

**LAND SURVEY METHODOLOGY RESEARCH PROJECT
'FIT for PURPOSE'
FOR
BRUNEI DARUSSALAM**

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Land Survey Methodology Research Project 'Fit for Purpose' for Brunei Darussalam (12252)
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EXECUTIVE SUMMARY

ABSTRACT

The Brunei Darussalam Survey Department was established in June 1952 and is one of the agencies responsible for the administration, coordination, and survey of land for the public and government agencies in particular, including Temporary Occupied Land (LTS), Re-Survey (BR), Land Acquisition (AQ), Gazette (GR), Replaced Land (LA), and Land Grants (PT). The Survey Department's mission is to provide accurate and comprehensive geomatic information as well as efficient services to meet customer expectations, and to stimulate that mission.

The project is based on one of the meeting papers presented at the International Federation of Surveyors (FIG) Commission 7.2 of Cadastre and Land Management, Fit-for-purpose (FFP) Implementation on August 8, 2019 in Seoul, South Korea by the professional body of the International Federation of Surveyors (FIG).

Several technical officers and colleagues from the Tutong District Survey Branch were chosen to carry out this project since they are experienced, high-potential, and knowledgeable in the field of cadastral and geodetic surveying. The main aims are to bring the terms of the 'Fit for Purpose' methodology into line with Brunei Darussalam's environment.

The Brunei Darussalam research work for the 'Fit for Purpose' (FFP) Land Survey Methodology is a study for a potential land surveying innovation that was authorised by the Surveyor General on August 29, 2020.

As a result of the research project, the Tutong District Survey Branch held a 'Provision of cadastral methodological approaches for 8 working days' on 14 October 2020.

The goal of this project is to ensure efficiency in attaining optimal collection results using the most up-to-date technological land surveying system, as well as a unique flow process manual and new ideas. Included are the skills of Survey Department personnel with the potential to improve cadastral survey services. Furthermore, this method assists the government in achieving the government's desire to improve Brunei Darussalam's position in the World Bank report (Ease of Doing Business), particularly in the progress of earthworks and public complaints.

PURPOSES

PROJECT OBJECTIVES

- a) Implement the Proposed Special Workflow Process Manual within 8 working days.
- b) Ensure that you have a wide range of technical surveying abilities that are up to date with today's technology advancements.
- c) Specially to improve measurement services in line with the Ministry of Development infrastructure:
 - Vision-Quality Life, Continuous Development, Prosperous Country
 - Mission-Ensuring the provision of excellent infrastructure, housing, buildings and services
- d) Supporting the Mission and Vision of the Department
 - Excellent Geomatic Services Towards National Prosperity

- Mission-Providing Comprehensive and Accurate Geomatic Information and Efficient Services to Meet Customer Expectations
- e) Improvements to existing surveying service approaches' workflows
- f) To participate in the 2021-2022 Premier Innovation Award (AIP) in Brunei Darussalam
- g) To propose the paper at the International Federation of Surveyors (FIG) Commission of Cadastre and Land Management, Fit-for-purpose (FFP) Implementation in Brunei Darussalam

REALISTIC

Selected land sites, including the majority of the land lots surveyed from Tutong district in particular, and one (1) area each district in Brunei Darussalam, were used as a preliminary assessment. The 8-Day Cadastral Working Method for Tutong District alone has been formally implicated in relation to the project, and all information from measurement and productivity has been used for this project's study analysis. This will serve as a test to see if it is effective before uniformity is implemented in stages throughout the district.

