EKADASTER: A LEARNING EXPERIENCE FOR MALAYSIA

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SUMMARY

Malaysia has moved leap and fold from her original states of old conventional surveying to the current modern technique with state of the art equipment. Malaysia has experimented and employed various available techniques to enhance her data capturing ability and expedite the production of certified plans for final land title. eKadaster (eCadastre) is the latest venture of the Department of Surveying and Mapping Malaysia (JUPEM) in achieving the said objective. Malaysian Cadastral system is based on the Torrens System which basically consists of 2 vital components namely; land registration and cadastral survey. Since 1980's, to better support the land administration system, JUPEM has embarked on the modernization of the cadastral survey system in stages in line with the advancement of computer technology. JUPEM's modernization programs started with the initial computerization of its cadastral office and field system based on automating the manual procedures and the subsequent improvement with the introduction of Geographical Information System (GIS) technology. However, in 2007, the computerized system was deemed obsolete with the introduction of "coordinated cadastre". The earlier system developed was unable to capitalize on the advent of satellite based technology (GNSS) and hinders the practice of an absolute real time positioning cadastral survey. Thus, a complete revamp of the system is needed with the incorporation of coordinated cadastral survey concept to the newly developed eKadaster system. The system in essence means to improve JUPEM's delivery system and expedite the process of preparing and producing Final Title Plan (B1 Plan). The eKadaster coordinates system is developed based on an earth-centered datum. The least-square adjustment technique is used to replace the old Bowditch method in the distribution of survey errors as the ultimate prove of boundary mark position. At the same time, a new fully GIS-ready database is established, namely the National Digital Cadastral Database (NDCDB). The NDCDB allows B1 Plan to be issued quickly and together with the introduction of a multipurpose cadastral module would open up the system to new potential users in Malaysia. The paper looks into the cadastral system and the whole exercise of JUPEM's eKadaster and its potential for future expansion.

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1. INTRODUCTION

Land security and good land delivery system have been the focus of the government of Malaysia long before its inception in 1959 as an independent country. It has been realized that poor land administration system hinders investment and hence good land usage. However, couple with existing Land administration and demarcation system, Malaysia have made full used of the advancement of the Information and Communications Technology (ICT) to help provide an efficient land delivery system to the people.

In doing so, two (2) major ICT projects were carried out under the 9th Malaysian Plan by JUPEM and the Land Office. JUPEM was entrusted to expedite the survey and preparation of B1 Plan related to the issuing of land title which resulted in the development of eKadaster (eCadastre). At the same time, the State Authority (Land Office) is entrusted with the development eTanah (eLand), to efficiently manage land registration and to allow data movement from eKadaster digitally. Both initiatives and efforts under the eTanah and eKadaster encompasses the effort to reduce bureaucratic red tapes as well as improving and reengineering internal processes in managing and administering components involved in land administration, specifically in the issuance of Final Titles (FT).

2. CADASTRAL SYSTEM OF MALAYSIA

Basically, Malaysia adopted the Torrens System originated from Australia in its land administration system. It has two components, which are the land registration and the cadastral survey. Land matter in Malaysia is exclusively a state matter except for lands in the Federal Territories. The State Authorities basically administer state lands which also includes rights to all minerals and rocks material within the territory of the state. It can alienate land in perpetuity or for term of years, in consideration of payment or rent. Land owner only own rights to the land. There are several laws involved with land administration with the National Land Code 1965 (Act 56, NLC) as the main umbrella law on land. When putting the NLC into practice, it must be read together with other Acts, Enactment and Ordinance of individual States in Malaysia. JUPEM as a Federal entity carries out survey of land in all the states with the support of Licensed Land Surveyors.

Land ownership under the Torrens Systems is defined by land parcel with distinctly demarcated boundaries and land area. It aims at guaranteeing legal property boundaries and to assure an indefeasible of title to those included and registered in the register. Thus, land titles, both Qualified Titles (QT) and FT are conclusive proof that the person mentioned is indeed the owner of the land described therein. As registered owner with indefeasible title, the law protects and assures the certainty of land ownership and other rights in land, coupled with the ability to locate the land on the ground. These are essential recipes for a stable and vibrant economy which would encourage investment into the country. A valid title requires an accurate description of boundaries shown in a B1 Plan. This is provided through cadastral surveying. Thus it is important for State Land offices and JUPEM to work closely to ensure efficiency in land delivery system.

