GEOSPATIAL TECHNOLOGIES APPROACH FOR CEMETERY MANAGEMENT SOLUTIONS: A REVIEW

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ABSTRACT

The study was first initiated to tackle an issue currently faced by the state religious council in Perlis, Malaysia, towards the oversupply of waqf land specifically for cemetery purposes which would be unsustainable for the current development trend. This study was conducted quantitatively by obtaining data from the urban planning department, PLANMalaysia, and the state religious agencies, MAIPs, Perlis. Two types of GIS software used are QGIS and MapInfo, while the result from the database will be updated into MAIPs' database, so-called MYGOS, with the most recent data. Therefore, the study finds out that most of the waqf land is not in line with the land use zoning of the local plan which indicates a lack of two-way communication between the state planning authority and the state religious council. This caused the cemetery land supply in Perlis to exceed the current and future needs until the year 2035. Consequently, the study conducted will elevate the management system of waqf land in Perlis into adapting the current technology of GIS. Updating the database with the most recent data will ease other related agencies to access and integrate the information related to waqf land, as well as improve data transparency in promoting cooperation between the two agencies. This study demonstrates the uses of GIS in waqf land management from conventional data storing methods to modern and convenient technologies and is also capable of showing the data inconsistency that exists between the religious institution and urban planning agency in Malaysia.

Keywords: GIS, geospatial planning, waqf land, cemeteries management, and urban planning

ABSTRAK

Studi ini pertama kali dimulai untuk mengatasi permasalahan yang saat ini dihadapi oleh dewan agama negara di Perlis, Malaysia, yaitu kelebihan pasokan tanah wakaf khusus untuk keperluan pemakaman yang tidak akan berkelanjutan bagi tren pembangunan saat ini. Penelitian ini dilakukan secara kuantitatif dengan memperoleh data dari departemen perencanaan kota, PLANMalaysia, dan lembaga keagamaan negara, MAIPs, Perlis. Dua jenis perangkat lunak GIS yang digunakan adalah QGIS dan MapInfo, sedangkan hasil dari database akan diupdate ke database MAIPs, yang disebut MYGOS, dengan data terbaru. Oleh karena itu, studi ini menemukan bahwa sebagian besar tanah wakaf tidak sejalan dengan zonasi penggunaan lahan dalam rencana daerah yang menunjukkan kurangnya komunikasi dua arah antara badan perencanaan negara dan dewan agama negara. Hal ini menyebabkan persediaan tanah pemakaman di Perlis melebihi kebutuhan saat ini dan masa depan hingga tahun 2035. Oleh karena itu, kajian yang dilakukan akan meningkatkan sistem pengelolaan tanah wakaf di Perlis dengan mengadaptasi teknologi GIS saat ini. Pemutakhiran database dengan data terkini akan memudahkan instansi terkait lainnya mengakses dan mengintegrasikan informasi terkait tanah wakaf, serta meningkatkan transparansi data dalam mendorong kerja sama kedua instansi. Studi ini menunjukkan pemanfaatan GIS dalam pengelolaan tanah wakaf mulai dari metode penyimpanan data konvensional hingga teknologi modern dan nyaman serta mampu menunjukkan inkonsistensi data yang ada antara lembaga keagamaan dan badan perencanaan kota di Malaysia.

Kata Kunci: SIG, perencanaan geospasial, tanah wakaf, pengelolaan makam, dan tata kota

