Fifteen (15) government agencies are currently participating in the state SDI.

1. Lands and Surveys Department
2. Department of Agriculture
3. Forestry Department
4. Public Works Department
5. Department of Fisheries
6. Department of Industrial Development and Research
7. Department of Irrigation and Drainage
8. Town and Regional Planning Department
9. Department of Mineral and Geoscience Sabah
10. Department of Statistics Malaysia Sabah
11. Environment Protection Department
12. Sabah Parks
13. Kota Kinabalu City Hall
14. Sandakan City Council
15. State Public Service Department

The state SDI needs to be fit for the modern digital age and data requirements, including the diverse range of providers, users, and stakeholder. The technological, market and social environments have changed dramatically in many ways over the years. New rules of engagement and standards will be necessary to help manage growth and change.

3. SABAH GEO HUB

Even prior to the first COVID-19 case was confirmed in Malaysia, the state government of Sabah had taken the action to mandate all government agencies to make digitalisation programme a prioritised agenda for improving service delivery of each and every department. The state government also set up a Digital Government Division (DGD) under the Sabah State Public Service Department to take charge of the state-wide digitalisation initiatives spearheaded by the state government (Peter, 2020).

Prior to the COVID-19 pandemic, the state government of Sabah had already been embarking on various initiatives to digitalise the business processes of government agencies. Upon the establishment of DGD in 2020, the digitalisation roadmap of the state government was reviewed, planned actions were reprioritised, and relevant goals were reassessed. The revised roadmap sets sight on nudging the government agencies to speed up the transition from the focus on creation of digital processes to digital automation within the next one to two years from 2020. After that, government agencies should be focusing on digital transformation and digital innovation from 2021 to 2024. Digital transformation means government agencies will review the cross-agency digital processes and evaluate the feasibility of streamlining. When it moves into the digital innovation phase around 2023 or 2024, the state government will have its present in the digital world and established as a 'digital government' providing services to citizens and businesses.

Digitalisation is a key enabler, but it is not an end goal. Being a 'digital government' is about using data to transform the way how government serves its citizens and businesses, and the way government enables its public officers to contribute fully to their work in the digital environment. Owing to the twenty-odd years of continuous effort in developing and maintaining the state SDI, a lot of the most sought-after information of critical assets such as land parcels, administrative boundaries, and topographies are findable, accessible, interoperable, and reusable (FAIR), which is the guiding principles established by Open Geospatial Consortium (OGC) (OGC, 2022). The state SDI has laid a strong foundation for the government to progressively evolve into a 'digital government'.

Sabah Geo Hub is the initiative of modernising the two and a half decades old state SDI. The mission of FAIR of OGC plays a special role in designing the Sabah Geo Hub. Not only does data need to be findable, accessible, interoperable, and reusable, but the entire resources around the data including maps, applications, tools, and geoprocessing algorithms should adhere to the same principles.