3. ISSUES IN THE CADASTAL SYSTEM

In the 1960s, Malaysia introduced the concept of Qualified Title (QT) which is a form of land titles available in accordance to the National Land Code (NLC). It has the properties of a Final Title (FT) and was recognized as alternatives to confirming security of tenure, thus promoting the growth of Malaysia's land market. It is issued to land owners for all intents and purposes without a final survey (Cadastral survey). The concept was initiated for administrative expediency in the face of slow pace registration of FT, attributed to increasing land openings for developments and the lack of qualified land surveyors to cater the rising cadastral survey demands.

QT was very successful in support to Malaysia's active land market. It however has the effect of instigating more land ownership units than surveyed land parcels. This eventually caused FT registration to be delayed in the Land Offices, hence resulted in the loss of revenue to the Federal and State Governments by way of survey fees, quit rents and hinders sub-division, partition and amalgamation for land developments. A QT and an FT are conclusive proof that the person mentioned therein is the owner of the land described therein. It establishes the ownership of an indefeasible' title to land and, therefore, legalises all dealings on land.

4. MODERNISATION OF CADASTRAL SURVEY

There have been many changes made technically, operationally, structurally and institutionally in Malaysia cadastral survey over the past decades The reasons for these changes have been metrication, micro-economic reform, quality assurance demands, the requirement for increased service provision and increased efficiency, and the larger needs of clients and governments. As public expectation relating to land delivery system increases, the issue involving delayed QT to FT registration has notably became crucial to overcome. Speed is of the essence and zero error. Furthermore, poor land governance inhibits investment and undermines investor's confidence for land developments.

Cadastral Survey in JUPEM goes digital with the implementation of the Computer Assisted Land Survey System (CALS) pilot project in 1985 initiated for the state of Johor. The system has generated, for the first time ever in the history of JUPEM, a Digital Cadastral Database (DCDB) at a scale of 1:4,000. This, subsequently, led to the implementation of another CALS in the State of Pahang in 1986 and the introduction of the Mini-CALS system in all remaining State's JUPEM of Peninsular Malaysia in 1992, thus completing JUPEM initial nationwide computerisation programme. The ensuing generation of CALS system incorporates a decentralised "client-server" workstation configuration, a "seamless" database and a GIS suite of software for future integration with information systems of clientele departments.

In 1998, JUPEM also introduced the Cadastral Data Management System (CDMS), mainly to repopulate the DCDB in every State's JUPEM and allow multiple users to operate the user-limited Mini-CALS system. The ensuing CDMS Upgrade used the Gigabit Ethernet (GE) backbone and co-exist with the CDMS ATM backbone to work insymphony as one. The aim of the CDMS Upgrade is to upgrade the functionalities of the CDMS modules without modifying the modules to provide minimal interference on JUPEM's production line.

In tandem with the technological changes introduced in the office, modern survey equipment such as the Theodolite, Electronic Distance Measurement and Total Station were introduced to JUPEM's field surveyors to replace the obsolete land survey equipment. Rapid IT development has enable JUPEM to further enhance the cadastral data acquisition capability in the field by implementing the "field-to-finish" (F2F) concept in 2002. The main components that were developed to achieve the F2F concept were the Total Station System (TSS), CDMS Upgrade and District Survey Office Automated System (DOAS). Its development have demonstrated significant improvement in productivity, and hence increased cost-effectiveness.

5. REFORM IN CADASTRAL SURVEY

Various modernisation and innovative efforts been made in the cadastral surveying system, to make the rigid cadastral surveying method becomes a simpler yet meets the desired accuracy method is necessary. A study by the Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) has sanction JUPEM to improvised cadastral survey workflow and shorten the duration in preparing Title Plans from two years to ten months.

Through studies carried out by JUPEM, it was found that the mechanism in the existing cadastral survey has some drawbacks. In an ideal environment, the likelihood for JUPEM to fully complete the inevitable Request for Survey (PU) by optimizing the digital environment of Field to Finish (F2F) was still time-consuming. Nonetheless the lengthy and rigid cadastral workflow unfortunately still does exhaust long operation time, resources and very costly to complete it. It

was also found that the method of survey and error distribution is not truly whole-to-part method and is unable to handle redundant observations. At the same time, the bearing and distance, as the main information, as well as the Cassini projection system does not augur well with the requirement of GIS and Global Navigation Satellite System (GNSS) technologies. The different coordinates systems employed in both the cadastral system and mapping system uses different datum and resulted in incompatibility as far as digital databases is concerned.