1.   **INTRODUCTION**

The increasing contribution on waqf land recently has positive feedback on social economic development. One of the important practices in Islam that catalyze the development and economy of Muslims is waqf. This practice has been around since the time of the Prophet PBUH and was the basis for the success of the Islamic social system, as well as the existence of other practices such as zakat, Infaq, and many others. Waqf refers to a property donated by the Muslim community solely for charity purposes. The uniqueness of waqf lies in its characteristics that are permanent, inalienable, and irrevocable (Ghazali et al, 2020). The owner's intention for donating is to obtain rewards in the hereafter from God (Ismail et al, 2015; Lita, 2018). The two components of waqf are categorized as moveable assets such as physical property, shares, stocks, and cash, or immovable assets such as land and buildings. The waqf land has been categorized into two types which are special waqf where the endowment or any form of dedication is specifically declared for a purpose or special beneficiaries precisely by the endowers and general waqf is without the endowers stating any special beneficiaries be it any individuals, organizations, or institutions, therefore, can be used for any form of charitable dedication or endowment made to support all the public welfare purposes. Although it is not an act compulsory for its believers, waqf is much needed in Islam. In Malaysia, there is a positive increment in the act of waqf land by the Muslims from time to time, but the way the local Muslim community can fully benefit from the waqf property had been an issue for the waqf land management (Ismail et al, 2015). Most of the waqf land has been developed as a mosque, cemetery, orphanages and old folks, offices, shops, and residentials (Abdul Rasam, 2013; Shabbir, 2018). The development of waqf lands in Penang comprises commercial premises, residential, treatment centers, shop lots, office shops, and mosques. For instance, Waqf management in Federal Territory has been given the role of sole trustee for all general waqf within their administration boundary and is responsible for developing waqf lands to benefit the Muslim community. The other example of waqf land development in Malacca shows the development of their land for cemeteries. We observed that managing the dead is not the only focus of religious institutions, particularly in the planning of the development of waqf land in Malaysia. The total of 31,949,777 inhabitants in Malaysia in 2019 (World Bank, 2021) shows the relation to mortality rate, affecting the Muslim cemetery management in the entire state of Malaysia.

Geographic Information Systems (GIS) is a computer-based information system that works using spatial data information as its reference to capture, check, integrate, analyze,

manipulate, and display the conditions of the earth that are spatially reflected. GIS has its function in visualizing the spatial data and its attribute table by adjusting the shapes, sizes, colours, and symbols to better differentiate each layer that can fit in various fields of science, work, and events. Within this decade, the rapid growth of cities and populations proves to be a challenge to the planner in forecasting the demand and needs of cemeteries in areas to be built. This particularly happens within the group of community that practices full burial of the dead rather than a cremation site. In Malaysia, the efficient use of space in cemetery management can be determined by integrating the use of GIS. It acts as a spatial database of people buried and helps to keep track of the number of demands to estimate the future needs of that cemetery based on population growth. The interrelation of this data can be used to estimate when the cemetery might run out of space based on population growth (Daud and Sulaiman, 2015). Meanwhile, the uses of GIS for cemeteries in the UK had been utilized in planning natural burials, where a popular concept developed by planting trees rather than headstones (Clayden et al, 2017). Other uses of GIS are to keep track of the burial records that are easily forgotten, where the burials trend is rapid to reassess the older burial sites. Based on the burial pattern and land use conditions, GIS can also predict the unknown mass graves or cemetery distributions. To aid with cemetery organization, the location of the deceased can be mapped with GIS. As a result, this research looks at the necessity of managing the waqf land for cemetery areas correctly and effectively has increased the importance of embedding Geoinformation System (GIS) technologies.

The conventional method of storing waqf land data limits its management efficiency. According to Megat et. al, (2015), among the issues that had been discussed regarding the waqf land management is the incomplete data list managed by the Religious Councils. It is not a major problem, however, can be one of the reasons why the waqf land cannot be developed efficiently. Therefore, the data searching process from the GIS database is more reliable than the manual searching from the manual logbook directory. By using this approach, the management of the waqf cemetery land will become more systematic. The user will be able to view the land profile more easily, quickly view data, and order systematically even the land's location can be mapped and viewed simultaneously. Along with the advancement of information technology in the modern era, government services must adapt to the demands of the times. Muslim cemetery site placement affects surrounding land use value and many other disadvantages. Most of the waqf land areas are found to be in less strategic locations and scattered around. The potential to develop some of the areas cannot be

undertaken due to certain constraints and restrictions, especially for cemetery placement that will affect surrounding property value to be decreased. Cemetery planning should concern with social, institutional, and technical perspectives and closely related to many factors, including physical, surrounding land use, hydrology aspect, etc (JBPD, 2012). All these requirements make it impossible for all the specific waqf land to be developed as cemetery uses, thus it needs to be planned for other uses that blend well with its surrounding value.

