Needs and Availability of Geospatial Information Personnel in Indonesia

Fahmi AMHAR, Lalitya NARIESWARI, Sugeng PRIYADI, Indonesia

Key words: Personnel of Geospatial Information, Manpower Needs Assessment, Quad-Helix

SUMMARY

This paper will show how to assess the need and availability of human resources in Geospatial Information after the enactment of Law No. 4/2011 on Geospatial Information in Indonesia. The methods used are the "Economy Cake", "Benchmarking", "Objective" and "Observative". Objective method is using the approach of trying to assess the position, size, number of administrative areas, the scale and type of work. The results of the objective method will be compared with the observative method. These methods are proven as complementary. The result obtained is that the number of national geopatial human resource information needs, whether working in the sectors of government, business, education and community is about 35,000 to 50,000 people. Of that amount 15% (7500 people) are for geodetic experts, 65% (32500 people) geodetic skilled, 12% (6000 people) geographical / thematic experts and 8% (4000 people) geographical / thematic skilled.

Needs and Availability of Geospatial Information Personnel in Indonesia

Fahmi AMHAR, Lalitya NARIESWARI, Sugeng PRIYADI, Indonesia

1. INTRODUCTION

After the Law 4/2011 on Geospatial Information was passed, it arises various interesting question to be answered. First: How far will this law lead to geospatial information market grows and how its effect on the growth of demand for the geospatial information personnel (GIP). Second: How far the availability of GIP in Indonesia today and how its distribution both in terms of educational background, areas of expertise, skill levels, and expertise user, both in the field of work and location. Third: how the education world at both the secondary and higher education should anticipate this development.

GIP mapping that will be done is a thorough nationwide, not just in the government, or even in the Geospatial Information Agency / GIA (or Badan Informasi Geospasial / BIG) alone, let alone the only GIP for Basic Geospatial Information (BGI), let alone only for land-BGI. So what wants to be mapped is also the human resources required for both Basic Geospatial Information (BGI) and Thematic Geospatial Information (TGI), land and sea, both in the education sector (academic), business sector (bussiness), public sector (government), and society (community), or often also called "quad-helix ABGC". Across the sector, it is tried to map GIP need both on the field which has been conventionally used GIP and the potential users.

For example, in the government sector, GIP for the BGI is much needed in Geospatial Information Agency (GIA), the National Land Agency (NLA) and their partners from surveys and mapping enterprises, who joined the Association of Surveying, Mapping and Information Geospatial (APSPIG). Later still in the government sector, BGI data will be used to make TGI. They are in the Ministry of Public Works (MPW), Ministry of Energy and Mineral Resources (MEMR), the Ministry of Forestry (MoF), and the Ministry of Agriculture (MoA). These are ministries that are "classic" as BGI users and producers of TGI.

There are also several ministries that are rather "classic" GI users, such as the Ministry of Transport (MoT) or the Ministry of Defence (MoD). This is when we calculate the Directorate of Army Topographic Service or the Department of the Navy Hydro-Osenografi separately from the Ministry of Defence, due to its status under the Military Headquarters.

In addition, there are still potential GI users, considering that so far has not been much use or produce GI, for example, the Ministry of Youth and Sports, Ministry of Religious Affairs, Ministry of Finance, the Ministry of Women's Empowerment, Ministry of Law and Human Rights, and so on.

This type can also be applied in the business sector. There is business that has become a classic GI producer who now join the APSPIG. They are generally to be a partner of the government sector (Business to Government, B2G), although many also began working on his fellow private orders (Business to Business, B2B).

Later in the corporate world there is a classic GI users, such as real-estate world, plantation, mining transportation and so on.

There are also GI potential users, such as the tourism world (to make tourism maps and road atlases), retail trade (for optimization of retail outlets), the media industry (to illustrate the report spatially), the financial industry (for calculating insurance risk, optimization appraisal collateral for credit) and so on.

As a result, in the academic world, in addition to vocational in surveys and mapping and colleges which are relatively closed to Geospatial Information (such as geography, geodetical engineering and geomatics), geospatial information will be also studied at several related higher education, such as urban design / regional planning, informatics, forestry, marine, and so on. But in the long term geospatial information will also need to be utilized by the world of education, economy, tourism, anthropology and so on.

Being in the community, it's been growing a variety of groups or non-governmental organizations associated with the participatory mapping or community mapping. That has "classic" example such as Participatory Mapping Community Network (JKPP) that forwhile focused on indigenous people area mapping (customary forest, communal land), and Open Street Map members who want to help each other to provide a road map.

