



Geospatial Manpower of Indonesia in 2030

Fahmi AMHAR
SUPRAJAKA
SUMARYONO
Budi SUSETYO
Iksal YANUARSYAH





INDONESIA ???

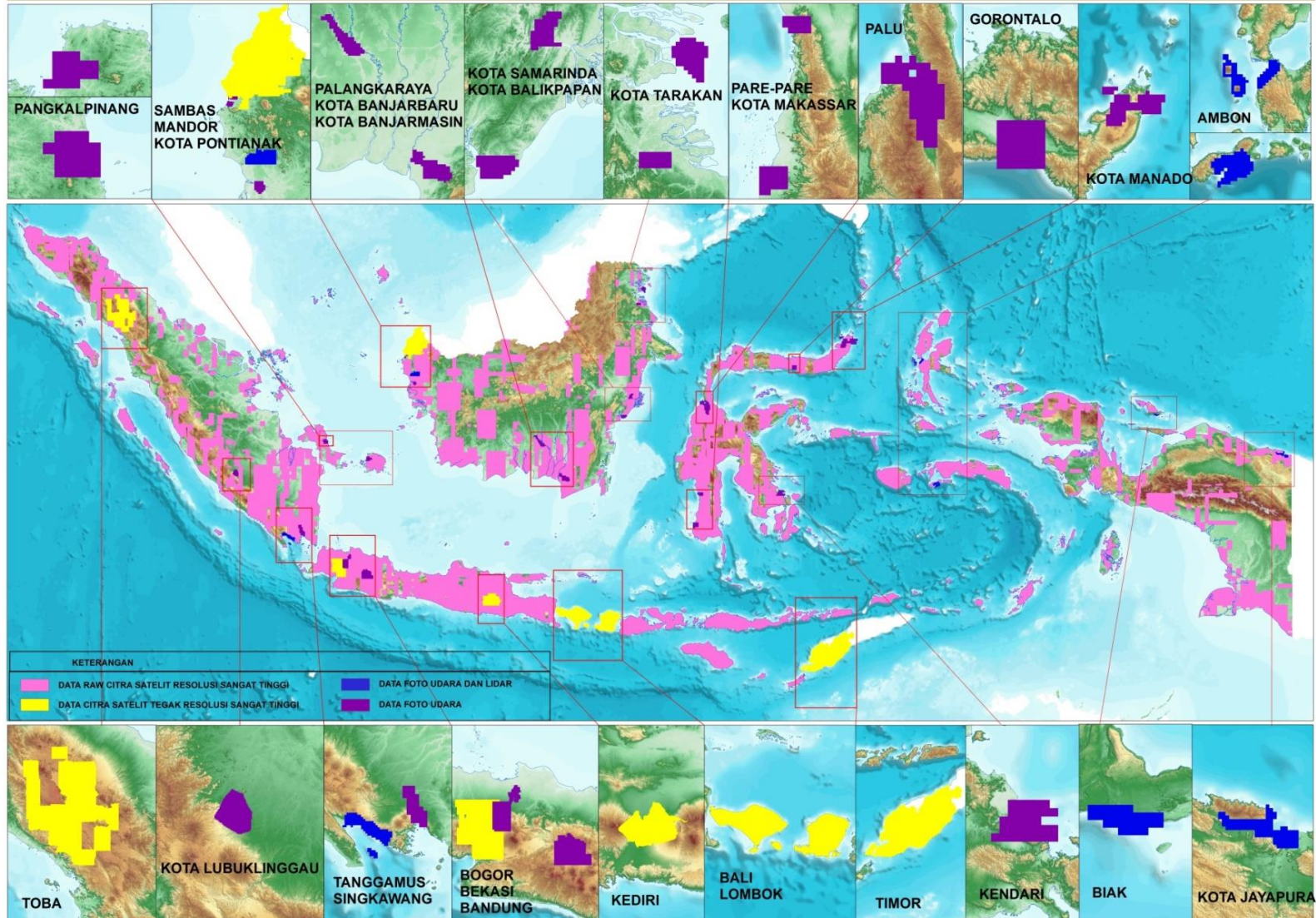
HUGE ARCHIPELAGIC STATE

HUGE GEOSPATIAL WORK

Topographic Mapping,
Large Scale Urban Mapping,
Cadastre, Hydrography,
Disaster/Environmental Mapping,
Location Based Services,
Precision Farming, ...