In the wake of this, JUPEM has undergone a complete transformation in its cadastral workflow with the development and implementation of the eKadaster project under the 9th Malaysian Development Plan.

6. eKADASTER; OPTIMIZING ICT TO IMPROVE CADASTRAL SURVEY DELIVERY SYSTEM

eKadaster is a system that optimized current ICT, GIS and survey technologies, implicating modification in cadastral survey manner from the traditional Bowditch and Transit methods to a Survey Accurate Coordinate system using Least Square Adjustment. eKadaster transforms the current regiment cadastral system to a coordinated cadastral system (CCS). The main philosophy of applying CCS is to use a geocentric datum, to have a common datum for the whole country and the application of least square adjustment procedure in the distribution of survey errors. With CCS, GNSS will be the natural tool for cadastral surveys, hence enabling absolute and real time positioning, with coordinates being given legal significance. The prominence of measured bearing and distances are reduced whereby they are considered as only a means by which the final adjusted coordinates are derived. In supporting the development of eKadaster, all ICT projects which have been successfully implemented at state JUPEM, i.e., TSS, DOAS and CDMS Upgrade were incorporated into the new eKadaster environment.

7. eKADASTER ENABLERS

7.1 DIGITAL OPTIMISATION & CHEAPER EQUIPMENT

Nowadays, digital hardware and on the shelf software are cheaper and easily available. Bigger data storage and the capabilities of current ICT advancement have favours innovation of processes, which was once thought impossible or tedious to be done via the conventional method.

7.1.1 Least Square Adjustments

The conventional Bowditch method is known as an arbitrary method since the corrections to the observations are applied irrespective of their uncertainties, whereas the least square adjustment method is a more advanced technique which adjusts observations based on the laws of

probability, which models the occurrence of random errors. This results in adjusted values having the highest probability. Thus, the least square adjustment method provides the best and most rigorous traverse adjustment, but until recently the method has not been widely used because of the lengthy computations required. The availability of computers has now made these calculations routine and consequently the least squares method has gained popularity. On top of that, the least square adjustment is valid for any type of traverse and has the advantage that observations of varying precisions can be weighted appropriately in the computations.

7.1.2 Internet/broadband/wireless revolution

World Wide Web and laptop computing on wireless LAN infrastructure allows mobility and faster access and performance. Today, the proliferation of PDAs and smart-phones running on EDGE and 3G technologies have given rise to a pervasive computing environment that not only supports mobility but more importantly the efficient and fast processing of data anywhere, anyplace. This enables field officers to download job/data anywhere within the telecommunication

7.1.3 Data Security via Public Key Infrastructure

Due to the sensitive and confidential nature of the data and business operations handled by JUPEM, security is a very important feature of the JUPEM system.

A Public Key Infrastructure (PKI) is now available with the implementation of the Digital Signature Act (DSA) 1997 and the Digital Signature Regulation (DSR) 1998. The PKI is a digital security solution that ensures the integrity and irrefutability of digital data submitted and received by JUPEM, valid in a court of law. With the use of PKI, paper documents and handwritten signatures are replaced with automated workflow processes and digital documents secured with digital signatures and digital envelopes.

Innovative use of technology to authenticate hardcopy documents to prevent counterfeiting and forgery is now available in the form of 2D barcode (Figure 1). The 2D barcode enables to deter and detect unauthorized reproduction and tampering of documents due to its capability to store large amount of data that is only accessible by an authorized person. With the security features of PKI embedded, it ensures the authenticity, data integrity and non-repudiation for the document. This would also make easy detection for any tampering.

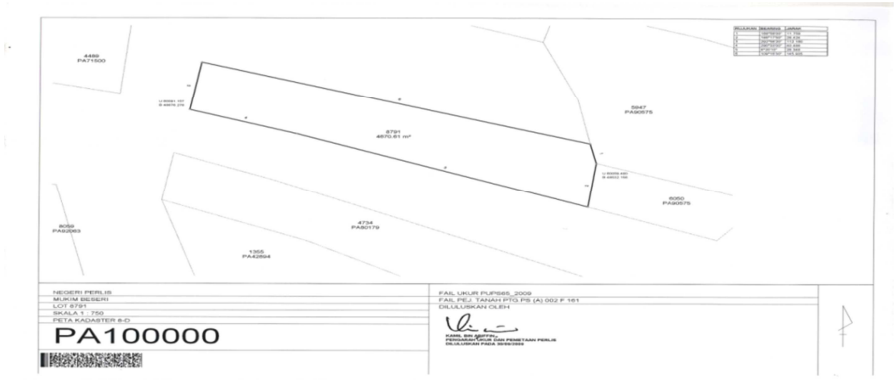

Figure 1: A Certified Plan with 2D barcode generated using the Digital Raster Plan (DRP) Module under the eKadaster system