After that there are many map users as Indonesian Environmental Forum (Walhi) and hundreds of other NGOs. Some map users creates also their own map, although very simple. On top of this, it will begin to grow also GI potential users from NGOs which have not as yet touched the map, such as the Indonesian Consumers Foundation (YLKI) and Majlis Ulama Indonesia (MUI). YLKI might be interested to map the service quality of consumer protection in Indonesia, MUI may need to create a map of the mosque or Islamic boarding schools across Indonesia, or map of islamic da'wa (missionaries) and also map of religious tolerance.

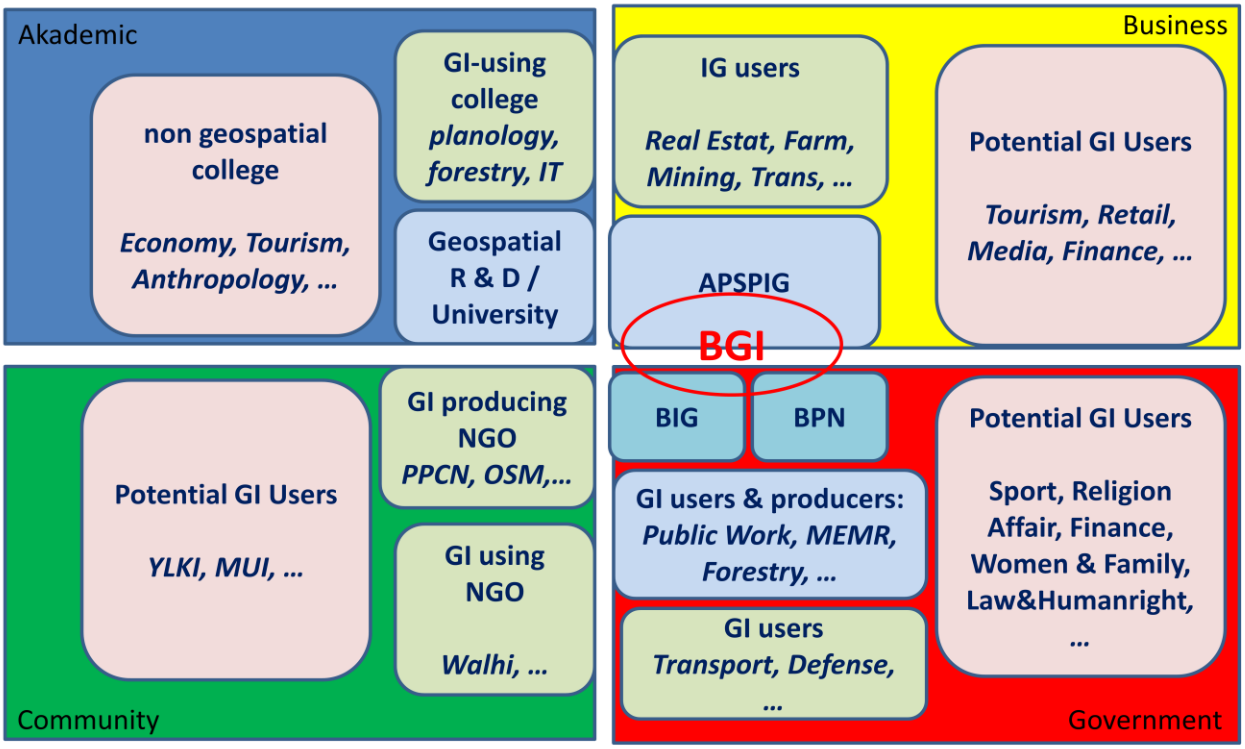


Figure 1 Geospatial Information Personnel according to the field dedication

2. MATERIALS AND METHODS

To answer the questions above, in 2013 a series of seminars, workshops and focus group discussion (FGD) are held, which brought representatives from a variety of backgrounds, either of universities (academic), businesses, government, and community, or often also called "quad-helix ABGC".

There are several approaches to answer the research questions.

First: Method " Economy Cake".

This method starts from the question: how much total gross domestic product (GDP) of Indonesia? If the value of the current state budget is in the range of US$ 200 Billion, and value for money that in the business world is spinning in US$ 800 Billion, the total GDP Indonesia is US$ 1000 Billion (IMF, 2014). The next question is, how much from the value GDP will flow into the Geospatial Information sector? If this question can be answered with reasonable accuracy, it will affect the number of people who want to jump into this field, and will further grow the number of qualified personnel who will pursue Geospatial Information. However, at this time, the number of GI related budget in several ministries, agencies and local governments are still below the estimated range of US$ 1 billion, or just 0.1% of the new GDP (MoF, 2014).

