

Human Resource Inventory of Geomatic Graduates: a Case Study of Universiti Teknologi Malaysia

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SUMMARY

Geomatic represents a branch of engineering that comprises the area of Global Navigation Satellite System (GNSS) technology, field surveying, cartography, geodesy, photogrammetry, hydrography and cadastral studies. The current Geomatic degree administered by the Faculty of Geoinformation and Real Estate (FGRE) at Universiti Teknologi Malaysia (UTM) is the Bachelor of Engineering (Geomatic). Introduced in the early 1970s, this bachelor program strives to deliver a quality educational experience via emerging geomatic technologies towards providing significant contribution to the needs of surveying and engineering profession nationwide. This paper encompasses the issue of human resource inventory in relation to the whereabouts and the demographic distribution of geomatic graduates in UTM.

For understanding and conducting comprehensive geospatial analysis related to UTM geomatic graduates, *Jawatankuasa Alumni Dan Sumber Manusia (JASMG)* was formed at FGRE in the year 2014. Preliminary results on the number of graduates, graduates employability, distribution by gender, age and states obtained from the study were presented and discussed in this paper. Despite certain drawbacks in retracing graduates existing careers, it is suggested that a spatio-temporal human resource inventory database is used where their continuous demographic and career information is stored. Incorporating the spatial aspect enables the current employment location of graduates to be mapped while slotting in the temporal aspect are beneficial for continuous observation of graduates' career movement in the future.

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1. INTRODUCTION

Tracer study for university graduates is a recurring issue in Malaysia. Normally, higher learning institutions are usually only serious during the initial years of students graduating, conducting tracer studies for identifying the learning experience, existing career or the career path the students are heading to (Kementerian Pendidikan Malaysia, 2015). Furthermore, some institutions simply disregard the call to properly document their graduates' career path (Melink, & Pavlin, 2012).

A tracer study is defined as a study that provides current data on graduates career and employment together with the learning experience they faced during their years in higher learning institutions (Millington, 2001). An output of a tracer study that only concerns with the career data is called a human resource inventory. Unlike a conventional inventory where tangible objects such as goods and materials are stored, a human resource inventory stores human resources' characteristics data (Management Innovations, 2008). This characteristics data are subsequently used for observing current trends and planning future potentials of any personnel (MBA Official, 2015).

This paper defines a human resource inventory from the higher learning institution point of view. Therefore, a human resource inventory is defined as a graduate database where their current demographic and career information is stored. Subsequently, this database can be used to analyze the unique relationship between higher education and career (Schomburg, 2003). This paper intends to highlight the issue of geomatic graduates human resource inventory.

With regards to Universiti Teknologi Malaysia (UTM) as the most established technological based public university for a case study, the geomatic program is the oldest program of the Faculty of Geoinformation and Real Estate (FGRE). Therefore, sufficient data of geomatic graduates are available that enables further analysis to be conducted in relation to the whereabouts and demographic of the graduates. Other aspects of data within the database include graduation related data such as the quantity of geomatic graduates for each year.

This paper establishes the human resource inventory of geomatic graduates from UTM. This paper commences by defining 'geomatic' and introducing its relevant education activities at UTM in Section 2. Then, in Section 3, the method used to derive the geomatic graduates human resource inventory is presented. This includes the data collection and further analyses of the data. Finally, Section 4 presented the implications for the human resource inventory as well as limitations and future research suggestions.

2. GEOMATIC EDUCATION AT UNIVERSITI TEKNOLOGI MALAYSIA

Geomatic represents a branch of engineering that is increasingly present in our daily activities. According to Oxford Dictionary (2015), the definition of geomatic is “the mathematic of the earth, the science of the collection, analysis, and interpretation of data, especially instrumental data, relating to the earth's surface”. Hence, geomatic encompasses the art, science and technology involved in collecting and managing geospatially-referenced information.

The term geomatic was created at Laval University, Canada in the early 1980s (Gomasasca, 2009). It is based on the the increasing potential of electronic computing where it revolutionize surveys and representation sciences. Furthermore, the use of computerized design was compatible with the treatment of huge amounts of data. These elements must be processed in an interdisciplinary and interoperable manner, and the discipline of geomatic can satisfy such requirements (Gomasasca, 2009).

