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Geomatics Engineering Ecosystem, What More to Be Done

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ABSTRACT

Shared Prosperity Vision 2030 (WKB2030) is one of the Malaysian government's initiatives to achieve the goals of a developed country by the year 2030. It is one of the motivational pillars that ought to underpin state-level policymaking and development strategies with the participation of all relevant professional professions. The geomatics engineering profession is one of the country's core prospects and has contributed to the geomatics field in Malaysia, also responding to the call of WKB2030. Unfortunately, the digitalization process is moving too fast and adaptation to current technologies is crucial to stay relevant in the industry. As a result, this study highlighted the geomatics engineering direction through previous study trend identification and the compilation of the blueprint for WKB 2030 to ensure the geomatics engineering profession strives hard in adapting and contributing to national development. To empower the geomatics engineering ecosystem, various initiatives have been emphasized with the involvement of the geomatics engineering community in implementing new measures to enhance the field's established services by leveraging innovations developed in the context of the Fourth Industrial Revolution (IR 4.0). Lastly, this manuscript will examine, from a geomatics engineering stance, how the geomatics field has adapted to recent technological breakthroughs in order to realize the WKB2030 objectives.

Keywords: WKB2030; geomatics engineering; geospatial; direction

INTRODUCTION

A human being, whether they're on land or water, is interested in finding the best route to their destination with the fewest number of stops. Keeping its hold on the land is important to them because it allows them to provide necessities like shelter and food. In addition to these uses, maps are becoming important for things like settling legal disputes, assessing land value, and enforcing territorial rights through geomatics engineering (Bikis & Pandey 2022). When compared to earlier times, today's map-making and usage are vastly superior. Records from as far back as 5000 BC show that Egypt implemented a land tax system based on land area and income and that maps were drawn up to settle legal issues caused by Nile flooding. The oldest known document dates back to 4000 BC and was drawn on a tablet. The tablets on which this information is written were discovered in the Arabian Peninsula's arid regions (Yakar et al. 2020). On the other hand, in 1513, Piri Reis drew the first complete map of the world (Narin & Gullu 2022).

Gathering field data, processing it with math, and drawing out the results is all it takes to create these maps (Fischer et al. 2019). Each technique is unique since it is based on the specific instruments used in each of the process steps. Steel tapes, plumbs, poles, and prisms were some of the common measuring tools of yesteryear. Measurements were taken by hand and used in calculations with the help of rulers, squares, and compasses. Large-scale maps of relatively tiny locations were painstakingly drawn out with lead pencils and then inked. As technology has progressed, digital equipment for geomatics engineering has been developed that makes measuring simpler, quicker, and more accurate (Abdul Rahman et al. 2022). Electronic tacheometers and GNSS receivers have mostly supplanted the theodolites, while dumpy levels have given way to compensated (automated) levels, digital levels, and laser levels (Yakar et al. 2020; Gunawana et al. 2021). Computer software allows for faster and more accurate computations and mapping. Map plotters can be used to create both flat and 3D representations of the landscape (Mustaqim Mazlan

et al. 2022). The use of Light Detection and Ranging (LiDAR) systems and Unmanned Aerial Vehicles (UAVs) has made it possible to quickly and accurately obtain maps showing the elevation and position of vast areas. Accurately simulating Earth's surface will be impossible without the further progress of Artificial Intelligent (AI) and space/ satellite technologies in the not-too-distant future.

In general, the geomatics engineering field is responsible for driving the country's development and functions in the fields of geomatics, surveying, civil engineering, mapping, and geospatial information, in addition to carrying out measurement and mapping work as the basis of socio-economic development and national sovereignty (Hassan & Abdul Rahman 2021). As one of the sources of information, the geomatics engineering field is evolved and committed and responsive to the Shared Prosperity Vision 2030 or *Wawasan Kemakmuran Bersama* (WKB2030) initiative to become a fully developed country by 2030 (Sanwari & Teknokorporat 2020). The geomatics engineering field has played a role in the aspect of geomatics and geospatial information to achieve government vision and programmes introduced and implemented in the realisation of WKB2030, either directly or indirectly. In this context, geomatics engineering together with geospatial information and technology are essential in forming a primary platform to drive the country's development, which undoubtedly contributes to achieving WKB2030 objectives. Therefore, this article discusses some initiatives that need to be taken to empower the geomatics engineering field from a geospatial perspective to fulfil WKB2030 goals, including the ability and readiness, and impact on the geomatics profession.