The oversupply of Waqf-specific land (cemeteries) leads to improper planning for future waqf land management sustainability. The state of Perlis is currently facing problems developing the land which has been declared as a form of waqf specific since any plans which are to be undertaken must take into account the endowers' intentions and their beneficiaries (MAIPs, 2022). Since the management of waqf land can be used for many other developments that can bring more benefits, the land usage of the Waqf land needs to be optimized without focusing only on cemetery purposes. The biggest issue in the management of waqf land is the wrong perception of waqf land by the people who are looking at the land in a religious context, usually for cemeteries and mosque uses, rather than their potential for economic development. according to various resources, the SIRC nowadays had been actively developing their waqf land into residential and commercial unit with a lower rental value as compared to the market, however, the restriction of the waqf-specific land constrains the uses of it and contribute to the higher number of undeveloped and idle land within the state. Therefore, this study attempts to identify the existing distribution of Waqf land and cemeteries within the state of Perlis. Secondly, to construct a systematic spatial database for Waqf land and cemeteries by using the GIS approach to improve the efficiency of management systems. And lastly, to recommend a solution mechanism for the oversupply issue on specific Waqf land specifically for cemetery uses.

Most of the waqf land in Malaysia is used for burial purposes, as mentioned in paragraph. Although the paragraph discusses the concept of waqf in general, it also briefly mentions that most of the waqf land in Malaysia has been developed as mosques, orphanages, nursing homes, offices, shops, residences, and cemeteries. Additionally, the paragraph highlights the challenges in managing Muslim cemeteries in Malaysia related to population size and efficient land use. The paragraph also introduces the use of Geographic Information Systems (GIS) to manage cemeteries more efficiently, track burials, and estimate future needs based on population growth. This all reflects the link between waqf land and cemeteries in the broader context of waqf development and the social economy in Malaysia.

2. METHODOLOGY

This research was conducted quantitatively. The first stage starts with research formulation where the background study was being carried out and then comes out with the aims and objectives of the research study. Adjusting the scope and clarifying the limitations of the study were also part of the initial stage before moving on to the data collection process. The list of the data needed was identified as follows:

- Waqf land distribution

- Cemetery land distribution

- Mosque and Qariah area

- Administration boundaries

- Demand and supply of cemetery

- State population growth and mortality rate

All these data were obtained from several resources as secondary data from the related agencies such as PLANMalaysia and MAIPs. It was also extracted from related documents namely the Local Plan of Kangar and the State Structure Plan of Perlis. These data will need to be pre-processed before finally being used in a form of layers in the database created. Such a process involves data acquisition, data projection, data digitization, and data cleaning for each of the layers to be included in the GIS software. Table 1 below shows the summary of the list of data:

Table 1. *Summary of The List of Data Collection*

Sources	Data Received	File Types
PLANMalaysia HQ - Land use & Zoning Negeri Perlis - Perlis Cemetery land use	9/12/2021	shp.
PLANMalaysia Perlis - Muslim cemetery land use - Muslim cemetery zoning	29/12/2021	tab.
MAIPs - Waqf land list	5/12/2021	pdf.
- MyGOS portal	5/12/2021	Website
- Mosque lot no. and cemetery land use list according to Dun boundaries	10/1/2022	pdf.