The work of geomatic is practically diversified and it may fall under one or more categories, such as (summarised from Gomasasca, 2009 and RISM, 2015) :

- *Cadastral Surveying or Surveying for Title*: a land survey stream for establishing and recording property boundaries and may form the bulk of a land surveyor’s work. Cadastral surveys are controlled by law and the surveys within the meaning of Section 396 of the National Land Code 1965 (Act 56).
- *Engineering Surveying*: a specific type of land surveying done specifically for engineering purposes. Engineering surveying is ultimately tied to cadastral surveying, because an engineering survey is hardly done in isolation. It must be properly orientated and must be tied to the survey marks authorised by the Survey Department, such as boundary marks, triangulation points whether primary, secondary or tertiary.
- *Topographic Surveying*: a land survey type to determine and locate the features and improvements on a parcel of land for the purpose of producing a topographical plan or map. The features mean both natural and man-made structures on a piece of land such as vegetation, types of soil, buildings, land utilities, fences and boundaries, roads and land marks.
- *Photogrammetry*: a land survey type to determine the position and shapes of the objects by measuring them on photographic images.
- *Geodetic Surveying*: a specific type of land surveying to determine the shape and size of the Earth. On one hand, it defines the surface of reference in its complete form which is the geoid, as well as in its simplified form, which is the ellipsoid. On the other hand Geodetic Surveying defines the external gravitational field as a function of time. It provides significant precision and establishes highly accurate control networks.
- *Hydrographic Surveying*: this type of survey deals with the measurement and description of the physical features of the navigable portion of the earth’s surface (seas) and adjoining coastal areas, with special reference to their use for the purpose of navigation.

Normally, the tasks carried out by Geomaticians vary depending on the area they are working in but can include (Land Surveyor, 2015):

- measuring the land as required by the client, including aspects such as small and large-scale distances, angles and elevations;
- gathering data on the land's physical and man-made features through surveys;
- processing land data;
- undertaking digital mapping;
- producing detailed information on land (subsequently analysed by planners, builders and cartographers);
- using a range of equipment to produce surveys, including modern method such as Global Navigation Satellite System (GNSS) and conventional methods;
- analysing land information thoroughly before it is handed over to other professionals;
- interpreting data using maps, charts and plans;
- utilising land data from a range of sources, such as aerial photography, satellite surveys and laser beam measuring systems; and
- using computer-aided design (CAD) and other IT software to interpret data and present information

The current geomatic degree administered by FGRE is the Bachelor of Engineering (Geomatic). Introduced in the early 1970s, this bachelor program strives to deliver a quality educational experience in surveying, mapping, and emerging geomatic technologies wherein providing significant contribution to the needs of surveying and engineering profession within a vibrant and fast growing nation.

Formerly known as Bachelor of Surveying (Land), this programme obtained full accreditation from the Board of Land Surveyor for Peninsular Malaysia and also from the Public Services Department of Malaysia. This bachelor program is a 4 year study course, carried out for a duration of 8 semesters at FGRE. Focusing on student-centred learning approach that encourage innovation, critical thinking and ethical responsibility, this programme offers a unique platform that not only lead to a lifelong learning experience but also towards successful professional employment, attainment of professional licensure, and opportunities for graduate studies.

Amongst other core subjects covered during this programme includes Geodesy, Cadastre, Global Navigation Satellite System (GNSS), Hydrography and Photogrammetry. Graduates that have successfully completed the program are expected to exhibit expertise in both theoretical and practical aspects related to surveying sciences and mapping as well as capable of managing, administrating, and updating geospatial data effectively.

3. THE GEOMATIC GRADUATES INVENTORY: PROCESS AND DERIVATIVES

Within FGRE, “Jawatankuasa Alumni Dan Sumber Manusia” (JASMG) or The Committee of Alumni and Human Resource was established on 2014 to look into human resource inventory issue for geomatic graduates. Initially, graduates data are obtained mostly from the convocation booklet where it supply the names of geomatic students as early as 1978 until 2015. Later on,

using these names, cross checking were made to identify graduate's current career using three different registries. These registries are from The Royal Institution of Surveyors Malaysia (RISM), The Land Surveyor Board of Malaysia as well as The Department of Survey and Mapping Malaysia (DSMM). Extra efforts were made if graduates name are absent from these registries. This effort includes cross-checking their names on socio-career media for instance LinkedIn and Researchgate.