According to Prof. Samsir Mira (ITB Geodetic Engineering professor, former rector of Itenas) by quoting the opinion of a professor in Germany: the demand of GIP is about 0.5% of the total population. When Indonesia's population is 250 million people, then it means that 1.25 million people were active in the field of Geospatial Information.

Of course all of the figures were made with the assumptions of the economic pie is not able to provide a good mapping of the GIP educational background, areas of expertise, skill levels, and user expertise, either jobs or locations.

Second: Method "Benchmarking"

This method compares Indonesia with Malaysia. Information supplied by GIA staff Syahrudin Yadi, M.Sc. after attending a meeting with the Bureau of Measure and Mapping Malaysia (JUPEM) in 2012. It should be remembered that the national mapping work was done by JUPEM himself, never done by others. Only for the maintenance of rights linked parcels that can be performed by a licensed surveyor (non employee of JUPEM). For all this activity, Malaysia which has an area of approximately 250,000 km2 (eighth Indonesia), has 10,000 employees. So when projected into Indonesia, the GIP of Indonesia is needed about 80,000 people, both for the construction of the BGI, the update, as well as to the added value (TGI). Of course, this new method gives a rough figure, yet detailed enough to the type and level of expertise.

Third: An Objective Method

This method departs from the assumptions related objects to be created as geospatial information. This is related to the position, size, number of administrative areas, scale and type of work.

A. Position → close / remote areas

However we must admit that the position of the needs and availability of GIP in Indonesia is asymmetry. The majority of institutional, corporate and GIP is in Greater Area of Jakarta and Bandung. It makes the majority of Indonesia is a "remote area". At each province, most of the district / city are also "remote" areas too, even some the scattered remote islands.

B. Size → widely varied areas, land & sea

The most objective method to calculate the effort in making geospatial information is area (km2), instead of map sheet numbers. Sometimes the area is to be "normalized" when it consists of many scattered islands, or irregular shaped. Geodetic control network can not be counted by the number of regions, because they have to fulfill their spatial distribution. The area to be mapped with their position and scale are very influential on the choice of technology. For extensive land area, it is more efficient to be mapped with satellite imagery / aerial photography. Very small or narrow land area is more efficient to be mapped by the Unmanned Aircraft System (UAS). For sea bottom, the surveys technology depends on the depth and distance from the shoreline. This technology choice will determine the number and type of required personnel.

C. The number of boundary → Administrative Region, Spatial

The total number of regional (provincial / district / city) and lower than that (up to the level of the villages) will affect the length of the administrative boundary line. Indonesia has about 34 provinces, 520 districts / cities, about 6,000 sub-districts and 70,000 villages. The length of the boundary line between the districts / cities of about 56,000 Km. With the enactment of Village Law, GIP are needed by the village. Map of Detailed Spatial Plan and Disaster Risk Map will be also made by Region. The number of needed GIP can simulated according to area, population and economic growth.

D. Scale→ level of detail

Mapping across Indonesia in homogeneous large-scale (eg, 1: 1000) is unrealistic and unnecessary. Areas with high population density, has the priority to be mapped in a larger scale (Amhar & Wijanarto (2009). Smaller scale maps can be generalized from a large-scale map. Following simulation results show the scale and the covered area:

1: 50,000: 658 781 km2 (35.4%),

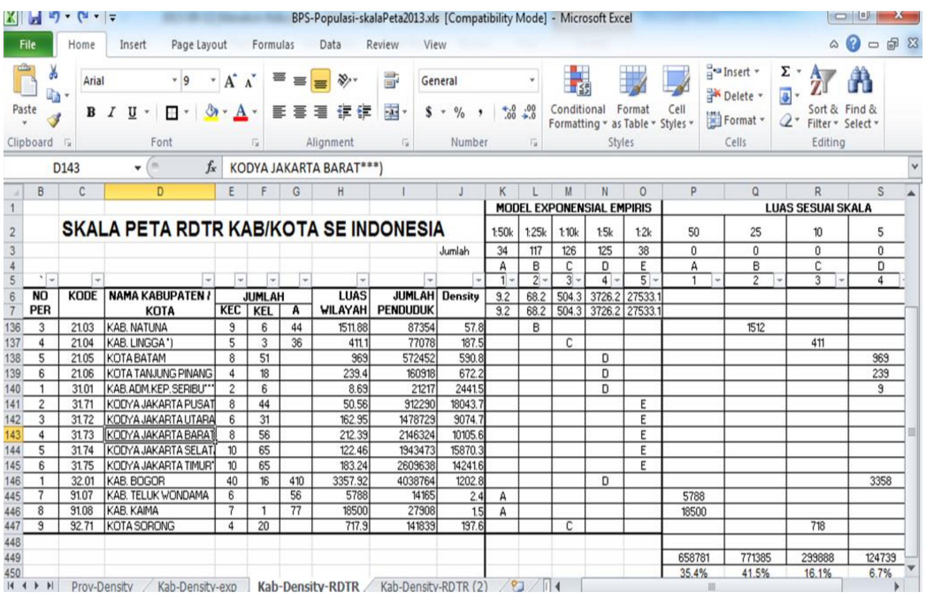
1: 25,000: 771 385 km2 (41.5%),

1: 10,000: 299 888 km2 (16.1%),

1: 5,000: 124 739 km2 (6.7%),

1: 1000: 3,804 km2 (0.2%).

The larger the scale tends to short the update cycle (the more detailed changes), so it will require more GIP .



SKALA PETA RDTR KAB/KOTA SE INDONESIA

	NO PER	KODE	NAMA KABUPATEN / KOTA	JUMLAH KEC	JUMLAH KEL	JUMLAH A	LUAS WILAYAH	JUMLAH PENDUDUK	Density	MODEL EXPONENSIAL EMPIRIS 1:50k	1:25k	1:10k	1:5k	1:2k	LUAS SESUAI SKALA 50	25	10	5
3									Jumlah	34	117	126	125	38	0	0	0	0
4										A	B	C	D	E	A	B	C	D
5										1	2	3	4	5	1	2	3	4
6										9.2	68.2	504.3	3726.2	27533.1				
7										9.2	68.2	504.3	3726.2	27533.1				
136	3	21.03	KAB. NATUNA	9	6	44	1511.88	87354	57.8		B					1512		
137	4	21.04	KAB. LINGGA *)	5	3	36	411.1	77078	187.5			C					411	
138	5	21.05	KOTA BATAM	8	51		969	572452	590.8				D					969
139	6	21.06	KOTA TANJUNG PINANG	4	18		239.4	160918	672.2				D					239
140	1	31.01	KAB.ADM.KEP.SERIBU**	2	6		8.69	21217	2441.5				D					9
141	2	31.71	KODYA JAKARTA PUSAT	8	44		50.56	912290	18043.7					E				
142	3	31.72	KODYA JAKARTA UTARA	6	31		162.95	1478729	9074.7					E				
143	4	31.73	KODYA JAKARTA BARAT	8	56		212.39	2146324	10105.6					E				
144	5	31.74	KODYA JAKARTA SELAT	10	65		122.46	1943473	15870.3					E				
145	6	31.75	KODYA JAKARTA TIMUR*	10	65		183.24	2609638	14241.6					E				
146	1	32.01	KAB. BOGOR	40	16	410	3357.92	4038764	1202.8				D					3358
445	7	91.07	KAB. TELUK WONDAMA	6		56	5788	14165	2.4	A					5788			
446	8	91.08	KAB. KAIMA	7	1	77	18500	27908	1.5	A					18500			
447	9	92.71	KOTA SORONG	4	20		717.9	141839	197.6			C					718	
449															658781	771385	299888	124739
450															35.4%	41.5%	16.1%	6.7%

Figure 2 Simulation to determine the optimal scale of according the population density

E. Occupation → Technology → Production speed

According knowledge management, in making of geospatial information, there are 2 phases of work, the first stage of "transfer phenomena from the real world into data," and the second "convert the data into information". At each stage there are 2 different types of jobs, so in total there are 4 different jobs that affect the needs of its personnel. This method is based on advice from (Soliman & Spooner, 2000).

In stage of transfer the reality to the data, the first is a very capital intensive, which output is a linear function to the available money. For example is the acquisition of satellite imagery.

While Indonesia does not have an sovereignty in earth observation satellite, then inevitably all satellite images must be purchased from foreign vendors. Similarly, if it is done with the data capturing from aircraft, either optical, lidar or radar. Everything is technology, and it means the increase in the value of the investment is not linear with the addition of GIP needs.

The second is a technology-intensive. It is not to be related to the amount of capital, but the right technology to do something. Mapping on the cloud covered area can be done only with radar technology, difficult to do in any other way, regardless of the dollars being poured and human resources involved.

Exceptions from the above problems is the surveys for administrative or international boundaries demarcation and toponimi data collection. At TGI there are also some jobs that are relatively labor intensive or knowledge-intensive.

At this stage of process data into information, the situation is somewhat different. There is more labor intensive or wisdom intensive. Labor intensive means that the output depends on the number of workers jobs. Some boundary demarcation surveys activities, even they are part of "transfer of reality into data", are very labor intensive. Similarly, the quality control over the general mapping activities are labor intensive.