SHARED PROSPERITY VISION 2030 (WKB2030)

On 18th October 2018, the Prime Minister of Malaysia unveiled the Shared Prosperity Vision as the new direction of the country during the drawing up of the Mid-Term Review of the Eleventh Malaysia Plan (MTR 11MP) in Parliament (EPU, 2019). The main goal of the Shared Prosperity Vision is to ensure that all Malaysians have access to a comfortable standard of living by the year 2030. To achieve the goals of the Shared Prosperity Vision, the nation must alter its economic system, revamp its business ecosystem, and fortify its current policies and programs.

As part of the proposed labor market reforms, workers' skill sets will need to evolve to meet the demands of high-wage industries. It is hoped that by making these changes, the average Malaysian will be able to boost their standard of living and so maintain their competitive edge over time. To realize the desired aims, the Shared Prosperity Vision specified three objectives, 15 guiding principles, seven strategic thrusts, and eight enablers. The framework of WKB2030 is as in Figure 1 and Figure 2. Some of the guiding principles of WKB 2030 were adopted in this study to identify the potential direction of geomatics engineering in tandem with the WKB 2030 vision.

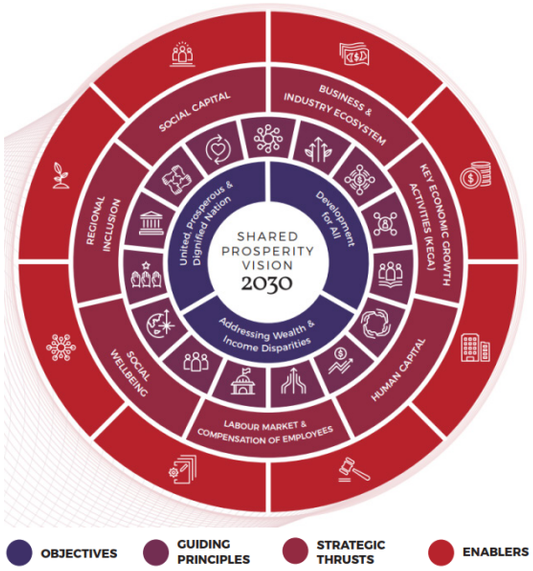

FIGURE 1. The framework of WKB2030 (EPU, 2019)

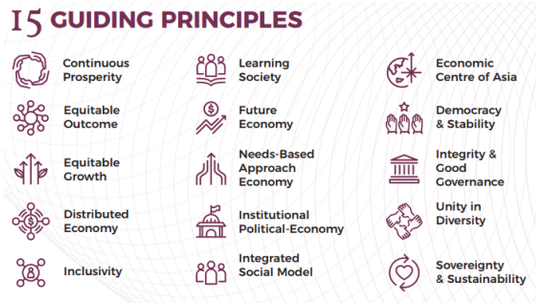

FIGURE 2. The 15 guiding principles of WKB2030 (EPU, 2019)

WKB 2030: HOW GEOMATICS ENGINEERING SHOULD RESPOND?

In order to respond to the government's demand, especially in achieving the WKB2030 goals, there is some initiative that needs to be taken to empower the geomatics engineering field as a core prospect in the geospatial activities in Malaysia. The eight (8) geomatics engineering direction identified from the previous study trend (Reddy & Singh 2018; Visvizi et al. 2018; Coutts & Strack 2019; Lu et al, 2019; Timoulali, 2019; Tucci et al., 2019; Li et al., 2020; Mancini et al. 2020; Tang et al. 2020; Zhang et al. 2020; Hsu et al, 2021; Oniare & Kirim, 2021; Botto et al., 2022; Clemen, 2022; Hassan et al, 2022; Yeap 2022) and highlighted in this article comprises core aspects including (i) governance and institutions, (ii) policy and legislation, (iii) entrepreneurship and finance, (iv) security and defense, (v) technology and innovation, (vi) human capital, (vi) collaboration, and (vii) data and standards.