Index of aerial photos, lidar and hi-res satellite imageries until . 2015

INDEKS KETERSEDIAAN DATA FOTO UDARA, LIDAR
RAW CITRA SATELIT DAN CITRA SATELIT TEGAK RESOLUSI SANGAT TINGGI
HINGGA TAHUN 2015





HUGE DEMAND OF GEOSPATIAL MANPOWER

How much?

Which field?

Which academic level?

We need these for education planning



INTRODUCTION

- Research Objectives are
 - (1) to capture the existing situation of geospatial information manpower in Indonesia, their distribution, competence type and competence level;
 - (2) to make prediction about need of geospatial information manpower in the next 10 years.
- The result of prediction could give a benchmark for the education sector, how to fulfill the manpower gap and which competence type and level which they should have

MATERIAL & METHOD (1)

to estimate the total need and availability

- Economy Cake (state budget USD 200 B → GI ? → GIP ?)
- Benchmarking (to some ASEAN countries)
- Objective Simulation
 - A. Position → close / remote areas
 - B. Size → widely varied areas, land & sea
 - C. Number of Administrative Area → boundary
 - D. Scale → level of detail
 - E. Worktypes → Technology → Production speed
- Observation



MATERIAL & METHOD (2)

to asses the fields & level of expertise

- Uses self estimation in form of questionnaire
- Respondents select which their competence indicator.
- The indicators are taken from working competence standard.
- From the answers, we can conclude which competence's type and competence's level the respondent has.



MATERIAL & METHOD (3)

- There are 6 competence types, i.e. Terrestrial Surveying, Hydrography, Photogrammetry, Remote Sensing, GIS and Cartography
- The competence level is divided in 9 levels, but in this research, only level 3 to level 9 will be practically effective.
- The research used stratified- & purposive random-sampling in nearly all provinces in Indonesia and the questionnaires are filled by hundreds respondent.
- Cities of respondents are classified using its population density.