Figure 1 shows the amount of geomatic graduates produced by UTM from 1978 until the first quarter of 2015. From Figure 1, it appears that after the year 1995, the number of graduates each year are inconsistent and to a certain degree, undulating. This happens due to different figures of enrolment for students each year. Altogether, there are a total of 1891 geomatics graduates from UTM since 1978.

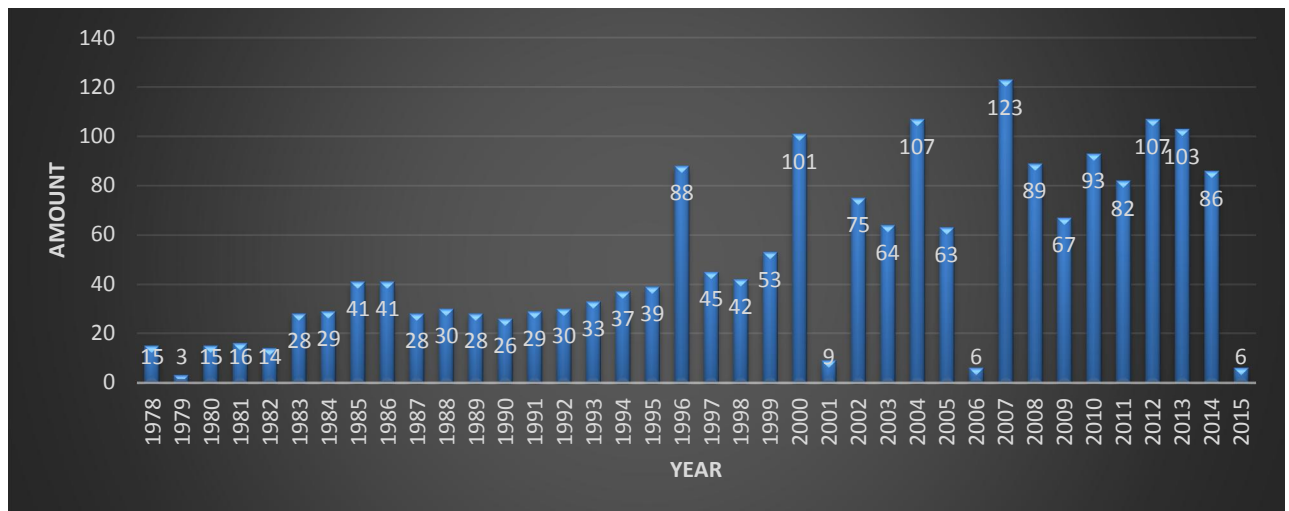


Figure 1: Geomatics Graduates from UTM

Specifically, the number of graduates increased significantly to 88 and 101 in the years 1996 and 2000 respectively due to extra enrolment of students in 1991 and 1995. This extra enrolment happened due to the higher demand of land surveyor for sustaining the job demand. There were dramatic plunge of graduates in 2001 and 2006 because of the transition period from four to five years mode of study duration. It is also important to note that the number of graduates for 2015 is low at six graduates as only the first graduation ceremony is covered whereas UTM usually has two graduations in a year.

Figure 2 shows the graduates employability for geomatic graduates in various fields. From Figure 2, it is obvious that geomatic students of UTM show deep interest for working within licensed land surveyor firm and DSMM with figures of 277 and 177 graduates respectively. There are also 17 graduates who work under local authorities and others government agencies besides DSMM. A significant number of 162 graduates are doing freelancing jobs or involved in other land survey related fields such as developer, construction, hydrography, oil and gas and shipping.