GOVERNANCE AND INSTITUTIONS

The first aspect of geomatics engineering direction is governance and institutions as a response to the 13th WKB 2030 Guiding Principle of Integrity and Good Governance. Strengthening governance is crucial to ensure efficient, quality, and integrated service delivery as highlighted by Timoulali (2019) in his study. Various efforts are required to achieve this aspect, including strengthening the organizational structure through the implementation of the restructuring of the geomatics-based organization (Tucci et al. 2019), establishing a holistic geospatial activity management platform, and improving organizational management efficiency and transparency of service delivery. Besides that, other attempts are also required such as enhancing and adapting new technologies from time to time (Reddy & Singh 2018), including strengthening the role of the geomatics-based organization (Tucci et al. 2019) in supporting the aspirations of WKB2030, creating a conducive and modern working environment, and optimizing the use of the latest technology, especially in Malaysia.

POLICY AND LEGISLATION

The second aspect is policy and legislation as a response to the 13th WKB 2030 Guiding Principle of Integrity and Good Governance and the 7th WKB 2030 Guiding Principle of the Future Economy. The strengthened policy and legal mechanisms in surveying, mapping, and geospatial activities need to be conducted to improve the feasibility of geospatial activities in Malaysia. A major challenge of our time is to strategically improve the quality of services in the geomatics and modern technology fields and transform them into dynamic, evolving organizations with virtual reference layers that enable one-of-a-kind service experiences (Visvizi et al, 2018). The conscription of acts/circulars for the affairs and regulation of surveying activities, mapping, and geospatial is being actively implemented and needs to improve the deliverables, especially for the geomatics engineering profession (Zhang et al. 2020). On top of that, the arrangement of regulations and guidelines related to measurement activities, mapping, and geospatial also improved from time to time to make sure the standardization of the geomatics activities can be centralized (Zhang et al. 2020).

ENTREPRENEURSHIP AND FINANCE

The third aspect, entrepreneurship and finance is responding to the 7th WKB 2030 Guiding Principle of the Future Economy. The increasing economic generation from geolocation-based services is planned for national development. The coordination activities include the payment of wages and survey fees based on current technology and reviewing the impact of return on investment (ROI) on each geospatial development that needs to be standardized. Furthermore, identifying the geospatial data demand in various industries and public activities was also determined to increase the economic results from new surveying, mapping, and geospatial activities (Oniare & Kirimi 2021). It is crucial to strengthen the geospatial sharing model at the inter-government and intra-government levels to fulfil the pillars (Figure 3) and digitalization trend of Industrial Revolution 4.0 (IR 4.0).

FIGURE 3. The IR 4.0 pillars (Saturno et al., 2017)

SECURITY AND DEFENSE

The fourth aspect, which is security and defense is a response to the 12th WKB 2030 Guiding Principle of Democracy and Stability. It is to ensure national security and defense are guaranteed through an integrated and comprehensive geospatial management system. Geomatics through geospatial technologies provides the capability of monitoring, forecasting, and combating threats. Additionally, these technologies assist in the strategizing and support of field operations in defense and intelligence-related fields. This is with the awareness that the most important factors to consider when carrying out military operations are the location and the timing (Yeap 2022). It is quite important to have the capacity to comprehend what took place, when it took place, where it took place, and how it took place. The strengthening of multiple components such as the management of the land and maritime boundaries of the country, the organization's infrastructure, and cyber security, was conducted to maintain and improve the security and defense, aspect (Yeap 2022). Establishing a clear information-sharing framework among security and defense agency stakeholders is also considered to ensure that national sovereignty is preserved through surveying, mapping, and geospatial activities.