RASIONALE

This paper's proposed project comprises surveying services such as:

- a) Using existing and cutting-edge technical innovations, a simple and quick land survey method is possible.
- b) The utilization of existing survey equipment's software and capabilities, which are fully utilized in accordance with field land survey conditions.
- c) Dispose of land survey waiting list status, particularly in Tutong District.
- d) Facilitate 'early entry' from the Department of Planning, Town and Country's proposed land site.
- e) Increase the Department of Survey of Brunei Darussalam's claim revenue and the resultant of unclaimed claims (hidden revenue). (Nurakmal & Elia, 2021).
- f) As certain that cadastral products and services could further meet the long-term needs of the national geospatial infrastructure.
- g) Maintain the highest quality of products and services.
- h) Restore trust and interest in Brunei Darussalam's Survey Department in land surveying in order to meet customer and stakeholder expectations.
- i) To infuse new ideas and concepts into the existing Cadastral workflow process in order to meet current requirements.

BACKGROUND

CURRENT SITUATION

For example, (i) the status of Land Acquisition (AQ)/ Land Acquisition at the Survey Department, where the Land Department is in urgent need of the grant diagram and the Certified Plan for the purpose of financing the land acquisition compensation to its owner, and (ii) the status of Land Acquisition (AQ)/ Land Acquisition at the Survey Department, where the Survey Department is in the waiting list for Land Acquisition surveying works (AQ) for the process of preparing the grant diagram and the Certified Plan.

For instance, (ii) the status of Land Grants (PT) works in the survey department's main list, where it is crucially significant to diagram the grant and the Certified Plan in order to hand over the land title granted by His Majesty to the landowner in the near future from the Land Department.

For example, (iii) Temporary Land Surveying (LTS), Re-Survey (BR), and Replacement Land (LA) works at the Survey Department in the existing list where the grant diagram and the Certified Plan for the purpose of land development for the owners are in high demand.

For example, (iv) proposed land site works from government agencies, non-governmental organizations, and the general public are made early entry works through the Town and Country Planning Department to facilitate the coordination of land sites through the proposed cut-out surveying to facilitate the implementation of complete surveying works after receiving the scheme map with the Ministry's approval (KPN).

PROBLEM ANALYSIS

- a) Because there are no set position coordinates, there are several concerns with land diagrams from the Land Department that are inconsistent in the land while surveying.
- b) Some of the scheme maps received through government agencies through the Planning, Town and Country Departments are out of alignment in the field in terms of shape, location of proposed sites, and scales such as drains, drains, roads, rivers, and progress around proposed land sites, which require confirmation of re-alignment.
- c) According to the Workflow and Cost Differences schedule and diagram, the analysis resulted in a 56-day reduction (87%) in working days and a cost savings of \$1761.41 (75%) in staff salary for 13 people. Please see Table 1
- d) Based on a Cost Benefit Analysis of the Fit for Purpose Research indicated, which compares and contrasts workflow process manuals, specifically the Cadastral workflow process manual and the F2F workflow process manual adopted in the Fit for Purpose group project. Please see Chart1

Table 1-Summary Table Analysis Differences Between Two Use of Workflows

No	Process	Monthly salary \$	Survey Position	Daily Salary \$	Cadastral Work Process Manual	Total \$	F2F Work Process Manual	Total \$
1	Registaran	\$ 630.0	Survey Technician	\$ 21.0	4	\$ 84.00	1	\$ 111.33
2	Survey Info (SI)	\$ 630.0	Survey Technician	\$ 21.0	4	\$ 84.00		
3	SI checker	\$ 630.0	Survey Technician	\$ 21.0	1	\$ 21.00		
4	SI Final Check	\$ 1,450.0	Survey Technician 1	\$ 48.3	1	\$ 48.33	2	\$ 227.66
5	Survey Team	\$ 1,965.0	Survey Technician/Workforces	\$ 65.5	19	\$ 1,244.50		
6	Cadastral 1st Comp	\$ 1,450.0	Survey Technician/Workforces	\$ 48.3	5	\$ 241.65	1	\$ 38.17
7	Cadastral 2nd Comp	\$ 630.0	Survey Technician	\$ 17.2	6	\$ 103.02		
8	Cadastral Final check	\$ 630.0	Survey Technician	\$ 21.0	2	\$ 42.00		
9	Point Database	\$ 630.0	Survey Technician	\$ 17.2	4	\$ 68.68	3	\$ 149.00
10	(CP) Certify plan/Title Dig.	\$ 515.0	Survey Staff	\$ 17.2	16	\$ 274.72		
11	Certify plan/Title Dig. Checker	\$ 1,450.0	Survey Technician 1	\$ 48.3	16	\$ 773.28		
12	CP/Title Dig. Final Check	\$ 1,990.0	Chief Surveying Technician	\$ 66.3	2	\$ 132.66		
12	CP/Title Dig. Approval/Delivered	\$ 2,270.0	Land Surveyor	\$ 75.7	2	\$ 151.34	1	\$ 75.67
Total					64	\$ 2,363.24	8	\$ 601.83