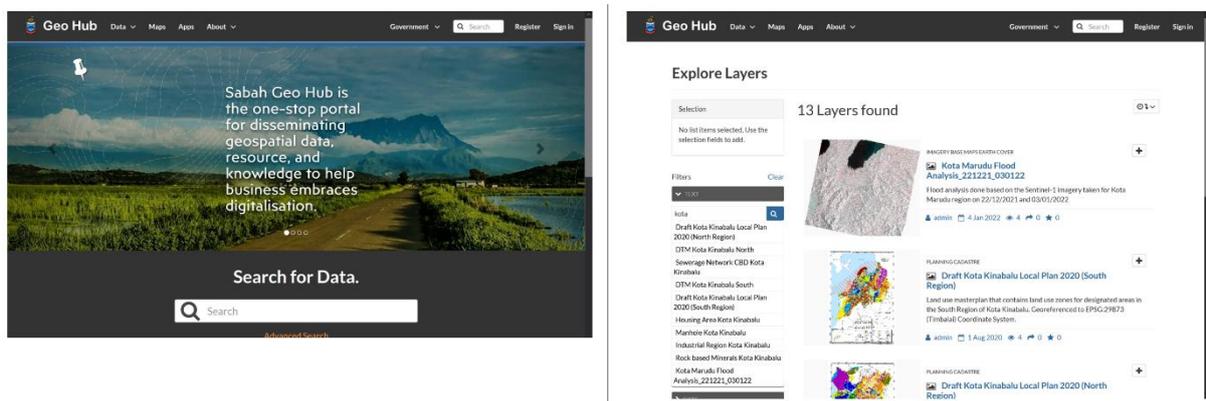


Figure 1: Sabah Geo Hub is designed based on the 'FAIR' guiding principles of OGC, ensuring data and resources are findable, accessible, interoperable, and reusable.

Sabah Geo Hub aims at creating a new sustainable model for government service delivery by putting together resources that can be **accessible by anyone at anytime, and anywhere using any devices**. Sabah Geo Hub will put together resources to support actions or activities revolving around the aspects of '4C' – content creation, contextualisation of data, capacity building, and Connect-and-Collaborate.

3.1 Content Creation

Data is the heart of government. Over the past few decades, government agencies have put in enormous efforts and resources in capturing, storing, and maintaining a diverse range of administrative data. Several of the administrative data such as land parcels, utilities networks, and conservation areas are being maintained in geospatial forms. A significant amount of the

geospatial data together with the respective metadata are being made available at the state SDI for sharing with others. The metadata is meant for facilitating data discovery, assessment, retrieval, and use by permitted parties and individuals.

Currently, various government agencies are contributing, sharing, and updating hundreds of data layers into Sabah Geo Hub in a regular basis. These data layers comprise information of administrative boundary, cadastral, conservation, land base, landform, utilities, infrastructure, natural resource, transportation, biodiversity, environment, public facilities, town planning, and place of interest. On top of the data obtained from the state SDI, Sabah Geo Hub will also be populated with data in the health, social, and economic sectors.

In 2020, the state government commenced a geospatial study with helps from a reputable international geospatial consultancy firm. According to the figures obtained through secondary data collection, evidence shows that greater levels of data access and sharing can generate positive social and economic benefits including increase the value of data to holders, also help create 10 to 20 times more value for data users, and 20 to 50 times more value for the wider economy (Frontier, 2021). Considering the huge potential of economic value to be extracted from data sharing, the state government has paid an additional attention to the strategy of content creation.

The state government has put together a plan to expand the scope of data collection through the approaches of ‘geospatialising’ non-geospatial data, ‘crowdsourcing’ data via mobile apps, and ‘deriving’ information from remote sensing imagery. As time goes by, the volume, velocity, veracity, and variety of data that are centrally stored and maintained will increase at an exponential rate. There will be needs for a more systematic approach to assist the various stakeholder in processing and managing the data.

Sabah Geo Hub offers the required toolset through the use of Feature Manipulation Engine (FME) by Safe for supporting government agencies in dealing with data and data-lifecycle management. Through FME, government agencies are able to create, host, and maintain the relevant automated digital workflows in Sabah Geo Hub for harvesting, converting, consolidating, and harmonising data of different sources continuously.

3.2 Contextualisation of Data

Data contextualisation means adding related information to any data to make it more actionable. Using insights gleaned from data to inform decisions and guide policy can be a radical departure for organisations that have traditionally relied on personal knowledge and, at times, instinct. However, real power will be unleashed when analytics-based approaches become deeply embedded in government culture, with data-based predictions and prescriptions shaping the core strategies of government.

Government collects a massive amount of data in different types, different format, and different size. In a nutshell, government has an important role to play in applying the

appropriate analytical techniques to obtain new actionable insight and using it to shape the new sustainable model for service delivery.

Sabah Geo Hub is leveraging on interactive dashboard to bring information and insights across to different levels of users with maps, charts, and attribute tables powered by Hexagon M.App Enterprise. The interactive dashboards allow different parties to bring up relevant information on a single screen for quick decision-making in critical scenarios and emergency situations.