7.1.4 GNSS

GNSS equipment is now not only smaller in size, but notably cheaper in cost whilst maintaining accuracy standards acceptable for the densification of cadastral survey control network of points. With the full constellation of satellites available today including the addition of new civilian signal and other system such as GLONASS and Galileo, precise positioning technology using satellites with its all-weather capability has enable position determination to be carried out with relative ease and cost effectiveness.

7.2 OPTIMISING AVAILABLE SURVEY INFRASTRUCTURES

JUPEM have set-up the surveying infrastructure throughout the country by employing real-time technology in surveying and product dissemination.

7.2.1 GDM2000; A Geocentric Datum

Cadastral Survey has always been based on the local Cassini-Solder Coordinate Projection System which is a plane coordinate system for local cadastral system. Each state has its own origin and reference meridian resulting in a total of 9 different states' coordinate systems. The different origins in different states have resulted with digital databases of incompatible coordinate system.

On 26th of August 2003, with the launching of Geocentric Datum of Malaysia 2000 (GDM2000) a single referenced geocentric datum was adopted to convert the state-based localise Cassini-Soldner system into the Geocentric Cassini Coordinate Projection System. The conversion

allows efficient data exchange and sharing from various information systems compatible with global coordinates obtained from GNSS and other coordinate systems adopted in many parts of the world such as satellite images, topographical maps and aerial photographs.

The GDM2000 is based on the ITRF geocentric reference frame defined at epoch 2 January 2000 at an accuracy of 1 cm. This datum supersedes the existing classical geodetic datum (Figure 2) in Malaysia. JUPEM have also taken into account the displacement and movement due to the Sumatran earthquakes in 2004, 2005 and 2007 with the new GDM2000 (2009) coordinates. This new GDM2000 (2009) would be continuously maintained and managed through the use of MyRTKNet permanent tracking stations to ensure the availability of highly accurate, homogeneous and up-to-date datum of Malaysia

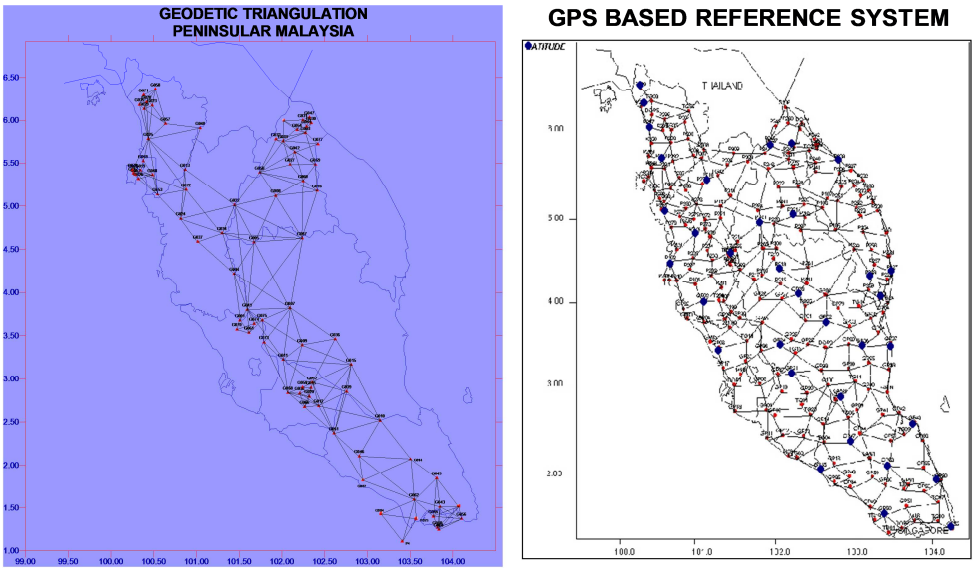

Figure 2: Old and new Geodetic Infrastructure established by JUPEM

7.2.2 MyRTKNet (Network-RTK System)

The Network-RTK utilising "Virtual Reference Station" is a technique based on having a network of GNSS reference stations continuously connected via tele-communication network to the control centre. A computer at the control centre continuously gathers the information from all receivers, and creates a living database of Regional Area Corrections. With VRS system, one can establish a virtual reference station at any point and broadcast the data from the reference station to roving receivers.