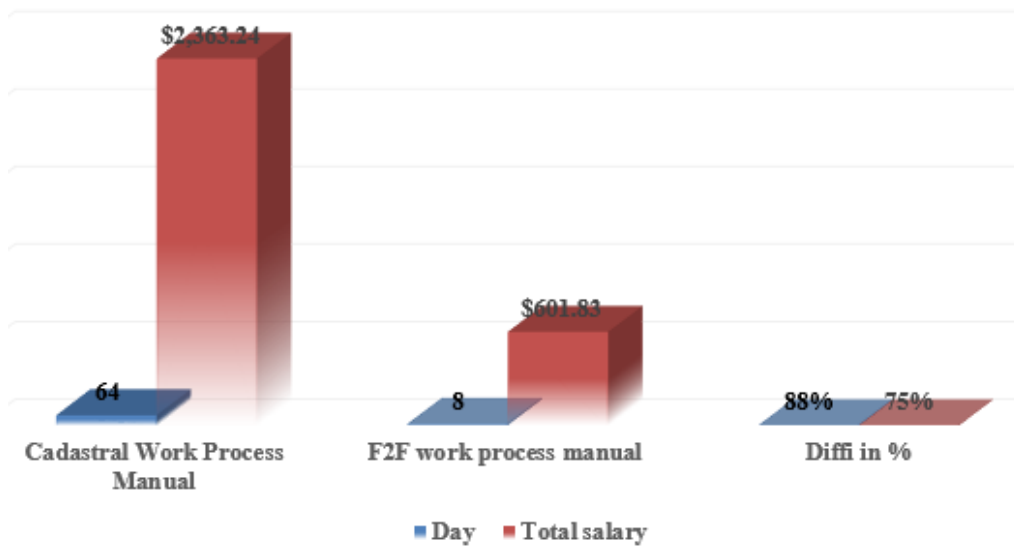


Chart 1-The Difference Between Workflows and Salary Cost

- a) Root cause- The Fit for Purpose Team has also conducted research utilizing the Fish Bone Diagram (Ishikawa) to determine the root of the problem and propose a remedy. Our study identified four major causes: a lack of expertise, electrical issues, a lack of alternative energy sources, and a lack of monitoring. Please see Figure 1.

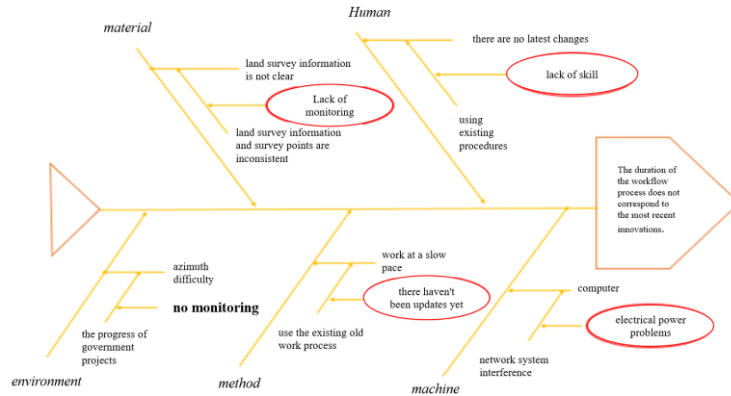


Figure 1-Fish Bone Diagram (Ishikawa)

b) Business Process Reengineering (BPR)