For example, when the announcement of Movement Control Order (MCO) was made by the government as part of the efforts to curb the spread of COVID-19 virus, it has sparked panic-buying and confusion throughout the state. The government has subsequently setup a taskforce to conduct regular on-site inspections to gather information on shortage of essential supplies for supporting informed decision making. All data collected on-site will be instantly stored, processed, and analysed in a common platform. The selected key outputs are visually displayed on an interactive data dashboard using maps, charts, and data tables. The interactive dashboard also allows users to interact with data, enabling officers to make well-informed and data-driven decisions.



Figure 2: Interactive map dashboards presenting various insights for easing the government agencies in making informed and data-driven decisions based on the current stock availability data collected via on-site inspections. The image on left provides an overview to the state-wide results of on-site inspections, and the image on right offers more details for each of the selected supplies i.e. rice, egg, face mask, soap, toilet roll, sugar, poultry, and vegetable.

3.3 Capacity Building

Geospatial is still a niche profession and there is a shortage in the workforce for geospatial professional in Sabah. The state government has to put in more efforts in the area of capacity building. In the past, the state government has been working with industry partners to deepen the awareness and knowledge of geospatial through online training as well as hands-on exercises using popular geospatial packages including QGIS, Hexagon M.App Enterprise, FME Desktop, and Sentinel Application Platform (SNAP).

In addition to the on-demand online training, Sabah Geo Hub comes with a built-in sandbox environment powered by FME Server. The sandbox is put in place to cater for the needs of permitted government officials to gain access to the pre-built tools, test data, and modular processes for creating, fusing, manipulating, and analysing data using place-based algorithms. Some of the popular pre-built tools are address geocoding, heatmap generation, and accessibility routes query.

The sandbox provides a safe environment for permitted government officials to learn and understand the concepts, steps, and functionalities of a selection of geo-processing capabilities through self-learning as well as exploration. With access to over 400 transformers under FME and the test data made available in the database, the sandbox can be used by government officers for multiple purposes including research and development, rapid prototyping, and idea validation.

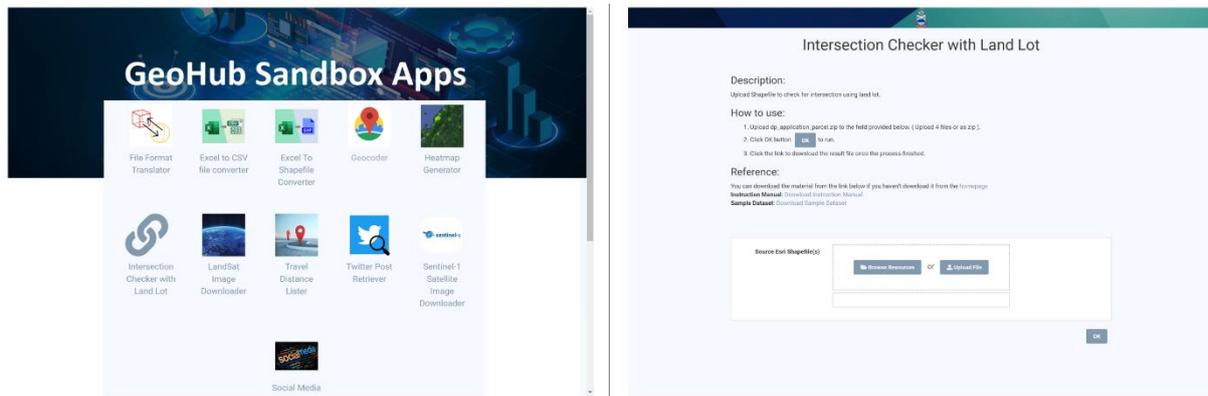


Figure 3: Sabah Geo Hub provides a sandbox environment assisting government officers to acquire geospatial knowledge and skill through self-learning.

3.4 Connect-and-Collaborate

Under the existing state SDI, collaboration mainly exists at the level of sharing and exchanging of data among the government agencies. Typically, agencies or stakeholder are accessing data through upload-download, web-service, and Application Programming

Interface (API). Although the upload-download is still the most popular method for accessing data, it brings along several challenges such as duplicated resources, wasted storage space, mismatched data, and long processing time when dealing with huge and/or dynamic data.