The wisdom intensive acitivies are decision-making activities with Geospatial Information, such as the creation of spatial planning, education and training activities as well, research and development, writing of related Geospatial Information’s SOP and so on.

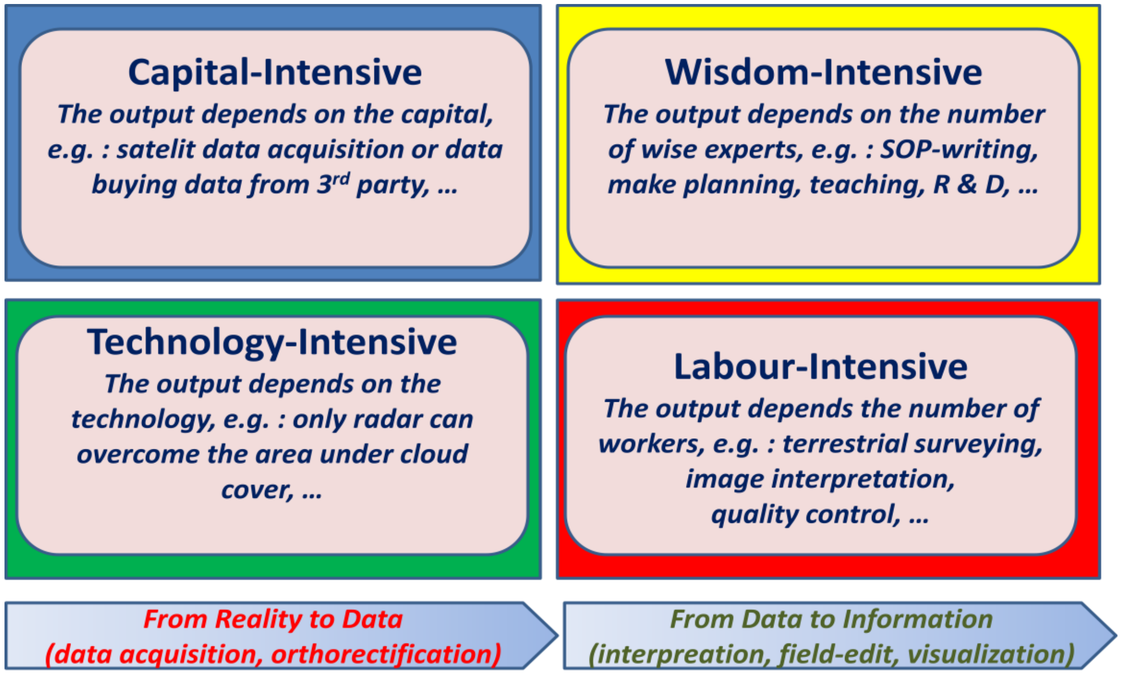


Figure 3 Types of GI work

Fourth: observational method

This method revealed from in-depth interviews with some old people experienced in the private sector related to Geospatial Information. From their observations, the needs of the GIP in the private sector regulated by the market, so that the numbers can be assumed to be always near optimum. When the addition of personnel with a certain type and level of expertise increases company profit, then there is likely to be added more. While if the presence of personne have no effect on profit, or will even be a burden, so it tends to be removed. This is the different from the government sector, except when the government will also implement a corporate-style governance.

Observational method gives an overview of the composition of the type and level of expertise of the needed GIP, while the previous methods have given an overview and rough numbers. However, this method may have only a temporary validity period, because in the future there could be a change due to a shift in the corporate world, as well as the influence of technology and politics.

3. RESULTS AND DISCUSSION

In this section, only the results of the third and fourth methods will be discussed, considering this is detailed enough to be followed up.

3.1 The results of objective methods

To build every square kilometer GI, the effort in man-hours (MH) depends on the type of map, scale, and technology. To create a basic topographic map of the scale 1: 1000 it requires 50 NH with terrestrial survey or laser scanning technology. For a scale 1: 5000 it requires 10 MH (because in the scale there is little detail object) with UAS technology. On a scale of 1: 10,000 and 1: 25,000 with photogrammetric technology or satellite imagery will be required respectively 5 MH and 2 MH. Once again this is the number per sqkm, not per map-sheet. It is also based on the assumption that the time spent by the operator of recording / measuring is about 25%, operator of interpretation / field-edit / visualization is about 65%, and for planning / management / quality assurance is about 10%.

Therefore for 1 map size 1 x 1 m will require human resources on a scale of 1: 1000 (1 sqkm) of 50 MH, at 1: 5000 (25 sqkm) of 250 MH; on a scale of 1: 10000 (100 sqkm) of 500 MH and at 1: 25000 (625 sqkm) of 1250 MH.