- The act of reinventing the work process manual from the review is done from the result of using the Fish Bone Figure (Ishikawa) and creating a change from the existing Cadastral workprocess manual to a special workprocess manual for the project. See Figures: 2-5
- The whole achievement of 25 files for completed land surveys, 40 grant diagram publications, and 52 Plan publishing on time using specific workflow guidelines for project research was clearly shown in the Key Performance Indicator (KPI) for August 2020. Please see attachment I

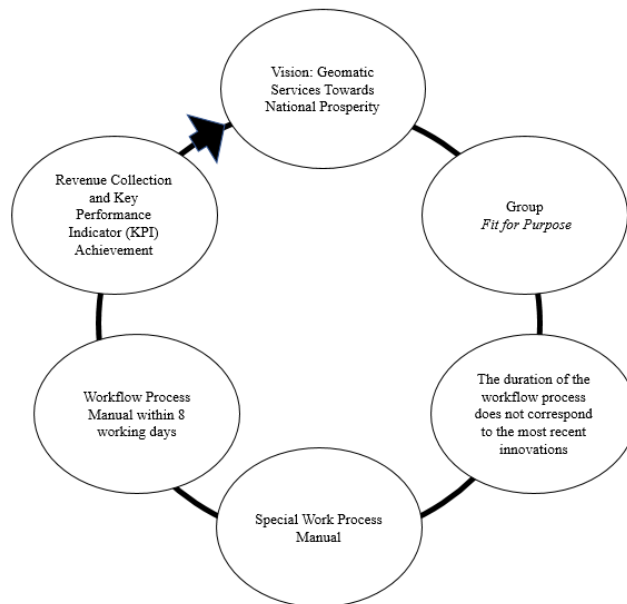


Figure 2-Business Process Reengineering (BPR)

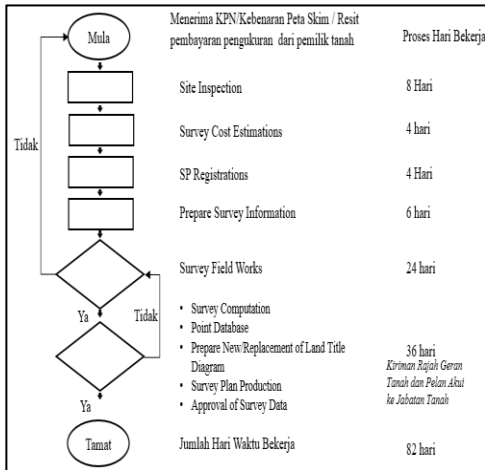


Figure 3-Existing Workflow Process Manual

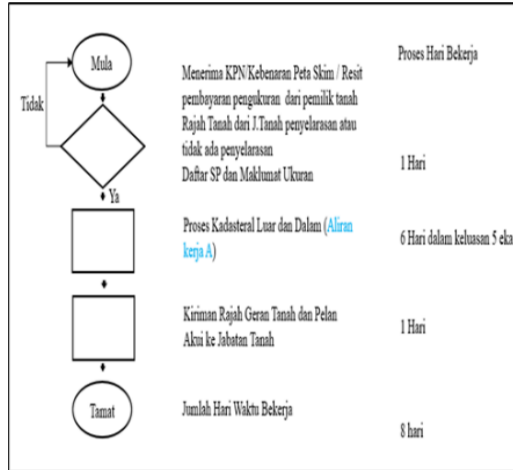


Figure 4-Special Workflow Process Manual

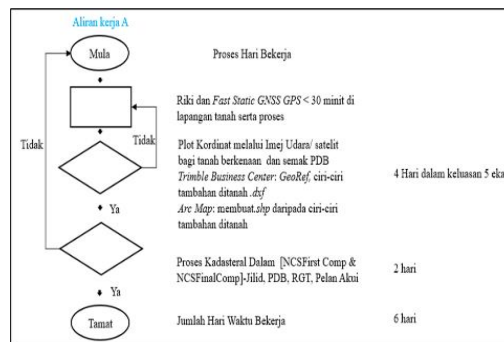


Figure 5-Special Workflow Process Manual (A)