The concept of Connect-and-Collaborate is about getting more value from less data. For example, if a party is only requesting for the information of total active registered companies in a specific area, the party should not be required to download the entire data and perform the calculation by its own. Besides sharing and exchange of data, collaboration among government agencies could be established through co-creation of business processes digitally. In Sabah Geo Hub, different government agencies are encouraged to come together to collectively define, design, develop, and deploy cross-agency business processes using FME.

3.4.1 Approval Process of Development Plan

One of the examples is the approval process of development plans in Sabah. In the past the process might take a long time to complete due to some back and forth clarifications during technical review led by different technical departments under the state and federal governments. Started 2021, the State Local Government and Housing Ministry has fixed six months for the approval process of development plans (The Borneo Post, 2020). Sabah Geo Hub is working together with the relevant technical departments to develop a list of standard workflows using FME.

Through FME in the Sabah Geo Hub, the relevant government agencies such as the Town and Regional Planning Department, Kota Kinabalu City Hall, and Lands and Surveys Department are joining force to co-create a common digital business process to quickly identify and consolidate the related information of land parcels, perform analysis, and use the analysis results to generate the relevant reports for respective stakeholder.

The workflow execution and performance monitoring are fully automated. The advantage of the automated workflows is that each of the process owners just need to spend as little time as possible on standard processes so that they can focus on other important tasks. This is a vital achievement of the government in its ambition to realise a new sustainable model of service delivery.

4. SABAH GEO HUB IS AN INTEGRAL PART OF THE DATA INTEGRATION AND INTERCHANGE PLATFORM

Apart from the Sabah Geo Hub, DGD is currently undertaking the development of another two data hubs – People Hub and Business Hub. The three hubs are part of the Data Integration and Interchange Platform (DIIP). With the three hubs come under the same roof, DIIP is aiming to pave way for the creation of Sabah Digital Marketplace that pool together data,

technology, intelligence, standard, and capability under the same roof to enable the state government to create new sustainable model for service delivery.

Geospatial data underpins almost everything and that is the main reason of Sabah Geo Hub is included in the DIIP. The place-based data in Sabah Geo Hub presents an alternative avenue for pooling data of different sources together. This includes data that is non-geospatial in nature such as company registration, demographic, and fund disbursement that are made available in the Business as well as People Hub. The integration of data and other resources including business processes among the Business, People and Geo Hub is the greatest benefit to be realised by the state government under the revised digitalisation roadmap.

4.4.1 Data Submission, Publisher and Subscriber Modules

Generally, under the DIIP, data from an identified source will be channelled through the modules of submission, publisher, and subscriber. First, data to be submitted through either SFTP or API to a common server. Second, the data publisher powered by FME will take over the processes of validating, filtering, and harmonising the ‘passed’ data into the respective consolidated source. Third, the data subscriber will be tapping on the consolidated source of data and create a unique profile for each individual or company. Eventually, every permitted subscriber will be given access to the finalised, validated and unique individual or company profile upon request via mobile devices.