Within a year, 1 GIP averaged only able to work about 1000 hours. There is a reason for the "idle" for example delay from the planning to the execution, for transportation to the location, weather disturbances, and also the time needed for refresher training, leave, and so on.

Of the extent, scale and capacity is obtained figures of GIP needs to Land-BGI = 5006 Man-Year (MY). If Land-BGI of the whole Indonesia should be updated every 5 years, then the specific GIP should be available, about 1000 people. Of this GIP, 10-20% are in the GIA /NLA (for PMQ), 80-90% is the business world. Not all of this GIP must held a Bachelor degree, partly sufficiently trained 1-3 months according to the required standard of competence. The same model can be done for TGI.

		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

Figure-4. Overview GIP needs to Land-BGI.

For TGI then divided into primary TGI and potential TGI. Primary TGI sectors that require GIP is Land (NLA, the Land-tax office, and licensed surveyors), Energy and Mineral Resources (Geological Agency), Forestry (Directorate General for Forestry Planning), Agriculture (Center for Land and Agro-climate), Marine (Ministry of Marine, Ministry of Transportation), Construction (Directorate General of Spatial Planning), Administration (Ministry of Internal Affairs) and Defense, which can be estimated at least 10 people at every level.

Assuming there are 10 people GIP in each Ministry of the Central Government, and GIP 10 people in each province, 10 GIP in each District / Municipality, then the minimum demand is 9x10 + 10x34 10x520 = 5630. If this government sector then drives the private sector to quadruple the number of people from the public sector, it would require 4 x 5630 = 22,520 person GIP in the business world. This GIP in TGI remain (because the work will be continued).

For GIP in potential TGI, the assumption is even wider, because almost the entire affair can be optimized with GI. This means that the entire Ministry / Agency (there are about 70 institution) with all of businesses associated with them will be a geospatial actor. If one assumes the necessary of 5 GIP in each affair x 70 institution, then the will be 350 GIP. This means, it will take for times the amount of the 1400 potential GIP in the business world. It should be recognized that the world of potential TGI develops according to the creativity of the actors to demonstrate the benefits of GI for the affair.

Geospatial Information Infrastructure generally involve human resources in the field of informatics, especially geoinformatics, so the GI can reach all levels of society through IT devices. The world of IT is very technology-intensive. Experience shows, that at this time, Google has served all over the world with Google Earth and Google Maps simply by minimum personnel (about 100 people). In addition, the Geospatial Information Infrastructure also includes the work in standardization and regulation of which are wisdom-intensive. If it is assumed in the public sector there are 10 GIP in each network hub (the numbers is currently around 20 institution) then it means that the demand is 200 GIP nationally. The numbers in the private sector is a four-time, so about 800 people GIP.

In the community sector, it should be understood that the civil society need to be strengthened so that they exercise social control over GI organized by the government and the business world. The civil society should consist of some people who are geospatial literate (academics) and geospatial aware (non-academic). This non-academic circles need to be equipped with a short training. Ideally, in each district / city there are at least 5 people who are at the core of GIP (activator) of the community, so we need about 2000 GIP for Community.

After all it is time to calculate GIP in the world of education. Academic world is the “upstream” for the GIP candidate and place for developing of science and technology related to GI. GIP needs Academics dependent life-cycle assumptions GIP. Because it is important to estimate the GIP that needs to be printed every year, so we can plan also academic facilities (space, lab) that need to be provided. In addition, there should be also various types of GIP Academics, namely that for a brief training (1 week - 3 months), and regular courses (high vocational school, D1, D2, D3, D4 / BSc., MSc., PhD.). The ratio of total GIP that needs to be formed can be assumed: 1:10. So for the 4 generation Bachelor with each class of 50 students, there should be 20 full-time lecturers.

Thus, when the composition of human resources is as below, then the total number of GIP is needed nationally is in the range of 34,200 people of GIP.

	Government	Business	Community	Academic
BGI	200	800	2000	700
Primary TGI	5550	22.200		
Potential TGI	350	1400		
GII	200	800		
Total	6300	25200	2000	700
	34200			

Figure-5. Summary of needed national Geospatial Information Personnel

This requirement would not be met instantaneously. It should be a sustainable process. The ideal number of GIP needs nationally should be assessed. This needs a will increase in line with economic growth. Therefore, this requirement should not be met simultaneously in order to avoid shocks when time of retirement arrives. If the GIP work-life-time is assumed to be 20 years, then in 20 years the ideal number should be achieved with uniform age distribution. So the amount of GIP to be recruited per year = (Number of ideal GIP – current GIP) divided by 20. So in the early days, human growth chart is going up a steep, having reached the point of equilibrium, will ramps.