TECHNOLOGY AND INNOVATION

The fifth aspect is the technology and innovation response to the 6th WKB 2030 Guiding Principle of a Learning Society. The management and dissemination of geospatial information were actively conducted through the latest information technology infrastructure. This is because

the data obtained through geomatics serves as the basis for the development of infrastructure. Both the geomatics community and the industry overall are going to receive a significant boost as a result of the quickly developing innovations in the geomatics sector, which are presenting previously unanticipated potential in the connectivity of geomatics engineering fields with other domains as shown in Figure 4. The approach of empowering surveying, mapping, and geospatial services digitally integrated with big data analytics functionality was taken in order to diversify the geospatial products to meet the needs of stakeholders (Mancini et al. 2020). In addition, activities to develop geospatial technologies with various experts and stakeholders were carried out to enrich innovation with existing infrastructure in line with current and future technology trends.

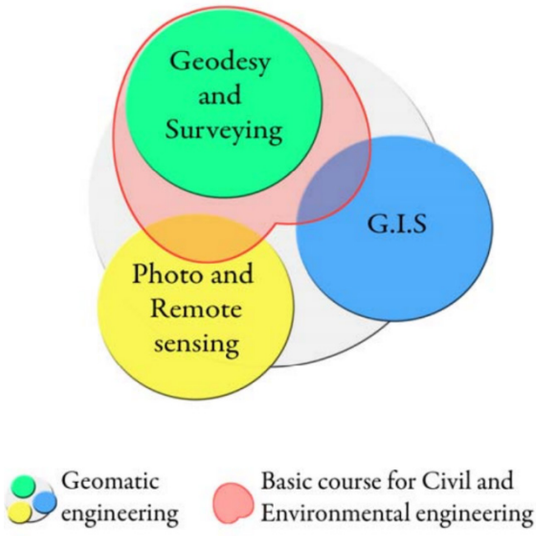

FIGURE 4. Connectivity of geomatics engineering with other related domains (Deshogues & Gilliéron 2009)

HUMAN CAPITAL

For the sixth aspect, human capital is a response to the 6th WKB 2030 Guiding Principle of a Learning Society. The continuing approach will be stressed to maintain competent, knowledge-based, productive, and proactive human capital. It is vital to increase geomatics communities' competence to holistically strengthen capabilities, authority, and skills to produce an expert workforce in the field of geomatics engineering at the organizational level (Tang et al. 2020).

Furthermore, it would appear that the geomatics engineering profession is the natural home for such experts, regardless of whether or not they would want to classify themselves as surveyors, and in specific, geospatial surveyors. This is because the geomatics engineering profession focuses on the collection, analysis, and interpretation of geographic data. They are all engaged in the same line of work, which is measuring and mapping, which is the traditional responsibility of the profession of surveying. A public that is better informed about the vastly expanded responsibilities of traditional land surveyors is another benefit of such integration between geomatics engineering and a geospatial profession (Coutts & Strack 2019). Lastly, the consolidation of surveying, mapping, and geospatial training modules is considered necessary to strengthen the research program according to the core areas of geomatics. It is to ensure the continuity and relevance of the surveyor profession over time in line with qualities without ignoring the geomatics engineering social responsibility to staff and the community.

COLLABORATION

For the seventh aspect, collaboration is a response to the 13th WKB 2030 Guiding Principle of Integrity and Good Governance. The collaboration aims to increase cooperation in delivering geospatial services to meet the needs of customers and stakeholders. The infrastructure's future interaction across the network and delivery life chain and beyond into the geomatics management lifecycle is progressively being established on the foundation of collaborative technologies. The geomatics engineering community needs to expand partnership and cooperation in geospatial technology with various parties at the local and international levels (Li et al. 2020). It helps in the geospatial data marketing strategy regarding data application and standards. Furthermore, establishing a working committee at the national level through the National Mapping and Spatial Data Committee (JPDSN) by the Department of Survey and Mapping Malaysia (JUPEM) has opened the opportunity for the geomatics engineering community to involve various experts from academic and industrial players, which is also part of the collaboration initiative.