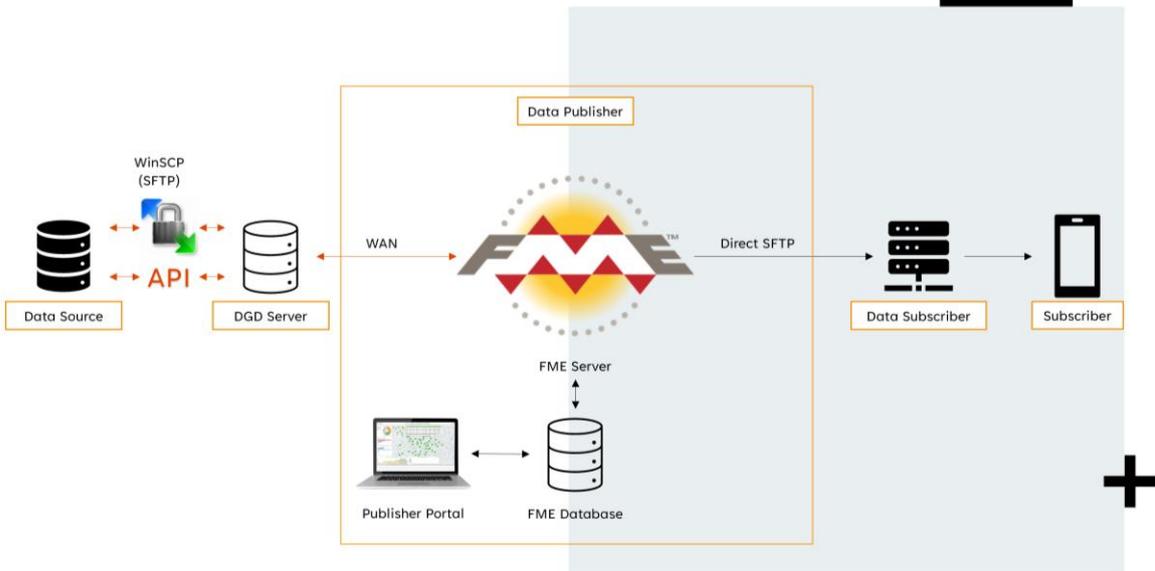


Figure 4: Data is channelled through the modules of submission, publisher, and subscriber under the DIIP.

4.4.2 Data ‘Geospatialisation’

Data that has been validated and harmonised into a single source will be sent for the ‘geocoding’ process. All geocoded data will be loaded onto the relevant interactive dashboard for easy access by the permitted users. This is how the Sabah Geo Hub is working alongside People and Business Hub to make data available in geospatial format. With the data is ‘geospatialised’, the usual geospatial analysis such as nearby search, features overlay, and location-based clustering are made possible.

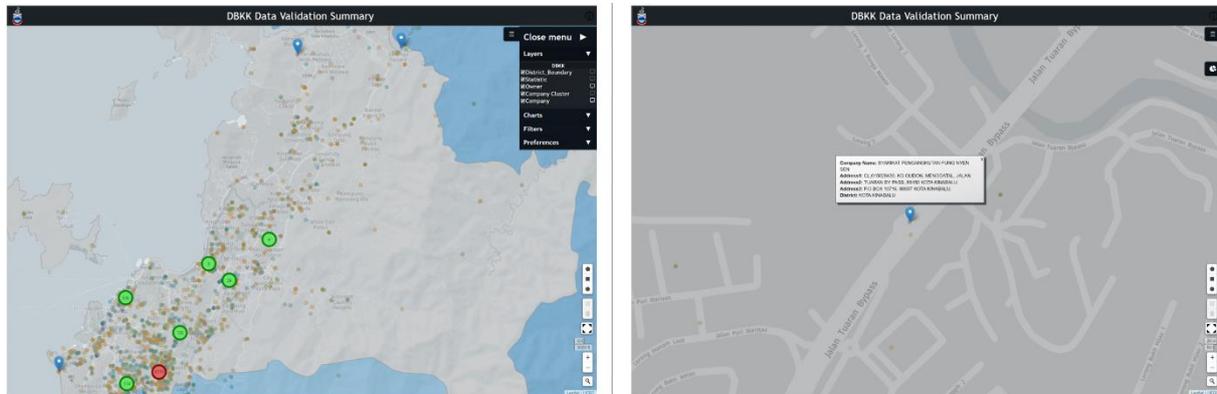


Figure 5: Validated and harmonised data to be geocoded and loaded onto the relevant interactive data dashboard.

5. Open Data and Single Source of Truth

Open data, especially open government data, is a tremendous resource that is as yet largely untapped. Many individuals and organisations collect a broad range of different types of data to perform their tasks. Government is particularly significant in this respect. Under the Sabah Geo Hub, the state government is promoting a more open sharing of data among government agencies by putting in place the relevant policies and best practices. Among all the identified initiatives, the single source of truth (SSOT) is placed on the top priority.