To take full advantage of the real-time capabilities of the VRS system, JUPEM has established MyRTKNet, a network of permanently running GNSS base stations, at spacing from 30 to 150 km, feeding GNSS data to a processing centre via a computer network. A central facility was setup to model the spatial errors that limit GNSS accuracy through a network solution and generate corrections for roving receivers to be positioned anywhere inside the network with an accuracy better than a few centimeters in real time. At the same time, a web site was made available to download GNSS data for post-processing differential solutions. Currently, there are 78 RTK reference stations for the network covering the whole Peninsular Malaysia and two major cities in Sabah and Sarawak.

7.3 TOWARDS COORDINATED CADASTRAL SYSTEM (CCS)

JUPEM have work on several projects with University of Technology Malaysia on the development of CCS for Peninsular Malaysia Since 1996. Among the main products is the prototype database re-coordination system and design of the Cadastral Control Infrastructure (CCI) to constraint the propagation of error in the cadastral network. This prototype modules were subsequently tested in a pilot project carried out in the state of Malacca in 2004.

The CCS pilot project aims at developing a database of homogeneous cadastral network based on the geocentric datum with a spatial accuracy of better than 5 centimetres in urban area and better than 10 centimetres in semi-urban and rural areas. The existing DCDB is not homogeneous and accurate to several meters. This is partly due to the inherent inaccuracy found in the underlying datum and unconstrained propagation of error within the network.

The project adopted the geocentric datum GDM2000 supported by permanent GPS tracking and real-time stations (MyRTKNet). The Cassini projection is maintained but is now based on the new GDM2000 parameters. At the national level, the process requires the readjustment of the cadastral network based on coordinates obtained from GNSS observation. In order to achieve the above objective there is a need to establish a dense CCI grid of 0.5km spacing in urban area and 2.5km spacing in semi-urban and rural areas. Once the dense CCI has been established the readjustment of the cadastral network will be carried out and this adjusted NDCDB will then form the base layer for all future cadastral surveys.

8. eKADASTER COMPONENTS

8.1. National Digital Cadastral Database

CCS is implemented through the eKadaster project to produce is survey-accurate and seamless cadastral database (NDCDB). NDCDB will overcome the shortcomings of the DCDB on several issues such as incompatibility with the current technologies, accuracy inadequacy, and difficulties resulting from the use of different projection and geo-reference system. The NDCDB

helps to correct the inherent issues found in the State DCDBs. In the older system, discrepancies or gaps exist between the graphical display and the value of bearings and distances stored within the DCDB as attributes. The gaps are snapped close to ensure topological integrity. Spatial analysis is limited due to the differences that exist between the observed values and those extracted from the graphical display. Only one neighbour polygon is recorded in the Boundary tables (without associated direction). Boundaries are defined by polylines instead of vertices and nodes (boundary stone). Shared line segment between boundaries are stored twice. High level spatial queries and analysis may not be possible because of the lack of topological information such as connectivity and adjacency.

To create NDCDB, the data set from DCDB has to be cleaned by undergoing rectification and adjustment by least square method on a plan by plan (PA by PA) basis, After the data cleaning process, it is essential to repopulate back the PAs by merging them, on their Block to perform the least square adjustment again. The repopulation step is required to produce a clean set of data as the main source of input for later Adjustment and Re-coordination process.

A CCI layer is then created as to establish CCI control networks on the ground. For CCI construction, GNSS stations have to coincide with DCDB boundary marks. In areas where this is not achieved, connections to boundary marks are made to tie up DCDB to CCI so that formation of a controlled network can be established. The CCIs were established using MyRTKNet GNSS positioning infrastructure and consist of 2.5Km x 2.5Km and 0.5Km x 0.5Km grids. The established CCI plays a major role in providing reference control points during DCDB adjustment process. DCDB is then re-coordinated and repopulated using the established CCI, hence NDCDB is created. The content of NDCDB is principally survey-accurate coordinates that have been populated, adjusted and undergone quality checks at every level of its formation.