The Waqf and Cemetery Land Database were created by combining several layers of data into one workspace. MapInfo and QGIS are the two types of software used in conducting this study where both applications offer various useful functions and ways of GIS analysis to be conducted at ease. Other supporting GIS tools used were Google Earth, iPLAN, and MyGOS which provided additional details such as lot number, satellite, and street images to

assist the study better. Data obtained are not all in the form of a GIS format that can be directly combined into the database. For those layers, it needs to be manually created from pdf. file and word. into shp. format. As a result, a fully completed database for this study with all the layers needed had been constructed and the database model can be referred to in figure 1 below. Every update on the layer's information can be edited directly in the database and the copies of the files were stored in Google Drive as a backup database.
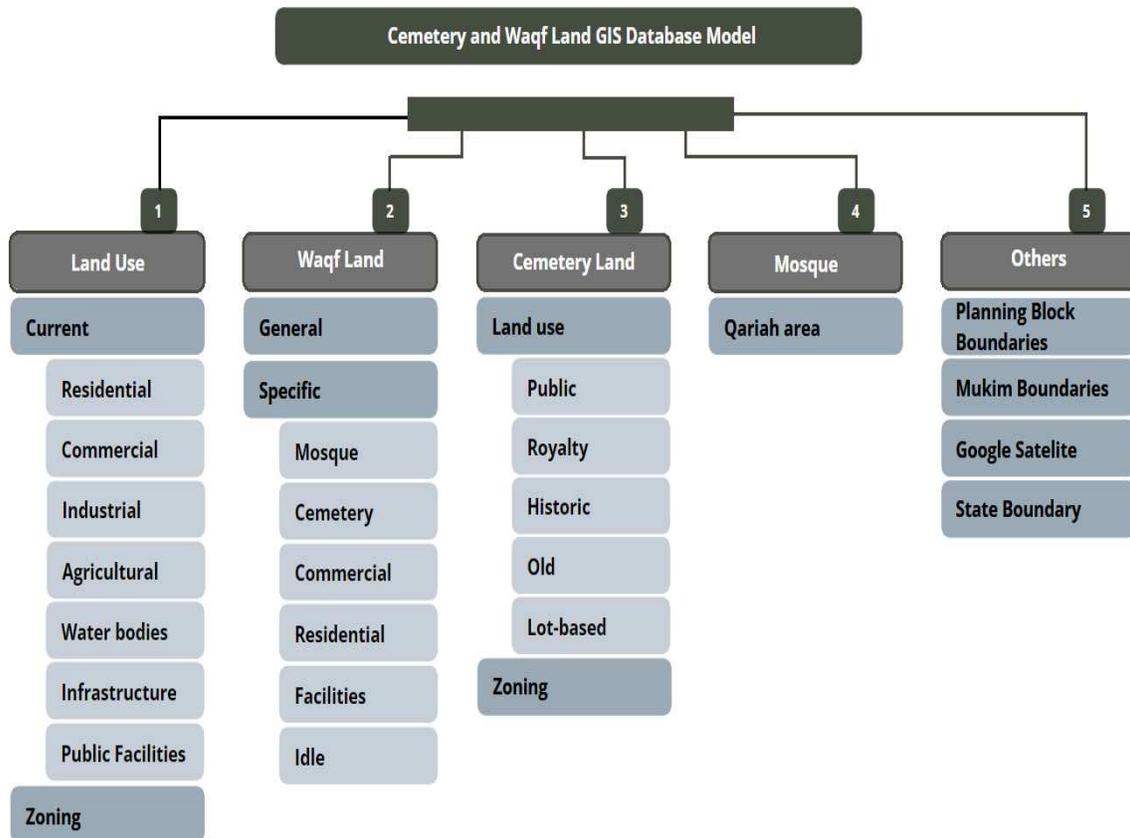

Figure 1. *The structure of the Cemetery and Waqf Land GIS Database model*

Next, three types of analysis conducted on these data were the analysis of waqf and cemetery land distribution, the analysis of mosque distribution and its qariah catchment area, and the analysis of demand and supply for Muslim cemetery land in Perlis. The population projection and cemetery need to be forecasted by referring to the state growth rate and the Muslim Cemetery Guidelines provided by the JPBD 2012. The projected result was then compared with the current cemetery land supply from both land use under the PLANMalaysia and MAIPs inventory list.