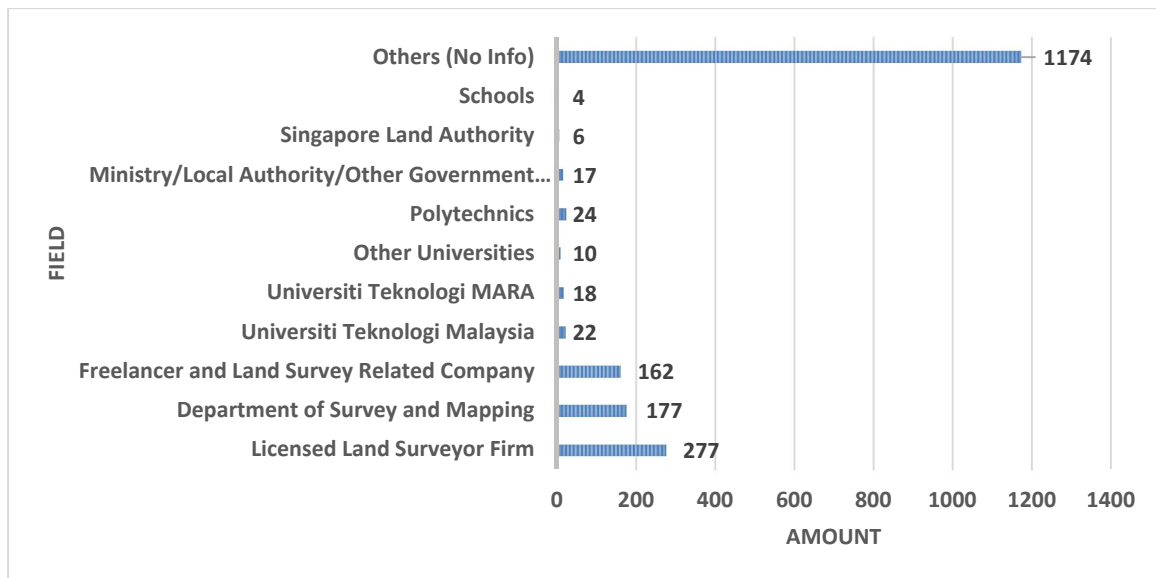


Figure 2: Graduates Employability

Another interesting finding centres around graduates who have chosen to work in a higher education sector. There are 64 graduates who work in various universities and polytechnics where UTM take the lead with 22 graduates. On the other hand, four graduates work as teachers in primary and secondary schools. Some graduates choose to work abroad and this is shown on Figure 2 where six graduates are working with Singapore Land Authority. Unfortunately, 1174 graduates are career untraceable, i.e. their names are not listed on any of the registries or searching over the Internet fails to trail them.

This paper now moves to only analyse the career traceable cohort from the whole sample. The analysis involves gender, age and current location of graduates. Out of 1891 graduates, merely 717 graduates are career traceable from our survey. In relation to gender, it can be seen from Figure 3 that 615 males and 102 females constitutes the overall figure of 717 career traceable graduates. Eventually, males constitute 85% and females made up 15% of the overall career traceable graduates.

This monopoly trend of male graduates are justifiable where traditionally, male students intake for the geomatic course at UTM are always higher than females. Among other factor, this in turn contributes to the domination of male within the geomatic job market (Yusof, 2015). This is also explained by Figure 2 where the majority of the traceable careers are related to the geomatic field (616 out of 720) and it is known from the previous statement that male graduates dominated this career field.