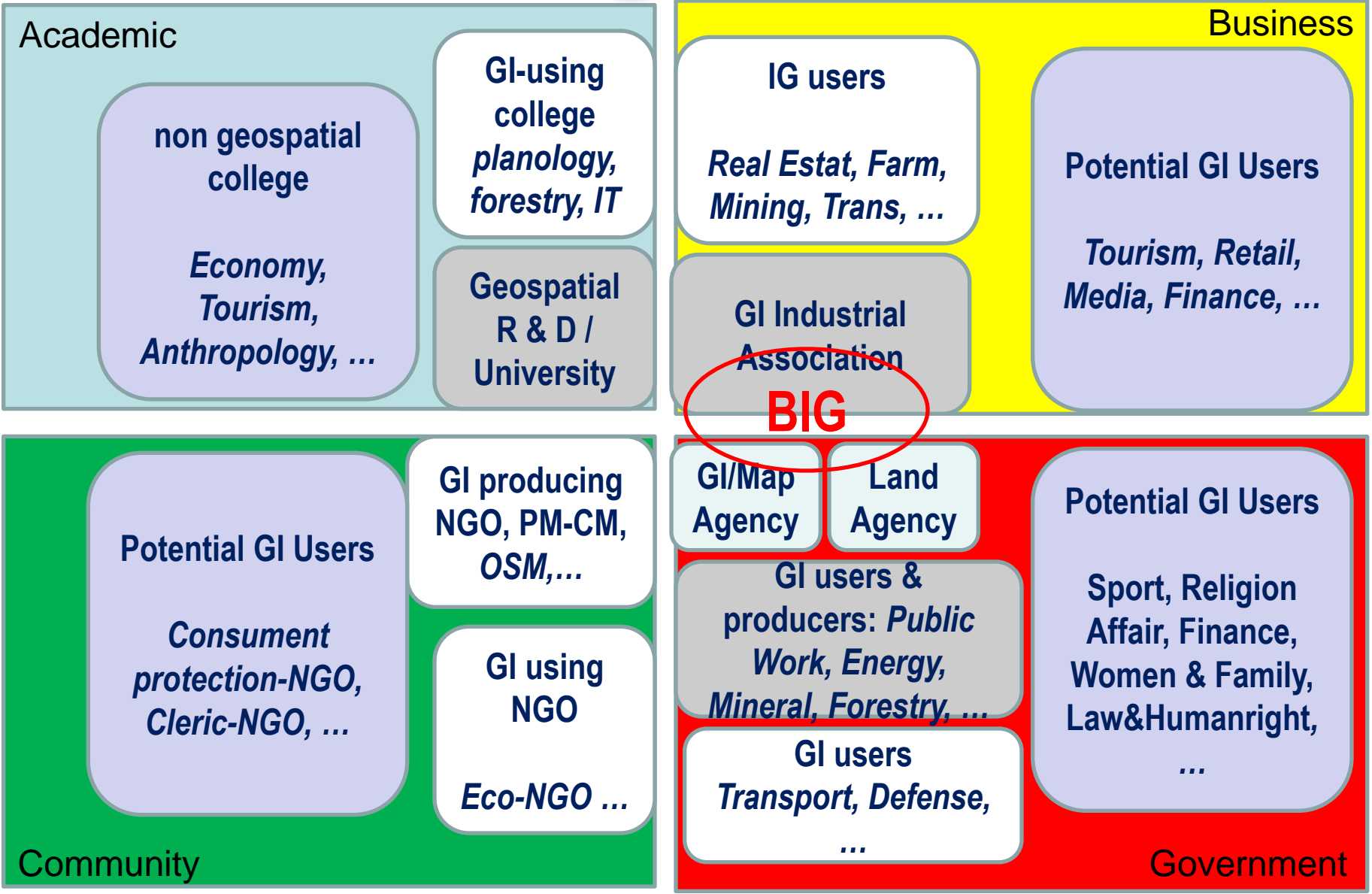


MATERIAL & METHOD (4)

For the prediction, simulation the need and demand of GI-manpower in the future, we can assume that :

- the **population growth** according the Statistics Agency is 1.9%,
- the **domestic economic growth** is 3%,
- the **impact of regional free trade area** is about -1%
- and the **impact of technological efficiency** is also -1%.

GIP according dedication field



Type of GI Works

Capital-Intensive

*The output depends on the capital,
e.g. : satelit data acquisition or data
buying data from 3rd party, ...*

Wisdom-Intensive

*The output depends on the number
of wise experts, e.g. : SOP-writing,
make planning, teaching, R & D, ...*

Technology-Intensive

*The output depends on the
technology, e.g. : only radar can
overcome the area under cloud
cover, ...*

Labour-Intensive

*The output depends the number of
workers, e.g. : terrestrial surveying,
image interpretation,
quality control, ...*

***From Reality to Data
(data acquisition, orthorectification)***

***From Data to Information
(interpretation, field-edit, visualization)***

Scale (Level of Detail)

- Not the whole country should be in the homogeneous scale
- Scale priority according to population density & growth
- According simulation, coverage of the scale are:
 - 1:50.000 : 658.781 sqkm (35,4%),
 - 1:25.000 : 771.385 sqkm (41,5%),
 - 1:10.000 : 299.888 sqkm (16,1%),
 - 1:5.000 : 124.739 sqkm (6,7%),
 - 1:1000 : 3.804 sqkm (0,2%).
- The larger the scale, the shorter is the update cycle

RESULTS & DISCUSSION (1)

- The effort for each sqKm Geospatial Information :
- GI-type = scale: ManHour (MH) : Technology
situation map = 1:1000 : 50 MH: TLS
situation map = 1:5000: 10 MH: UAS
topo-map = 1:10.000: 5 MH: aerial/satellite img
topo-map = 1:25.000: 2 MH: aerial/satellite img
- The working composition
Data acquisition Operator 25%
Interpreation/field-edit/visualization 65%
- Planning/Management/Quality Assurance 10%
- 1 sheet 1x1 m will need GIP
at 1:1000 (1sqkm)= 50 MH; 1:5000 (25sqkm)=250 MH;
1:10000 (100sqkm)=500 MH; 1:25000 (625sqkm)=1250 MH.