3.   RESULT

The result showed that only a small percent of waqf cemetery land recorded in MAIPs inventory are matching with the land use and zoning for future cemetery uses provided by PLANMalaysia. The number of waqf land for the cemetery is 58 lots, while the number of cemetery land use and zoning is 153 lots. However, the distribution of these two layers in the database can only find 3 lots that overlay with each other. Figure 2 shows the distribution of waqf cemetery and cemetery land use overlayer.

While most of the cemetery land is generally known as public cemetery land, it can be further categorized into five types: public and royalties use, historic, old or closed, and the new lot-based scheme cemetery. Table 2 below shows the types of cemeteries land in Perlis. Another layer for the cemetery land is the land zoning by PLANMalaysia where in this study, this layer will indicate the land that had not been used as a cemetery land yet. Most of its current land use on the ground was open spaces or agricultural land. Tables 3 and 4 below show the distribution of cemetery land use and zoning within the state of Perlis according to its planning block.

Table 2. *Types of Cemeteries Land in Perlis*

Cemetery	Frequency	Percentage
Public	142 lots	92.9%
Royalty	1 lot	0.6%
Historic	2 lots	1.3%
Old	6 lots	3.9%
Lot-based	2 lots	1.3%
Total	**153 lots**	**100%**

Table 3. *Cemetery Land Use Distributions by Planning Block*

Planning Block	Frequency	Acreage
PB Kangar	50 lots	25.65
PB Arau	13 lots	9.08
PB Kuala Perlis	18 lots	12.09
PB Padang Besar	33 lots	19.1
Total	**121 lots**	**65.93**

Table 4. Cemetery Zoning Distributions by Planning Block

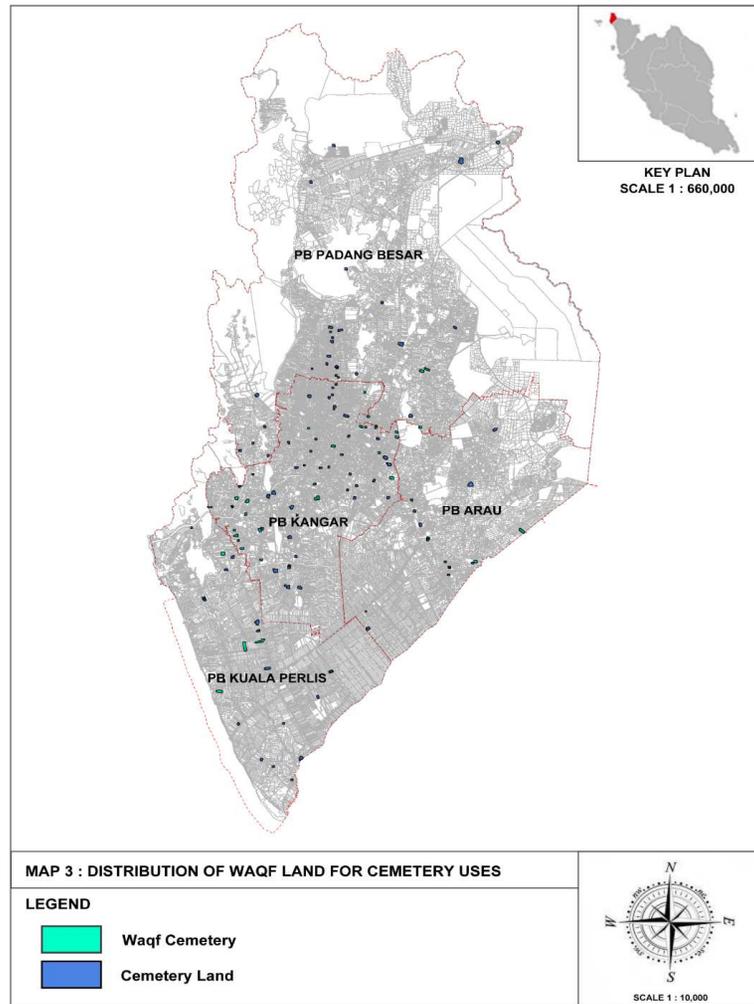| Planning Block	Frequency	Acreage
PB Kangar	28 lots	2.4
PB Arau	-	-
PB Kuala Perlis	1 lot	0.27
PB Padang Besar	3 lots	0.57
Total	**32 lots**	**3.23**