3.2 The results of the observational method

Experience in the bussiness world, in general, there are two levels of expertise required, the skilled surveyor level / instrument operator / interpreter level / map drawer (possibly with a vocational background and D1-D3), and the analysts level with backgrounds D4 / Bachelor or above.

In the agro/plantation sector, the oil palm area of 8 million hectares, currently requires 5000 surveyors. Meanwhile, rubber plantation / cocoa / industrial forest requires 10000 surveyors. Expansion up to next 10 years requires a surveyor roughly per 1500 hectares. When ready, the maintenance needs a surveyor per 8000 hectares.

In the mining sector is now 5000 people needed, construction companies need 2000, and geospatial / survey & mapping consultant need 1000. The rest is in the range estimated 3000 surveyors.

Overall it takes about 26000 surveyors or mapping operators. Observations showed that of this amount, 80% is of the field of geodesy (especially elementary surveying and little competence of photogrammetry, remote sensing, GIS and cartography), and 20% of the geographical or thematic expertise related, such as land, forestry, geology, mining, marine and so on.

Of the 80% geodesy, 15% expected to graduate Bachelor degree and 65% fairly graduates of vocational or D1-D3. The 20% geographical / thematic, it is expected 12% Bachelor degree and 8% vocational. The results of these observations are very important and can be used in subsequent analyzes.

In addition to working in the corporate world of the above, the government agency needs GIP distribution is Bappeda average of 5 people, the Land Office (district / city) 8 people, the land-tax-office 4-5, Public works 25 people, and all multiplied by the number about 500 districts / cities, namely 12500 people. Then the local private sector serving local needs, the average person only has 10 GIP, multiplied by 500 district / city to 5,000 people. For the provincial level, the needs of human resources in the provincial IG is 50 x 33 to 1650 people. And the local private sector counterparts on average 25 people. Meanwhile, the central agencies about 2300 people. Total, GIP that it takes about 48,000 to 50,000 people.

4. AVAILABILITY OF GIP

In the Focus Group Discussion (FGD) which brings representatives in college, obtained figures of the number of graduates per year in majors geospatial information as follows:

For Geography: UGM 200 Bachelor, 70 D3; UI 100 Bachelor; UMS (Solo) 70 Bachelor, and UM (Malang): 50 Bachelor.

For study program Geodesy / Geomatics: UGM 100 Bachelor; ITB 100 Bachelor; ITS 80 Bachelor; Undip 50 Bachelor; ITN 50 Bachelor; Itenas 50 Bachelor; UPI 50 D3; STPN 40 200 D4 and D1. Total production was 400 Bachelor Geography and 100 D3 per year. While for Geodesy / Geomatics is 500 Bachelor and 200 D1.

For vocational school in Survey and Mapping, with the presence of about 10 vocational schools in Indonesia, and on average have two classes with @ 40 students, then the estimate of graduates per year is 10 x 80 = 800 graduates per year.

Not all graduee of college entirely plunged into geospatial disciplines. Estimated at no more than 30% who end up working in the geospatial field, although this needs further survey on contribution of alumni ten years after graduation. Most of the women ended up so alumnus housewife. There is a plunge into banking, journalists, IT businessmen, culinary, etc.. This is consistent with what was reported by (Carmeli & Freund, 2004) on job satisfaction.

The distribution of geospatial HR qualifications are not always suited to the needs of industry so necessary for the world's mapping industry, especially HR IG potensial.Sebaran users per region is also very uneven. It needs further study on the needs of GIP-related IG per region extents, scale of detail maps and geospatial information types. Maybe the amount of general-allocation-fund figures can be used as one of the parameters (number of GIP per Billion-Rupiah DAU).

When we receive a count of the various assumptions in advance, and the ideal number of GIP is in the range of 35000, while the number of human resources at present is in the range of 3500 (ie, 2000 in the government - especially the NLA and GIA, and 1000 in the private sector and 500 in the community), then the amount of human resources needed per year to next 20 years is (35000-3500) / 20 = 1575 GIPs to be produced every year. In year 2034, GIP conditions will be to the point of equilibrium, after which the retirement will be equal to the entry. Bachelor production capacity of GIP at 10 campuses with 3-campus study program Geodesy and Geography Prodi is in the range of 650 if the entire needs of the GIP must have Bachelor, let alone there are about

70% of alumni who choose to no longer work in the field of IG (out of geospatial world), then it means that the GIP production capacity is to be increased by up to threefold.