RESULTS & DISCUSSION (2)

- In one year, effective working average is about 1000 hour, due to delay in planning-execution, transportation, weather and also re-training, holidays etc.
- Considering the area, scale and capacity, the whole country needs for Basic GI is about 5006 Man-Years.
- When the BGI should be updated every 5 years, then for BGI should be reserved about 1000 Men.
- From this personnel, at least 10-20% should be in Gov for Planning, Management & Quality Assurance.
- Not all GI Personnel should be Univ-graduate, many could be trained for 1-3 month according to specific competency
- The same model should be work for Thematics GI

| | |
|---------------------------|-------------------|
| MODEL EXPONENSIAL EMPIRIS | LOAS SESUAI SKALA |
|---------------------------|-------------------|

Prov-Density Kab-Density-exp **Kab-Density-RDTR** Kab-Density-RDTR (2) 80%

| | | | | | | |
|----------|--------|--------------------------|----------|-----------------|-----------|---------|
| | | area (km2) | OJ utk | Luas wil Indo | | OT |
| Skala 1: | OJ/km2 | @1 m2 peta | 1m2 peta | dalam skala ini | OJ-tuntas | OJ/1000 |
| A | B | C | D | E | F | G |
| 1,000 | 50 | 1 | 50 | 3,804 | 190,200 | 190.2 |
| 5,000 | 10 | 25 | 250 | 124,739 | 1,247,390 | 1247.4 |
| 10,000 | 5 | 100 | 500 | 299,888 | 1,499,440 | 1499.4 |
| 25,000 | 2 | 625 | 1250 | 771,385 | 1,542,770 | 1542.8 |
| 50,000 | 0.8 | 2500 | 2000 | 658,781 | 527,025 | 527.0 |
| | | Luas Daratan Indonesia = | | 1,858,597 | Jumlah = | 5006.8 |

Overview of National GIP Need

RESULTS & DISCUSSION (3)

| | Government | Business | Community | Academic |
|-------------------|------------|----------|-----------|----------|
| Basic GI | 200 | 800 | 2000 | 700 |
| Primary TGI | 5550 | 22200 | | |
| Potential TGI | 350 | 1400 | | |
| GI-Infrastructure | 200 | 800 | | |
| Sum | 6300 | 25200 | 2000 | |
| Grandsum total | 34200 | | | |

- GI-Infrastructure: 10 in each of 20 GI-Clearance-Houses.
- Community : about 4 men in each of about 500 municipality
- Academic: ratio lecturer:student ~ 1:10, to educate 4 students-years which reperate all needed GI Personnel in 20 years.

RESULTS & DISCUSSION (4)

- Need of surveyors / mapper (non univ-graduate)
- Palm farm 8 Mio ha: 5000 persons
- Rubber farm 10000
 - Expansion for the next 10 year, now 1500 ha/person
 - If setup finished, maintenance 8000 ha/person
 - Geodesy 80% (BSc 15%, non unigrad 65%)
 - Geography/Tematic 20% (BSc 12%, non unigrad 8%)
- In mining industry 5000 persons
- In construction & engineering 2000 persons
- In geospatial product reseller / consultant 1000 persons
- Others branch: 3000 persons.

Estimated Total > **26000**



RESULTS & DISCUSSION (5)

Table 3-1 Distribution of GI manpower according education level and workplaces.

| No. | Workplaces | Educational Level | | | |
|----------------------|-----------------------------------|-------------------|------------|--------------|----------------|
| | | VHS | Vocational | Bachelor | Post Graduates |
| 1 | Central Government Offices | 1.872 | - | 1.144 | 67 |
| 2 | Cities / Municipalities Offices | 79 | 237 | 948 | 316 |
| 3 | States Own Enterprises | 60 | - | 319 | 20 |
| 4 | Mining Industries | 17 | 11 | 84 | 0 |
| 5 | Agro-Forestry Industries | 26 | 5 | 71 | 0 |
| 6 | Real Estate Industries | 21 | 14 | 106 | 0 |
| 7 | Geospatial Information Industries | 1.712 | 86 | 999 | 57 |
| 8 | Cities Consultant Offices | 22 | 15 | 175 | 7 |
| 9 | NGO | 9 | 14 | 56 | 14 |
| Total (8.584) | | 3.817 | 382 | 3.903 | 481 |