DATA AND STANDARDS

For the eighth aspect, data and standards are a response to the 7th WKB 2030 Guiding Principle of the Future Economy. It is crucial to empower geospatial management and services according to standards and achieving the best quality of work is part of the geomatics engineering direction. Guidelines developed by the International Organization for Standardization (ISO) can assist organizations in managing the accessibility, quality, and correctness of their data, among other aspects of data management (Clemen 2022). When it comes to the publication of data, there are standards in place that can assist a wide variety of users in gaining access to and modifying a variety of data.

The standardization, sharing, and consistent data development at various levels are highlighted to complete the preparation of fundamental data and a national framework (Hsu et al. 2021). Activities involving the development of standards for geographic information in this country are carried out in stages. Cooperation and support from all data providers and users of geospatial information

are very necessary especially in providing comments during the preparation of geographic information standards and also for the implementation of standards that have been developed. Furthermore, efforts are being made to improve geospatial accuracy and usability in order to strengthen the country's geomatics fabric and infrastructure.

ABILITY AND READINESS

As a way to react to geomatics engineering direction, the ability and readiness among geospatial data providers, specifically in Malaysia, should be assessed. Therefore, this section will discuss the ability and readiness of geospatial data providers from a geomatics discipline perspective. In the ISO/TC 211 group of standards by the International Organization for Standardization (ISO), geomatics is described as a discipline concerned with the collection, distribution, storage, analysis, processing, and presentation of geographic data or geographic information (Botto et al. 2022). The geomatics discipline is expanding in line with technological advancement. The influence of IR 4.0 throughout the world has undoubtedly revolutionised the geomatics field. For example, the data collection, storage, processing, and presentation process is evolving from manual to semi-automatic or automatic through the IoT medium. Moreover, the extraction of every detail that contains information related to a specific location on the earth's surface has also been influenced by artificial intelligence (AI) technologies, where automated feature extraction has been applied throughout the geospatial industries (Lu et al. 2019).

When it involves location, it cannot be separated from surveying and mapping activities as the primary source of geospatial data development. For example, in Malaysia, the JUPEM is an authoritative body for carrying out surveying and mapping activities. Among these activities are cadastral measurements, demarcation measurements, measurements for engineering purposes, geodetic positioning control measurements, and topographic mapping based on photogrammetry measurements, LiDAR, Interferometric Synthetic Aperture Radar (IFSAR), or remote sensing (Hassan et al. 2022). JUPEM is also the leading supplier of geospatial data to government agencies, the private sector, and citizens such as the general public and students. Among the geospatial products developed by JUPEM are cadastral lots, topographic data, utility data, digitized interface models, orthophoto images, and so on. All of these products have gone through standard audits to ensure usability by external users, especially among the geomatics engineering community. With the aid of geomatics-based organizations such as the Royal Institution of Surveyors Malaysia (RISM), Land Surveyors Board (LJT), and Association of Authorised Land Surveyors Malaysia (PEJUTA), the geomatics engineering direction can be accomplished, and the adaptation of current technologies in tandem with the relevancy of the surveyor profession over time can be preserved with the cooperation of all parties.

IMPACT ON GEOMATICS ENGINEERING PROFESSION

THINK BIGGER

The geomatics engineering direction is an excellent starting step. It reflects the geomatics engineering community's determination to produce not only short-term output but also comprehensive outcomes that are detailed and have a clear direction, in line with the Government's demand for the field of geomatics. The geomatics engineering community must think bigger and be responsible for providing geospatial information. They need to provide services not only to provide data but also to respond in terms of experts referring to the stakeholders and public users. Therefore, the geomatics engineering community must be aware of the advancement of current technologies and expand new skills in surveying, mapping, and geospatial to ensure this profession is always relevant to the digitalization trend.