SSOT refers to the ability to provide one access point to all of an organisation’s knowledge (Cahana et al. 2021). In this increasingly diverse data world, new data can be easily created from the existing pool of data through combination or generalisation. If the changes are not being managed properly, eventually the information of data provenance will become untraceable.

Under the framework of state SDI, the data owner is responsible for ensuring the data classification, quality, and update. Sabah Geo Hub adopts the same framework with improved data governance to ensure data, data-related processes, and resources are trustworthy and standardised. Proper data governance is the basis for SSOT that ensuring decisions based on

available data do not place the state government or the public at risk due to low data quality, data falsification, data obsolescence, or security or privacy threats.

SSOT is the structuring of information models and associated data schema such that every data element is stored exactly once. Nonetheless, SSOT is not a system, tool, or strategy, but rather a state of being for an organisation's data in that it can all be found via a single reference point. Metadata holds the key to the SSOT. By effectively collecting metadata, the government is able to finally unify context about all their tools, processes, and data (Prukalpa, 2021)

Metadata is fundamental to the SSOT. Sabah Geo Hub makes a reference to the ISO19115 standard for metadata capture and submission of metadata is mandatory for all resources including data, maps, and applications that loaded onto Sabah Geo Hub.

6. THREE DIMENSIONAL READY SABAH GEO HUB

The world is moving into Industry 4.0 and when compared with previous industrial revolutions, the Fourth is evolving at an exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country (Shwab, 2016).

In the geospatial industry, a lot of focus has been geared towards extending from a two-dimension (2D) to three-dimension (3D) approach, particularly the 'digital twin' (Digital Twin, 2022), a virtual representation that serves as the real-time digital counterpart of a physical object or process has been the talk of the town in past few years. Lately, the 'Metaverse' has become a buzzword with much debate on its potential implications once it is fully realised. A metaverse is a network of 3D virtual worlds focused on social connection (Metaverse, 2022).

The 3D geospatial related topic is not new to Sabah. Back in late 2007, the Sabah Lands and Surveys Department licensed a Canadian-based company to acquire a complete set of airborne Interferometric Synthetic Aperture Radar (IFSAR) data for the whole of Sabah. The mapping work was completed in January 2008 and part of the deliverables included a homogeneous Digital Terrain Model (DTM) that formed a consistent, complete and contiguous 3D base covering the entire Sabah. In 2016, the Sabah Lands and Surveys Department embarked on a pilot to create photo realistic 3D city model for a selected area in Kota Kinabalu, the capital city of Sabah. The 3D building geometries were reconstructed by referring to the relevant 2D strata title and building plans. The exterior facades of buildings were generated using both nadir and oblique aerial imagery. The sub-surface information such as underground pipelines and cables was also modelled. The Sabah Lands and Surveys Department also attempted to integrate the 3D city model and utilities models for creating 3D cadastre blocks that demarcate 'space'.

Both digital twin and metaverse are here. The main purpose of Sabah Geo Hub is about facelifting the existing SDI to support the foreseeable influx of 3D-related data, technology, application, and intelligence. The state government has already started to look into the possible frameworks and components related to governance, standard, and capacity building to prepare Sabah Geo Hub to be 3D ready.

6.1 Sabah Geo Hub Supporting Digital Twin

Countries worldwide that are running a digital twin initiative may encounter similar challenges in keeping the 3D models updated as regular as possible. The typical ways of maintaining a 3D model usually takes a fair amount of time in the laborious process of model creation using data including imagery, point cloud, and textual records that are acquired with airborne or terrestrial systems. Hence, under the revised digitalisation roadmap of Sabah, DGD will explore:

- i. Adopting AI-based solutions for rapid creation and modification of 3D models.
- ii. Developing digital twin prototypes for selected cities.
- iii. Identifying and implementing real world use cases for city digital twin.

6.2 Sabah Geo Hub Supporting Metaverse

The metaverse concept itself is not new. It has existed in online games such as Second Life, an online virtual world that was developed and owned by the San Francisco-based firm Linden Lab and launched on June 23, 2003 (Second Life, 2020) Metaverse is an online virtual world and many people believe that the metaverse is the next evolution of the Web where content is moving from flat 2D images and text to immersive, interactive 3D models.