RESULTS & DISCUSSION (6)

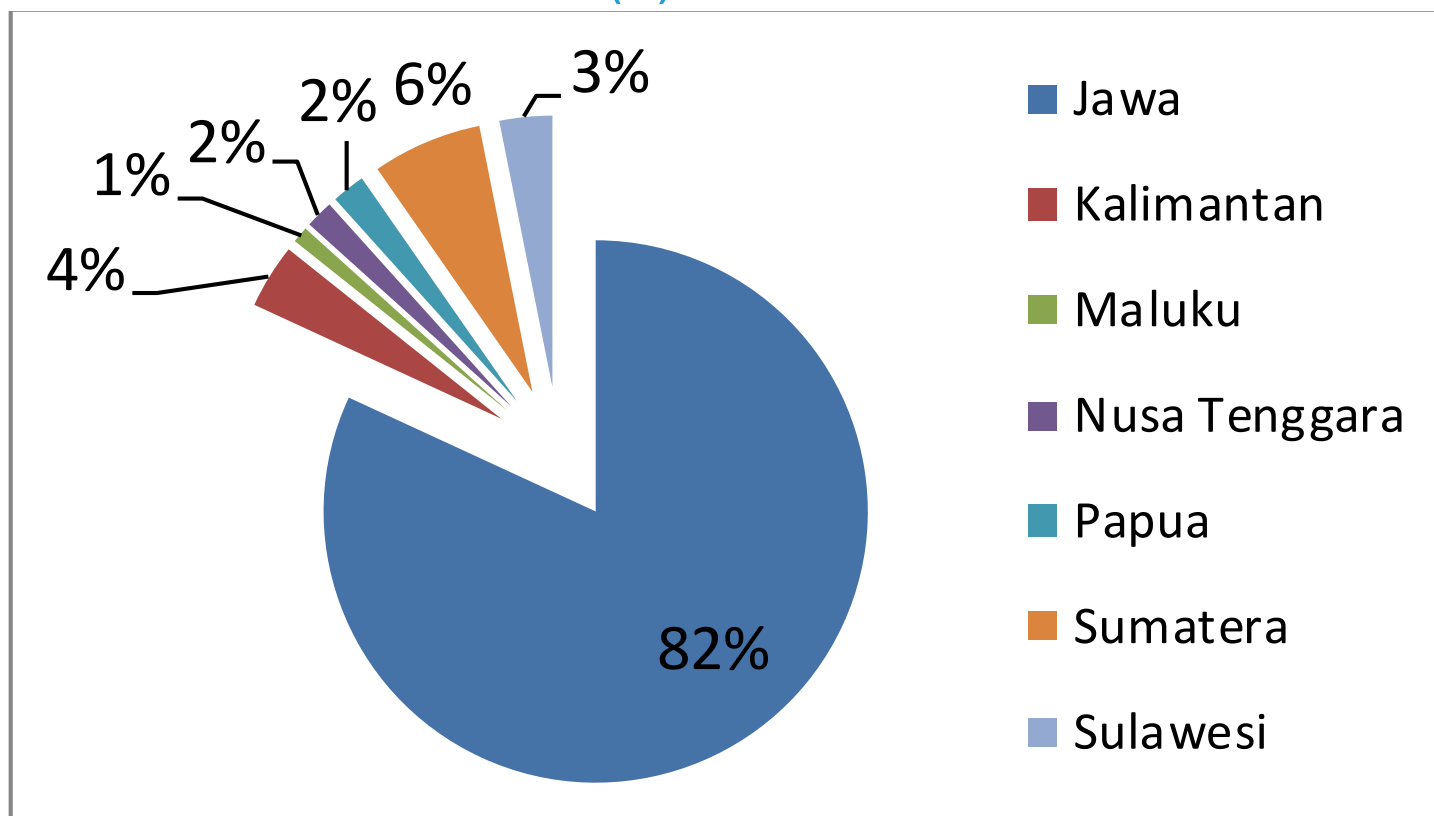


Fig 3-1 Procentages of GI-manpower availability in big islands



RESULTS & DISCUSSION (3)

According to working field, big number the existing GI manpower in Indonesia are working in surveys & mapping (41%), followed by research and development (16%), spatial planning (13%) and land cadaster (12%).