TOWARDS DIGITAL WORLD READINESS

In tandem with the 6th Enabler of WKB 2030, which emphasizes the use of big data as a driver for policy formulation based on empirical data and facts, the geomatics engineering community must strive to develop delivery methods to be more efficient in line with the latest technological advances. It is also essential to contribute innovation and improvement ideas that support the advancement of surveying, mapping, and geospatially based on IR 4.0, Internet of Things (loT), digital twin, and others without disregarding the challenges from the IR 4.0 evolution. Through this formulated direction, it can catalyze the work planning will become more focused, planned, and systematic in strengthening the delivery system of surveying and mapping services while also being able to achieve the stakeholders' wishes and give satisfaction to users.

GREAT CONTRIBUTION

Geomatics engineers have a big role in ensuring the development of the country runs smoothly. In the field of civil engineering, the geomatics engineering field provides many services from planning, development, monitoring, and verification of engineering projects. When it comes to potential job opportunities, the geomatics engineering field is among the most open-ended options. Its contributions to reducing poverty and improving people's standards of living in developing countries are crucial to the success of countries. As a visualization-based science for geospatial information connected to virtually any field of study, it plays a crucial role and provides excellent functionality. In light of this, it is crucial to raise awareness about the great contribution of geomatics engineering for their efforts to help countries in growth. Last but not least, geomatics engineering contributes to the cultivation of competent geo-experts, who

in turn could help to expand the Geo-market to all of Asia. In order to keep up with industrialized nations, rather than always falling behind, the mentioned directions should be highlighted to leap and catch up to their pace.

WAY FORWARD

The field of geomatics engineering holds the key to the future of our industry. The results from this area are used every day, often without people realizing it. Take, for example, the variety of personal navigation tools now available, from handheld gadgets to integrated solutions in everything from vehicles to emergency response teams and hospital x-ray systems. Digital photography, geographic information systems (GIS), satellite-based navigation, earth observation, Global Positioning System (GPS), and land tenure are just a few of the many fields that provide exciting opportunities. Everything that goes into geomatics engineering revolves around creating and employing cutting-edge technology, both to aid in the study of spatial information and to benefit people all over the world. Applications of digital imaging range widely, from mapping tools like Google Earth to x-ray and MRI imaging in the medical field to use in agriculture and building design. A geomatics engineer can help ensure Earth has a sustainable future by observing natural disasters and climate change through remote sensing and geodesy to gain a better understanding of the complex interactions between the Earth's many surfaces. The Prime Minister of Malaysia has introduced the policy framework known as Malaysia MADANI, which is built upon six core values: sustainability, prosperity, innovation, respect, trust, and compassion. As a geomatics engineer, one can contribute to elevating the field of geomatics to a new level through the implementation of these core values. The adaptation of Malaysia MADANI's values will serve as the driving force for development in Malaysia and will improve the quality and integrity of processes and products. In recent years, because of advances in technology, it has been simpler to find workable solutions to urban issues, all while attempting to cause as little harm to the environment as possible and make the most efficient use of available resources. In this context, new approaches to city administration are being developed all over the world, including the concept of a digital twin, as well as digital shadows and smart cities. The geomatics engineering sectors stand to benefit greatly from these cutting-edge advancements, as they provide sufficient space for advancement to meet rising global demand. Throughout this light, geomatics engineering's practical implications and prospects are practically boundless. Because of this, the highlighted geomatics engineering direction needs to be taken seriously and effectively implemented as a guideline for the development of the geomatics engineering profession.

CONCLUSION

In conclusion, the geomatics engineering direction is critical because it is a blueprint that is the basis of reference to determine the direction of the geomatics field for the long term. With the advancement of technologies, especially in the geomatics field, many things can be improved and enhanced for the greater good. The influence of IR 4.0 cannot be denied anymore, even though the whole world is moving fast to fulfil the space and opportunities offered. The current opportunity including IoT, digital twin, real-time and so on must be seized by the geomatics engineering community to ensure that the opportunities presented are not snatched by other fields. Therefore, the cooperation of all parties, especially the geomatics community, is very necessary to achieve the goals set out. Through the cooperation of the geomatics community, the empowering process of the national geospatial agenda through sustainable and inclusive surveying and mapping services to meet the nation's aspirations can be successfully implemented in line with the goals of the WKB2030.

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DECLARATION OF COMPETING INTEREST

None

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