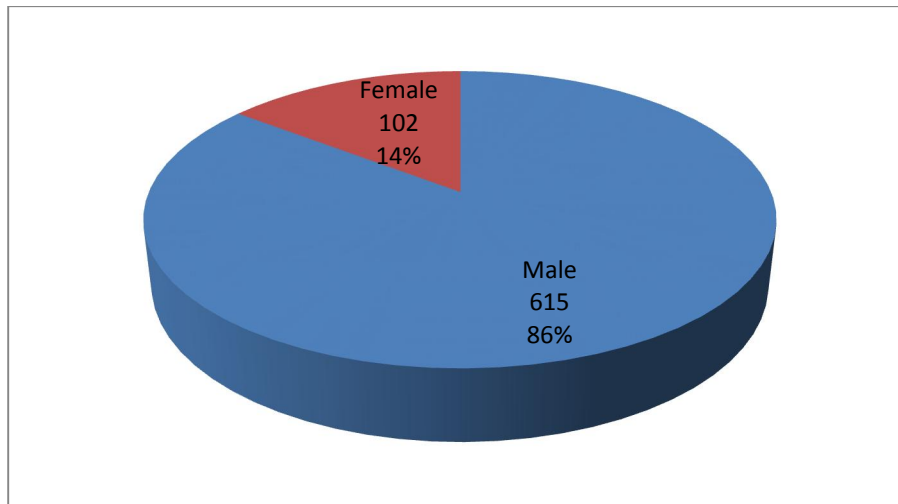


Figure 3: Demographic distribution of UTM geomatic graduates by gender

Figure 4 demonstrates the demographic distribution of UTM geomatic graduates by age. Age is divided into the following groups: 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 years and over. It is obvious from Figure 4 that most of the graduates fall within the 30 to 39 years age group (638 graduates out of 1717 graduates). Unsurprisingly, more than half of these graduates at 63.95% are 39 years and below. This is in line with Figure 1 where intake for the recent years that represents the age group of 39 years and below are high. The age group of 40 to 49 years and 50 years and over comes at 22.60% and 13.45%, respectively.

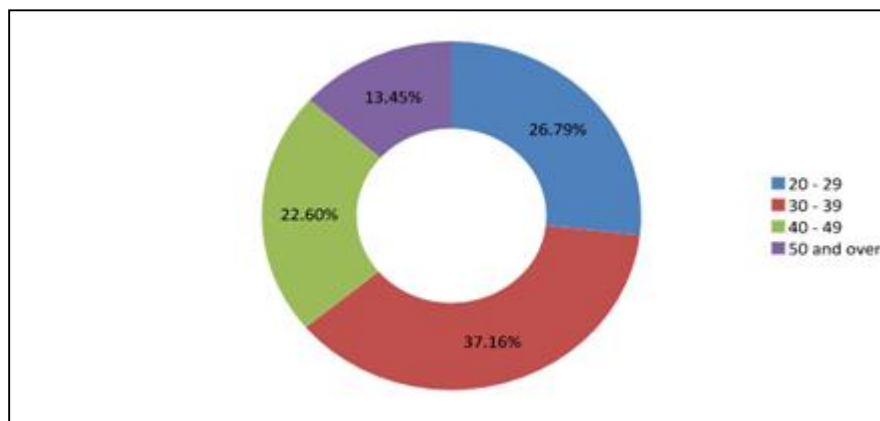


Figure 4: Demographic distribution of UTM geomatic graduates by age

Figure 5 illustrates the demographic distribution of UTM geomatic graduates working in the surveying sector (616 graduates) by states in Malaysia. It is interesting to find that almost a third (32.3% or 199 graduates) of all these graduates are working in the national capital, Kuala Lumpur. This is possibly due to higher salary along with additional values of experience in regards to the surveying sector in comparison to other states. Another major factor that influence graduates to work at Kuala Lumpur is the location of DSMM headquarters that is located within the central business district of Kuala Lumpur.