8.2. Virtual Survey System (SUM)

The Virtual Survey System (SUM) is a web-based application with centralised least square adjustment software residing in the system to verify and validate the survey ASCII files submitted by states JUPEMs' District Officers and field surveyors as well as from LLS. The web-based application enables field surveyors and LLS to lodge survey ASCII files to perform adjustment process, generate report of the adjustment results and provide notification to the ASCII files sender. Field surveyors would be able to interact with the system to extract information that will assist them in the field operation and most of the work will be automated to reduce tedious computation. The SUM re-engineered the field processes and permitted real time digital submission of completed surveys to servers located at the states JUPEM for verification. The most obvious change is that the field survey system is based on coordinates system similar to that used in GNSS and GIS.

All requests for cadastral survey either from the land offices or the LLS are lodged to JUPEM prior to field survey. The spatial location of the land parcels will be verified against the NDCDB to ensure that there is no encroachment. Field surveyors may start the survey based on controls obtained from existing marks stored in NDCDB, Cadastral Reference Mark (CRM) layer or through MyRTKNet services provided by JUPEM. Once the survey is completed, it may be submitted to the SUM Servers located at the state JUPEM for quality verification.

Field surveyors may choose to work in real time environment or online through the web depending on the communication bandwidth available. Rules were coded to control workflow and decision making and subsequently minimize human intervention. The field surveyors will be informed on the acceptability of the job in near real time. This will allow the field surveyors to rectify the survey in the field if required. The most significant change is that it allows the field surveyors the flexibility to use best practices in a totally digital environment. The final adjusted coordinates will then be posted into the NDCDB. Finally, a digital copy of the title plans will be generated based on the coordinates stored within the NDCDB and be kept in a separate database for security purposes. The main emphasis is the concept of coordinates which is the fundamental element employed in modern technology such as GNSS and GIS.

8.3. Cadastral Data Integrity System (CDIS)

The Cadastral Data Integrity System (CDIS) comprises of all the office applications which include pre-survey verification, field survey data computation and verification, digital title plans generation and approval. This sub-system is developed to ensure high integrity of the data and to render them GIS-ready. Various checks will be put in place to assist users when making decision on the validity of data before posting it to the database. The raster B1 Plans which are generated based on NDCDB will be delivered on-line to the Land Offices.

Subsequently, datasets from other land-related agencies will be incorporated to complete the requirement of a complete cadastral database especially the QT layer. Graphical user interface will be provided to assist users in data capturing, editing, and manipulation. Additional servers will be added to increase processing speed and storage space. The present communication network will be upgraded to cater for the high volume of data throughput between servers and users, including the daily field operation. Much of the applications will be designed based on a fully integrated system and web-enabled.

9. ACHIEVEMENT OF EKADASTER

Prior to eKadaster, the duration taken by DSMM to complete Request for Survey (PU) was 2 years but the duration was later reduced to between 2-6 months with the implementation of eKadaster in 2010. The advancement made by JUPEM directly attributed to resolving many issues in respect to land matters hence in a way has positive impact to the national development

projects specifically 'registering property'. According to 'Ease of Doing Business' prepared by the World Bank, Malaysia has improved her ranking at 68th place for the year 2010/2011 compared to 86th in 2009/2010 (from 185 countries), by which was achieved during the eKadaster system's first year implementation. Today (2013/2012) after almost three years of its implementation, Malaysia has climbed to 33rd place compared to 62nd (Table 1) out of 185 countries surveyed by the World Bank.

TOPIC RANKINGS	DB 2013 Rank	DB 2012 Rank	Change in Rank
Starting a Business	54	42	↓ -12
Dealing with Construction Permits	96	116	↑ 20
Getting Electricity	28	27	↓ -1
Registering Property	33	62	↑ 29
Getting Credit	1	1	No change
Protecting Investors	4	4	No change
Paying Taxes	15	25	↑ 10
Trading Across Borders	11	12	↑ 1
Enforcing Contracts	33	31	↓ -2
Resolving Insolvency	49	48	↓ -1

Source: A Co-publication Of The World Bank And The International Finance Corporation - Doing Business 2013

Table 1: Doing Business 2013: Smarter Regulations for Small and Medium-Size Enterprises – Malaysia's Rank