Table 3-Schedule of Department Key Performance Indicators

BAHAGIAN : MAKLUMAT KADASTER PEJABAT UKUR TUTONG STATISTIK PENCAPAIAN (APRIL2019- MAR 2019)														
TARIKH BERMULA: 01 APRIL 2020														
TARIKH BERAKHIR: 31 MAR 2021														
PROSES KERJA	MATLAMAT	JUMLAH PENCAPAIAN (SP SELESAI)												JUMLAH KESELURUHAN
		Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	
Site Inspections	100	10	16	20	17	26	24	17	21	16	18	17	31	233
Survey Cost Estimations	80	1	23	3	5	3	1	3	2	3	2	1	1	48
SP Registration	-	13	8	12	13	11	16	21	43	47	33	42	23	282
Prepare Survey Information	100	16	13	15	18	12	15	18	26	32	30	26	17	238
Survey Field Works	100	26	37	30	25	25	29	20	20	20	20	20	20	292
Survey Computation	150	52	46	31	53	47	34	21	16	20	26	6	24	376
Point Database	150	21	64	46	81	44	27	16	27	13	26	11	6	382
Survey Plan Production	100	39	25	52	87	52	31	6	19	12	28	18	7	376
Prepare New/Replacement of Land Title Diagram	100	30	3	45	28	40	25	7	13	14	19	14	12	250
Approval of Survey Data	-	41	10	55	57	47	42	18	24	31	31	20	13	389
Safe Keeping of Cadastral Information	-	16	42	46	73	28	62	13	23	37	31	21	14	406

Table 2- KPI August 2020-The Tutong District Survey Branch

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IMPLEMENTATION MECHANISM

MANAGEMENT TECHNIQUES or METHODS USED

A specific implementation workflow procedure manual is used to keep track of the items 'Cadastral Working Methodology in 8 Days.'

TECHNICAL IMPLEMENTATION OF INNOVATION MANUAL WORKFLOW PROCESS FOR FIT FOR PURPOSE

Once KPN is accepted, on the ground, riki surveys have been carried out as well as land surveys.

Land survey process for 2 working days under 5 acres

- a) The GNSS process is carried out in accordance with existing Geodetic / GNSS GPS technical instructions (Abdul Khaliq, Survey Department 2021).
- b) The GNSS static observation is generated for 30 minutes near the affected land lot, as well as 2 GNSS bases at geodetic stations, and the GNSS process adopting trimble Business Center (TBC) version 5.0 software and GNSS stations. It is used to georeference the most recent satellite image according to the GRSO projection, and the software's google earth tools are used to track the progress of various locations such as roads, rivers, drains, and buildings.
- c) For survey adjustment at land sites, Trimble Business Center (TBC) Version 5.0 software is utilized to enhance information from the Point Database (PDB) and survey information. Trimble Business Center (TBC) Version 5.0 Software's Tools Cad is also used to digitise new features on a scale of 50 to 100 meters.
- d) The arcmap 10.6 software is utilized when output format information for the survey of lot land area is required, such as image rectification and shape file.
- e) Readings are recorded on the GNSS and Land Lots stations in the occurrence of a technical difficulty with the Continuously Operating Reference Stations (CORS) network website, pending the coordinates as a result of the GNSS processes.
- f) A reading of 2 sets (00° 00' 00" and 45° 00' 00") is carried out and the readings are used in the traverse network for the surveying works.
- g) Resection is implemented through tools from the total station measurement tool. if require additional measurement information from the network or from GNSS stations.
- h) In the event of shifts, rotations and scales from the relevant land lots with the background of Prismatic Compass (PC) measurements, the Autocad Software is used to rectify graphically, provided that a land boundary or witness stone is found in the relevant area or the land lot surveyed.
- i) The cadastral workprocess is the basis for guidelines (Muhammad Hifney, SURVEY DEPARTMENT 2021)
- j) land lot survey information is made in the form of .CSV to facilitate the cadastral process in using the software as New Cadastral System (NCS)