Sabah has a lot of beautiful places of tourism and before the COVID-19 pandemic, tourism was one of the largest driving forces of Sabah's economy. Sabah won the designation 'Malaysia's Favourite Destination' at the 47th edition of the Malaysian Association of Tour and Travel Agents (MATTA) Fair 2019 (TTR Weekly, 2019). However, the tourism sector was greatly impacted by the pandemic. In the effort of rebuilding the tourism sector of Sabah, the vivid recreation of a real-world environment as digital twin through the Metaverse could allow tourism companies to build trust with potential customers, which in turn will sway purchasing decisions. By potentially offering the ultimate 'try before you buy' experience to the likes of younger generation, the Metaverse could be the future of tourism marketing.

7. SABAH GEO HUB SPURS DIGITAL INNOVATION

Based on the revised digitalisation roadmap, the state government is getting underway with various projects that are revolving around digital transformation. Under the Sabah Geo Hub, the key focus at this stage is encouraging more government agencies to co-create digital

business processes and leverage on data analytics or artificial intelligence (AI) assisted solutions to transform the ways how services are delivered to citizens as well as businesses. Furthermore, the proliferation of satellites and new data from space will bring more opportunities for ground-breaking downstream applications that will benefit everyone including the state government, businesses and citizens.

When the state government is moving into the phase of digital innovation according to its digitalisation roadmap, the focus of Sabah Geo Hub will be gearing towards introducing smart state initiatives on the digital twin and metaverse for allowing the state government to realise a new sustainable model for service delivery as well as revitalise the state economy in the COVID-19 endemic era. Among the smart state initiatives include Safe-Smart Tourism, Sabah Digital Marketplace, and Smart E-Sabah. These initiatives aim at bringing both online/virtual and offline/physical ‘transactional activities’ back into Sabah to build up the economy.

Sabah Geo Hub is not limited to sharing of data and other resources such as documents, applications, and algorithms among the stakeholder and members. It is a digital ecosystem that allows resources to be integrated, interoperable, and reusable. More importantly the ecosystem is enabled by ‘location’.

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BIOGRAPHICAL NOTES

Doria is the Director of Digital Government Division of State Public Service Department, overseeing the Digital Government Transformation Initiatives for the state. Prior to this appointment, she has worked in the Lands and Surveys Department, where she headed the Geospatial Development and Management Section (GDM) that looks after IT, Geospatial, Land and Survey Systems and as Chief Security Officer for the state department. GDM Section also serves as the secretariat for the Sabah Geographic Data Coordination (SGDC) which implements the State Spatial Data Infrastructure. She has BSc (Hons) in Surveying Science from University of Newcastle Upon Tyne, United Kingdom in 1989 and MSc in Remote Sensing and GIS from Universiti Putra Malaysia in 2003.

Datuk Haji Safar Untong is currently the State Secretary of the Sabah State Government and he has championed the Digital Government Transformation Programme for the state. Prior to this appointment, he was the Director of the Lands and Surveys Department. He joined the department in 1987. He holds a Bachelor of Land Surveying (Honours) from Universiti Teknologi Malaysia in 1987 and Master in Business Administration (MBS) from Universiti Malaysia Sabah in 2006 and Master of Science (Land Administration and Development) from Universiti Teknologi Malaysia in 2008. He has championed many digitalisation projects during his tenure in the Lands and Surveys Department.

He is a Registered Professional Land Surveyor, former Chairman of the Sabah Surveyors Board, Member of the Central Town and Country Planning Board (Sabah), Member of Royal Institution of Chartered Surveyors United Kingdom (MRICS), Fellow of Royal Institution of Surveyors Malaysia (FRISM) and Honorary Fellow of International Institute of Utility Specialists.

He is currently the Vice President of International Institute of Utility Specialists (session 2019-2023) and the Council Member of ASEAN Federation of Land Surveying and Geomatics (session 2017-2019).

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