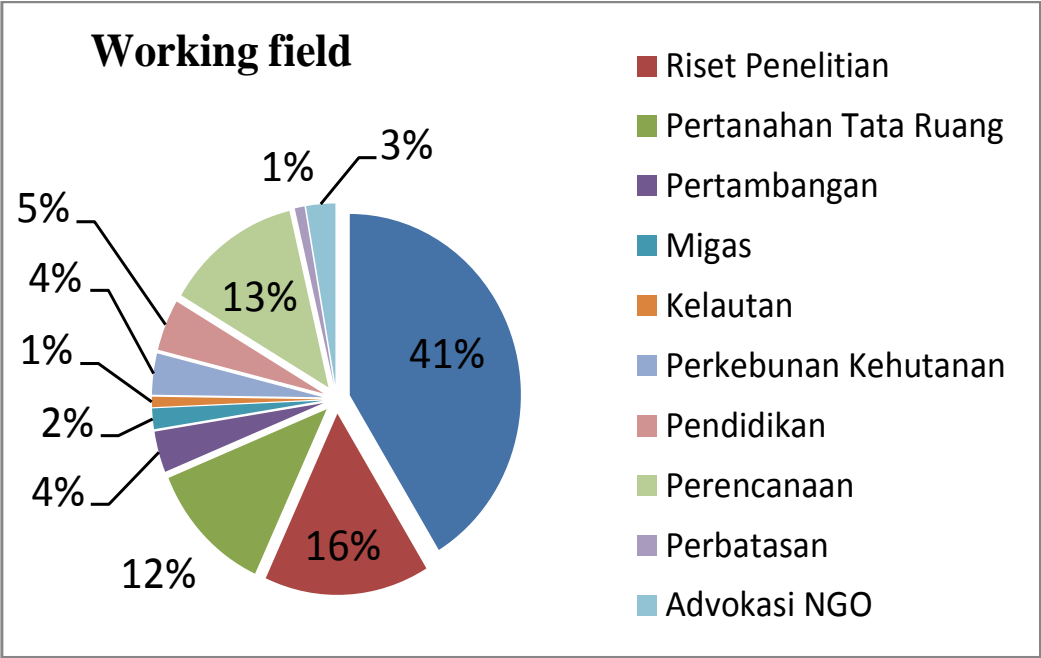


Fig 3-2 Procentages of GI-manpower in working fields



RESULTS & DISCUSSION (7)

Table 3-3 Profile of respondent according competence type and competence level

| Competence Level | Operator | Analyst | | | Expert | | |
|-----------------------|----------|---------|---|----|--------|----|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Terrestrial Surveying | 6 | 2 | 7 | 10 | | | |
| Hydrography | 1 | 1 | 3 | 3 | 4 | 11 | |
| Photogrammetry | 1 | 3 | | 3 | 1 | 1 | |
| Remote Sensing | 0 | 0 | 0 | 4 | 3 | 7 | |
| GIS | 13 | | | 10 | 1 | 2 | 4 |
| Cartography | 5 | | | 2 | 2 | | |



RESULTS & DISCUSSION (8)

| Year | Need Projection | Manpower availability | Manpower gap | Manpower fulfillment | Fulfillment plan |
|------|-----------------|-----------------------|--------------|----------------------|------------------|
| 2017 | 33,353 | 13,584 | 22,270 | 2,500 | 19,770 |
| 2018 | 34,321 | 16,084 | 20,737 | 2,500 | 18,237 |
| 2019 | 35,316 | 18,584 | 19,233 | 2,500 | 16,733 |
| 2020 | 36,340 | 21,084 | 17,757 | 2,500 | 15,257 |
| 2021 | 37,394 | 23,584 | 16,311 | 2,500 | 13,811 |
| 2022 | 38,479 | 26,084 | 14,895 | 2,500 | 12,395 |
| 2023 | 39,594 | 28,584 | 13,511 | 2,500 | 11,011 |
| 2024 | 40,743 | 31,084 | 12,159 | 2,500 | 9,659 |
| 2025 | 41,924 | 33,584 | 10,841 | 2,500 | 8,341 |
| 2026 | 43,140 | 36,084 | 9,556 | 2,500 | 7,056 |
| 2027 | 44,391 | 38,584 | 8,308 | 2,500 | 5,808 |
| 2028 | 45,678 | 41,084 | 7,095 | 2,500 | 4,595 |
| 2029 | 47,003 | 43,584 | 5,920 | 2,500 | 3,420 |
| 2030 | 48,366 | 46,084 | 4,783 | 2,500 | 2,283 |