Other than that, demands for an accurate NDCDB have been increasing since its inaugural in 2010. NDCDB is currently being utilised by most Malaysian GIS users namely utility companies, land related companies and agencies, academia and planners as base maps for accurate geospatial analysis. NDCDB has helped Malaysian GIS users to determine valuable estates, accurate determination of land for acquisitions or amalgamations, faster calculation for compensations, shortest emergency routes, crime and security analysis, etc. The increasing demand for a better accurate NDCDB has allowed JUPEM to embark on a NDCDB Strengthening Project which was approved by the government of Malaysia under the 10th Malaysian Development Plan (2011 – 2015). The objective of the project is to improve and maintain the spatial accuracy of 5cm in urban areas and 10 cm in sub urban areas and all existing

cadastral lots especially the lower class survey lots are consolidated and adjusted to meet the NDCDB spatial accuracy requirement.

10. FUTURE DIRECTION

While conventional Cadastre offers possibility of data usage for a single purpose, eKadaster can be used widely for many purposes through the advancement of ICT and geospatial technology. Today, JUPEM's geospatial information is becoming increasingly important in resolving environmental issues including disaster management. The vast geospatial information residing at JUPEM can be reached with just a click away through the development of GeoPortal.

10.1. Multipurpose Cadastre

The technology used in developing the eKadaster system as well as in other mapping and GIS systems shows that a system that works for various users and applications is inevitable, namely Multipurpose Cadastre (MPC). MPC has the potential to support the concept of spatially enable government and society in general. This can be achieved by expanding support for processes of visualisation, organisation and management of useful land information. In this context, MPC will serve as the vital geospatial dataset required for economic, social and infrastructure development in this country and hence will be one of the catalyst for growth and gearing the nation towards high income economy by year 2020. In a bid to understand the complexity and structure of the MPC concept in Malaysia, a pilot study was conducted for the Federal Territory of Putrajaya. The main reference base-map is the NDCDB with the main source of large-scale geographical features for urban areas from the Mobile Terrestrial Laser Scanning (MLTS). The idea of implementing MPC was also extended to add visual analysis through 3D data modelling shared with various subsystems and data sources such as topographic and utility maps.

Finally, an MPC database was developed together with an Online Web Access (OWA) prototype. OWA facilitates a spatially enabled system that integrate land information system which contains survey accurate cadastre, topography, man-made features and cultural (e.g., land use, demographics) information in a common reference framework through a portal site on the World Wide Web.

10.2. Marine Cadastre

In the future, JUPEM also aims to extend the Cadastre Survey scope offshore through its modernization program. This is due to an increasing realisation that the interests of Malaysian do not stop at the land-sea interface. There are economic, environmental and social impacts along with the ever increasing competition for the vast array of natural resources. With the United Nations Convention on the Law of the Sea came into force in 1994, the demand for more

efficient and effective maritime boundary management techniques, such as a Marine Cadastre has also been raised.

10.3. Ubiquitous Cadastre

Ubiquitous Cadastre (UC) would be the next move by JUPEM through the implementation of Multipurpose Cadastre and instigation of Marine Cadastre, which would hopefully benefit the land and marine markets and encourages sustainable developments. UC would encompass the concept of ubiquitous Cadastre information services and Service Oriented Architecture (SOA). In a ubiquitous environment it is possible to seamlessly connect and to exchange a wide range of information by means of accessible, affordable and user friendly devices and services at anytime, anywhere, by anything and anyone.

11. REMARKS

There are many things that JUPEM could learn from implementing eKadaster. An effective cadastre has a strategic role to play in rural and urban development plans of the country. By introducing eKadaster, JUPEM has initiated a reform which has wide ranging implications for the survey community and the country as a whole. Along the way, as expected there are problems encountered in the development and implementation stages. However this is usually confined to quality of archive data during the development of NDCDB. The core team of eKadaster would have to resolve such problems as it progresses along in the stages during the development and implementation periods.

As a whole, eKadaster project is a major shift from the old cadastral survey process. With the implementation of eKadaster, JUPEM is able to reduce the delivery time for its land title survey process from 2 years to between 2-6 months. The creation of NDCDB with survey-accurate coordinate has allowed JUPEM to expedite the cadastral survey process with the use of satellite technology (GNSS) and provide fully GIS-ready information. Hence, JUPEM believe the eKadaster implementation in the long run will benefit the people and support sustainable growth and development for the country.

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