New Cadastral System (NCS) process

Duration of the process for 6 working days

- a) Microsoft Excel CSV land survey data is imported into the New Cadastral System (NCS) First Comp software and processed to achieve an accuracy of > 1: 4000.
- b) To acquire chi-square level pass accuracy, Least Square Adjustment (LSA) employs MicroSurvey StarNet V7 software.

- c) The angle and distance differences are calculated using the results of the first comp and Least Square Adjustment (LSA) process, with an angle tolerance of 2 minutes 30 seconds and a distance tolerance of 0.050 meters.
- d) The coordinates of the land lot produced are then checked against the Point Database (PDB) to ensure that the site is in the correct location. If the position is found to be inconsistent, the land should be re-surveyed.
- e) Following the implementation of the Point Database (PDB) in accordance with the New Cadastral System (NCS) Final Comp process and the production of Volumes, Land Grant Diagrams, and Certify Plans in accordance with the KPN to be approved by the District Surveyor,
- f) The Memorandum and Letter to the Interested Parties have been sent.

MANUAL MANAGEMENT METHODS OF THE WORKFLOW PROCESS FOR FIT for PURPOSE

- a) Staff meetings
It is necessary to hold periodic meetings, at least once every quarter and report regularly to the management
- b) Staff efficiency
Where through discipline and technical monitoring of management to maintain staff efficiency in land survey.
- c) Quality
To control the quality of land survey work, new innovations of special workflow process manuals are used.
- d) Get insights from land surveyors.
With technical monitoring, management can ensure that all measurement works based on this special workflow manual will be well implemented.
- e) Infrastructure, information resources and systems
Responsible personnel ensure that the infrastructure, information resources, and systems necessary for the smooth management of land survey services are adequate and available.
- f) Maintenance
Monitoring and maintenance control for the measurement software and hardware used.
- g) Get public feedback
Complaints will always be viewed positively by management as opportunities for improvement.

INNOVATION

In July 2020 to July 2021, the Tutong District Survey Department implemented the 'Provision of Cadastral Work Methods for 8 Working Days' for Tutong District. This project led to formation of a special workflow process manual for land survey services, which aids in the resolution of issues as previously stated.

This new innovation has demonstrated that the method used in land surveying work is effective in terms of efficiency, accuracy, and convenience. It also saves time when it comes to obtaining high-quality land survey data.

PROJECT REVENUE AND IMPACT ACHIEVEMENT OF OBJECTIVES AND TARGETS

The project's objectives and targets have been met, either in full or on a trial basis. The achievement of these objectives can be seen in the Key Performance Indicators (KPI) as an assessment of the project's performance and success. Please see Table 3

Table 3-Table of Key Performance Indicators (KPI)

BAHAGIAN : MAKLUMAT KADASTER , PEJABAT UKUR TUTONG STATISTIK PENCAPAIAN (APRIL 2019- MAR 2019)														
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Branch Survey Tutong District 2020-2021

IMPACT ON CUSTOMERS AND DEPARTMENTS

This land survey service is capable of delivering excellent and efficient services to government agencies, non-governmental organizations/associations, and the general public in particular. Furthermore, the project's innovations provide customer satisfaction as well as increased revenue for the department and, more importantly, the national economy.

Furthermore, the Survey Department's staff has taken some necessary steps, such as ensuring that each survey employee is in charge in a multi-tasking mode in the technical field, particularly in the use of land surveying hardware and software. Also capable of producing highly skilled land surveying manpower, particularly to add new breath/ideas to existing surveying services.