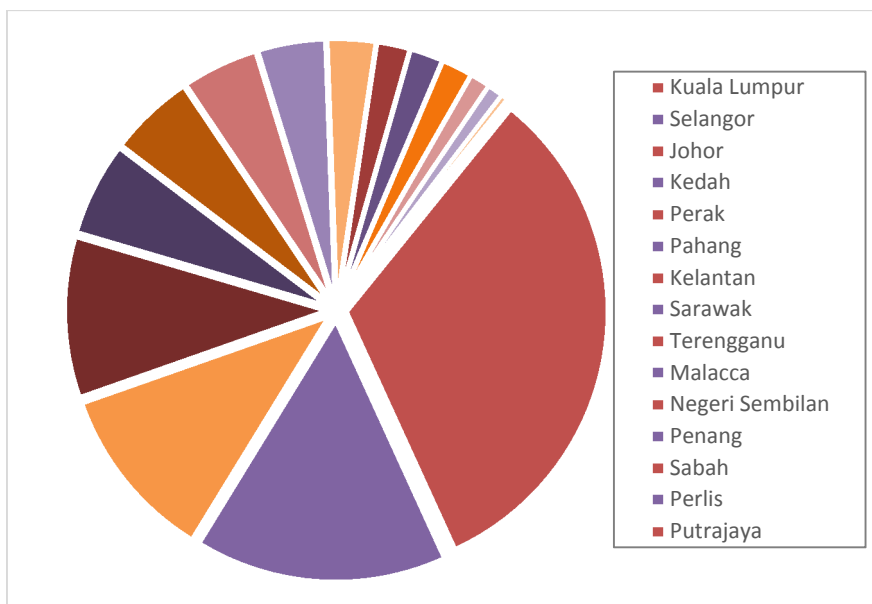


Figure 5: Demographic distribution of UTM Geomatic graduates by states

The economic prowess and industry frontier provided in other developed states i.e. Selangor and Johor have seen about 15.6% (96 graduates) and 10.9% (67 graduates) practising their surveying know-how in this area respectively. Accordingly, Kedah, Perak and Pahang comes at 9.9%, 5.8% and 5.2% respectively. At the other end of the spectrum are the states with less than five percent demographic distribution. These include Kelantan at 4.7%, Sarawak at 4.2% and Terengganu at 3.0%. Likewise, the proportions of those working in Malacca, Negeri Sembilan and Penang were similar at 2% while Sabah, Perlis and Putrajaya accumulates an average percentage of between 0.4% - 1.2% respectively.

4. CONCLUSION

The aim of this paper is to establish the human resource inventory of geomatic graduates. A case study of Universiti Teknologi Malaysia's geomatic graduates is used for the human resource inventory purpose. The output from the inventory sheds light on several significant graduate issues.

In terms of the graduation year, it can be seen that after the year 1995, the graduation figure is inconsistent. The years 2001 and 2006 have only produced nine and six graduates respectively. This might pose a risk when the supply of geomatic graduates is not able to fulfill the job market. To overcome this, the study duration needs to be consistent so a promising supply of graduates can be produced. The analysis has also confirmed that most of the graduates are working within the geomatic sector. Thus, current content of study could be maintained or improved to ensure this figure is consistent. However, the significant presence of untraceable career graduates is an issue therefore a better way to gather career data needs to be identified.

Next, the gender analysis made a mainstream finding where male graduates significantly outnumbered female graduates. To tackle this issue, extra efforts are needed for attracting

female students to enrol in the geomatic program. This can be done by increasing the study offer towards female. In the meanwhile, the curriculum can be modified to include more soft courses such as computing. In regards to age, the finding highlighted the prominence of the 30-39 age group. However, when cross-checking is made with Figure 1, this should not be the case. The finding highlighted that the number of graduates on and after 2007 were the highest, therefore the 20-29 age group should rise. Again, this was due to the untraceable career for the significant number of graduates as shown in Figure 2 whereas the age analysis only includes graduates with traceable career.

Finally, the location analysis reveals that 58.8% career traceable graduates are working at Kuala Lumpur and developed states such as Selangor and Johor. For fulfilling the job market within these city and states, the curriculum that exposes students to urban working environment can be maintained. At the same time, the issue of low number of graduates working within the rural settings can be tackled by introducing courses that exposes the rural working environment. In terms of intake, students who have their origin from rural places can be increased. This is due to the nature that Malaysian students prefer working nearby their hometown.

Altogether, findings from this paper proves useful for planning the curriculum and intake for geomatic students. Some courses can be introduce while others might be maintained. Intake issues are also discussed whereby it is suggested that the intake of female and rural students can be increased to diversify the program and fulfilling the job market.

The searching of the graduates' career data is a drawback of this study where a significant number of graduates career are untraceable. This happens due to the unavailability of the graduates records within the entire registries that are used. More efforts are needed to address this issue such as by using more career-based internet sites such as LinkedIn and cross-checking between more than one reliable Internet sites. In future, it is suggested that a spatio-temporal human resource inventory database is used where their continuous demographic and career information is stored. Incorporating the spatial aspect enables the current employment location of graduates to be mapped while slotting in the temporal aspect allows continuous observation of graduates' movement when they locationally change their career.

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