RESULTS & DISCUSSION (6)

| TAHUN | TERRESTRIAL | | HYDROGRAPHY | | PHOTOGRAMMETRY | | REMOTESENSING | | GIS | | CARTOGRAPHY | |
|-------|-------------|--------|-------------|--------|----------------|--------|---------------|--------|------|--------|-------------|--------|
| | VHS | B.Eng. | VHS | B.Eng. | VHS | B.Eng. | VHS | B.Eng. | VHS | B.Eng. | VHS | B.Eng. |
| 2017 | 4591 | 1968 | 106 | 248 | 2262 | 1508 | 567 | 851 | 2368 | 3552 | 874 | 874 |
| 2018 | 4235 | 1815 | 98 | 229 | 2086 | 1391 | 523 | 785 | 2185 | 3277 | 807 | 807 |
| 2019 | 3886 | 1665 | 90 | 210 | 1914 | 1276 | 480 | 720 | 2004 | 3006 | 740 | 740 |
| 2020 | 3543 | 1518 | 82 | 192 | 1745 | 1164 | 438 | 657 | 1828 | 2741 | 675 | 675 |
| 2021 | 3207 | 1374 | 74 | 173 | 1580 | 1053 | 396 | 594 | 1654 | 2481 | 611 | 611 |
| 2022 | 2878 | 1234 | 67 | 156 | 1418 | 945 | 356 | 533 | 1485 | 2227 | 548 | 548 |
| 2023 | 2557 | 1096 | 59 | 138 | 1260 | 840 | 316 | 474 | 1319 | 1978 | 487 | 487 |
| 2024 | 2243 | 961 | 52 | 121 | 1105 | 737 | 277 | 416 | 1157 | 1736 | 427 | 427 |
| 2025 | 1937 | 830 | 45 | 105 | 954 | 636 | 239 | 359 | 999 | 1499 | 369 | 369 |
| 2026 | 1639 | 702 | 38 | 89 | 807 | 538 | 202 | 304 | 845 | 1268 | 312 | 312 |
| 2027 | 1349 | 578 | 31 | 73 | 664 | 443 | 167 | 250 | 696 | 1043 | 257 | 257 |
| 2028 | 1067 | 457 | 25 | 58 | 526 | 350 | 132 | 198 | 550 | 826 | 203 | 203 |
| 2029 | 794 | 340 | 18 | 43 | 391 | 261 | 98 | 147 | 410 | 614 | 151 | 151 |
| 2030 | 530 | 227 | 12 | 29 | 261 | 174 | 65 | 98 | 273 | 410 | 101 | 101 |



CONCLUSION

- The surveys give accurate information about number and distribution of geospatial manpower and industries in some aspects: field, level and location.
- In 2017, about 33353 manpowers is needed, only 13584 available (Gap is 22270). It is projected that in 2030: 48366 needed, 13584 available (Gap 4783).
- Some expertise fields such as photogrammetry and GIS software development, still need high number of human resources.
- However, industries in this expertise have also good competitive advantages in regional and global market.



LIMITATION OF THE RESULT

- Prediction the future is difficult !!!
- There are some technology breakthrough & industry disruption in the past 5 years.
- Some new jobs are created (UAV pilots, LBS designer, GeoData Scientist), some disappeared (Surveying assistant, photogrammetric operator).
- Change in international strategic condition (South-China-problem, Trump-effect etc) could make change the assumption for the simulation.



TERIMA KASIH – THANK YOU

Prof. Dr.-Ing. Fahmi Amhar
Badan Informasi Geospasial
Jl. Jakarta – Bogor Km. 46 Cibinong 16911
INDONESIA

fahmi.amhar@big.go.id

famhar@yahoo.com

cellphone/whatsapp +62-816-1403109