At the same time, the impact of government agencies in general in the Whole of Nation approach to steering the country's progress as the main agency of the Government of His Majesty the Sultan and Yang Di-Pertuan of Brunei Darussalam in the field of Land Survey Services certainly plays a role in helping government in acknowledging the application for land survey information on behalf of the Public Works Department to build houses approved by the Housing Assistance for the Poor, as the main agency of the Government of His Majesty the Sultan (YSHHB). This innovation is used in the context of government gazette land surveying, which has a medium-scale area, in the geographical conditions of the land that do not have thick woods and are complicated.

To support the Ministry of Development's vision and mission, which includes infrastructure such as proposed rivers, roads, drains, and water pipelines that require the

production of a diagram plan involving the major part of private lands, which is carried out by the PWD through the Land Department. In this context, the land acquisition measurement must be implemented and completed as soon as possible in order to facilitate the compensation process and subsequent construction work.

This innovation also aids in the administration of newly appointed village heads by establishing area zones, particularly in national housing areas where the total population is divided equally for voting purposes.

From this innovation, we can also prepare new municipal boundaries in the Tutong Town area swiftly and effectively.

CHALLENGES IN IMPLEMENTING A PROJECT COMPLEXITY

The hereunder are some of challenges and main reasons that prevent the project from meeting its objectives and targets:

1. Site survey factors and weather conditions such as flooding and heavy rain.
2. Payment process is overdue and the site owner does not agree with the site (LTS) during pre-survey.
3. Land maps and scheme maps are not in line.
4. Requires a shift in mindset among a group of conservative land surveying professionals.
5. Improve the existing Workflow Process Manual to provide the flexibility needed for the 'Fit for Purpose' Methodological Measurement Research Project (FFP) approach for Brunei Darussalam'
6. The innovation of land survey services for the '8 Working Days Cadastral Working Method' depends on the latest technology measurement hardware and software such as Trimble Business Center, MicroSurvey StarNet, Arcmap and New Coordinate System and Auto Cad.

SUMMARY

Introducing the '*Cadastral Working Methodology in 8 Days*' land survey service innovation, which will have a significant impact on customer satisfaction. The Survey Department of Brunei Darussalam will have a positive image if demand is well-managed and met on time. The ability to provide effective land surveying, in particular for land surveying services, benefits not only the Survey Department but also the Ministry in terms of revenue. This can also be seen in the impact on the entire country that has been explained.

At the same time, the AQ (Land Acquisition) results from this innovation are shared with students from the University of Brunei Darussalam who have a background in Sociology and Geography Science. They received four months of industrial training at the Tutong District Survey Branch to investigate the impact of AQ (Land Acquisition) on the community, government, and socio-geographically involved areas. As written in the rational segment, one of the analyses discovered a large *hidden revenue* from government revenue from AQ land survey carried out by the government itself. (Tutong, 2021). See Figure 4

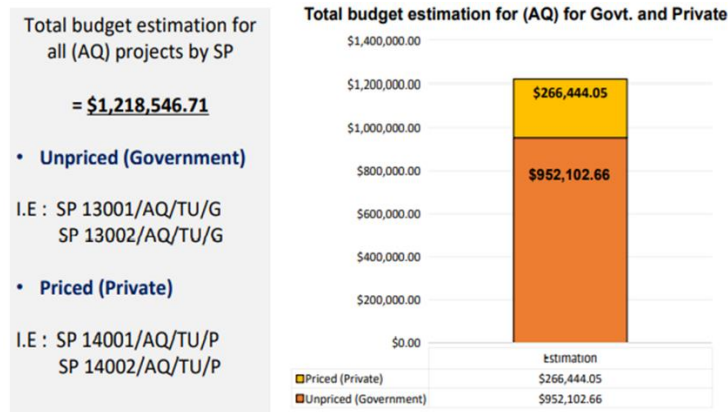


Figure 4-Hidden Revenue

The Tutong District Survey Branch's base capital for evaluating the innovations applied from the comparison of land surveys from 2018 to 2021 in Key Performance Indicators (KPIs). As a result of various types of survey (MPK KAD006), 180 Survey field work files have shifted (29 percent) from the previous year.