In fact, the current gap is not yet felt. Currently for Geodesy Bachelor program takes about 320 people / year, and is available around 500 people / year. For Geodesy D1-D3, it takes the same amount (320 people), and is available only SMK 200 For Geodesy, it takes 960, 800 Geography S1 available needed 160, 400 and is available for necessary D1-3 Geography 240, available 100. thus, it appears that less is to level vocational and D1-3 who plotted to become skilled instrument operator. As for Bachelor, the production is still relatively sufficient, even if it's 70% of alumni working in the other field outside of GI. However when potential GI is getting well excited in the public sector and the business world, and we must also expand to fill the open markets of Asia Pacific (AFTA), with a priority to improve the quality, then we need to increase the number of graduates. An increasing number of graduates through college capacity, and this priority is for the instrument operator level (vocational and D1-3).

More important than that is the GIP distribution by type and level of expertise. Indonesian National Competence Standard (SKKNI) have assign it to six kinds of raw skill competencies, namely surveying, photogrammetry, remote sensing, hydrography, GIS, cartography), and the level of competence (National Agency for Standardization Professions, 2004). In the work pyramid, 1 Expert supposedly in charge of 2 Analyst. While 1 analyst in charge of 4 operators, so that the pyramid is 1: 2: 8.

5. CONCLUSION

By looking at a variety of data above, can finally be concluded that Law No. 4/2011 to foster the needs of the GIP in the range of 35,000 to 50,000 people. Of this total composition is 15% expert level (S1) Geodesy, 65% skilled level (SMK, D1-D3) Geodesy, 12% expert level (S1) Geography / Thematic and 8% skilled level (SMK, D1-D3) Geography / Thematic.

So far, the existing number of GIP in the range of 3500-5000 people. The education world produce every year about 500 S1-Geodesy / Geomatics, 1000 SMK-D1-D3-Geodesy / Geomatics, 400 S1-Geography and 100 D3-Geography. To spread geographically, further surveys required; but the present reality, the availability of GIP is still concentrated in Java, particularly in Jabodetabek.

Since the gap is still large enough, then integrated steps in the world of education is necesary. Education for skilled manpower both at the level of vocational or D1-D3 should be strengthened, especially for the field of geodesy which teaches the basics of surveying, aerial photography, remote sensing, GIS, or cartography. As for the college level, it needs strategies to meet the GIP demand is done by means of the transition, so it does not arise turmoil, both present at the time of preparation, and later that no mass retirement together.

REFERENCES

Amhar, F., Wijanarto, A.B. (2009): Skala – Sebuah Indikator Awal Kualitas Peta Rencana Tata Ruang *(Scale - An Initial Quality Indicator Map Spatial Planing)*. Bakosurtanal, isbn 978-979-26-6963-3

Badan Nasional Standardisasi Profesi (2014): Standar Kompetensi Kerja Nasional Indonesia (SKKNI) bidang Informasi Geospasial – *(Indonesian National Working Competence Standard in field Geospatial Information).*

Carmeli, A., Freund, A. (2004): Work Commitment, Job Satisfaction, and Job Performance: An Empirical Investigation,International Journal of Organization Theory and Behavior;Fall 2004;7, 3;ABI/INFORM Research pg. 289

IMF (2014): Report for Selected Countries and Subjects. http://www.imf.org.

Kemenkeu (2014): Infografis APBN 2014 – *Infographic of Indonesia State Budget & Fiscal Plan*. http://www.kemenkeu.go.id/Page/infografis-apbn-2014

Soliman, F., Spooner, K. (2000): Strategies for implementing knowledge management: role of human resources management, Journal of Knowledge Management, Vol. 4 Iss: 4, pp.337 – 345

UU 4/2011 tentang Informasi Geospasial – *The Law no 4 / 2011 about Geospatial Information*

ACKNOWLEDGEMENTS

his study was made at the request of the Center for Geospatial Information Standardization & Institutional (PSKIG), Badan Informasi Geospasial (BIG) in Fiscal Year 2013, with the involvement of many colleagues from the universities (especially the ITB, UGM, and ITS) and of private companies in field of geospatial information APSPIG members

BIOGRAPHICAL NOTES

CONTACTS

Prof. Dr.-Ing. Fahmi Amhar
Center for Research, Promotion and Cooperation
Geospatial Information Agency of Indonesia
(Badan Informasi Geospasial)
Jl. Raya Jakarta-Bogor Km. 46
Cibinong 16911
INDONESIA
Tel. +62 21 8790 6041
Fax + 62 21 8790 6041
Email: famhar@yahoo.com, fahmi.amhar@big.go.id
Web site: www.big.go.id