Figure 5-comparison of land surveys in 2018 to 2021

In addition, the assessment of the 'Fit for Purpose' (FFP) Methodological Research Project for Brunei Darussalam can be used to evaluate, research, analyse to create a 'Fit for Purpose' frame capital to be attempted for the survey of land concentrated in the Tutong District area in particular. In this regard, the use of the 'Fit for Purpose' methodology has already been carried out in several countries such as Colombia, Northern Territory (NT), Australia, Rwanda, Ethiopia and even Kyrgyzstan according to their respective national framework capital as stated on the International Federation of Surveyors website, FIG.

The productivity of land survey service innovation for the '*Cadastral Working Methodology in 8 Days*' can be increased in reducing costs and time. At the same time, this project is the foundation to support the platform of delivery in relation to the government's commitment of His Majesty the Sultan Dan Yang Di- Pertuan of Brunei Darussalam in order to further enhance the development system. In line with the department's mission and vision, and on par with global standards. As a result, this project can help to coordinate and support

Brunei Vision 2035's goals (2) and (3): a high standard of living-excellent service delivery and high economic growth and resilience-production and productivity.

Every new innovation or improvisation, as well as the innovation in this project, will raise questions. "Why should it be studied and simple?" seems to be the question. The following are the outcomes of this project innovation:

- a) According to the '*Cadastral Working Methodology in 8 Days*', this service will survey LTS (Temporary Land), BR (Re-Survey), LA (Replacement Land Survey), and GR (Government Land Survey) lands that are less than 5 acres in size, focusing on the Tutong district only. AQ (Land Acquisition) and PT (Land Grant) were carried out at the same time once the assigned staff had achieved a high degree of confidence in their respective skills.
- b) It's also worth noting that the existing workflow is still in use for land subdivision surveying, for which private surveyors use the service.
- c) The head of department in particular, as well as officers in the Survey Department in general, provide support, encourage, and contributions of a transparent and clear mind in order to effect this new innovation.
- d) The acknowledgement of the administration of each of the employees assigned to the new innovations to be implemented is a result of the IPA courses they took (Public Service Institute).
- e) The technical capacity of the employees in using available software to facilitate the implementation of the innovation
- f) For this new innovation, the land survey instruction is guided by the Cadastral work instruction (HJ ABD RAHMAN, SURVEY DEPARTMENT 2021) and Geodetic / GNSS GPS (Abdul Khaliq, Survey Department 2021)

MORE PLANS

ACTION PLAN FOR SUSTAINABILITY OR RESILIENCE

This Action Plan is a well-thought-out strategy for dealing with the Department's internal and external challenges from a variety of perspectives. All parties must commit to and participate in the basic Action Plan for the planned land survey service innovation. In addition, the plan's improvement and review process must be implemented on a regular basis to keep up with new challenges and policies enacted in the future. This is also a mechanism for long-term land surveying service innovation.

In ensuring the sustainability and innovation of measurement services by the Tutong District Survey Branch, the National Survey Department of Brunei Darussalam will focus on (4) key areas as follows:

Focus areas A: Strengthening staff skills through continuous training and exposure for the use of land surveying equipment and following the latest land surveying technology.

Focus area B: Land surveying knowledge is passed down through the generations.

Focus C field: Land survey equipment and systems must be maintained in a sustainable and continuous manner in order to keep up with the advancement of land survey technology.

Focus D field: Collaborate and exchange ideas with the combined countries of the International Federation of Surveyors, FIG, and the Asean Federation of Land Surveying and Geomatics on the key principles of 'Fit for Purpose' in innovation applied in Brunei Darussalam (AFLAG).

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