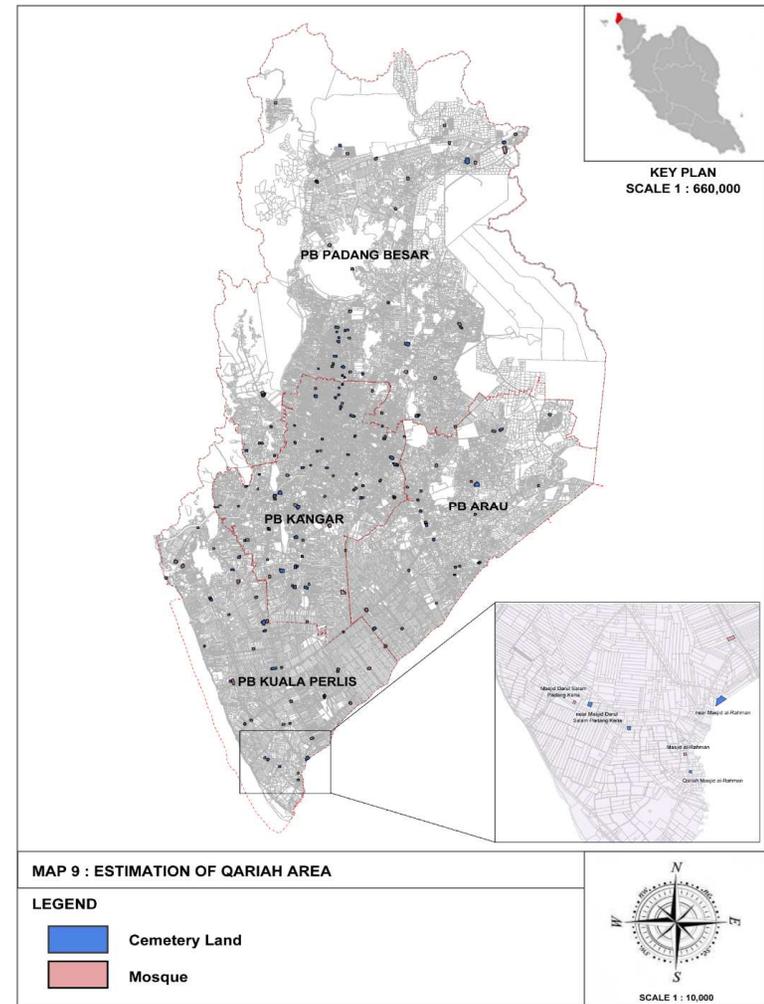**Figure 2.** Distribution Of Waqf And Cemetery Land

Figure 3. *Distribution Of Mosque And Qariah Area*

Figure 3 above shows the distribution of mosques and their qariah estimation. Data collected for the distribution of mosques was based on the primary data provided by PLANMalaysia while the qariah area had been referring to MAIPs. The distribution of mosques is supporting data to make it easier for allocating the cemetery qariah area. So far, the list of qariah areas for cemetery land based on the mosque provided by MAIPs has not been completed yet. Therefore, a site visit to each of the mosques helps this study gain the information needed to complete the database. Table 5 shows the distribution of mosques according to their planning block.

Table 5. *Mosque Distributions by Planning Block*

Planning Block	Frequency	Percentage
PB Kangar	30 mosques	29.4
PB Arau	18 mosques	17.6
PB Kuala Perlis	28 mosques	27.5
PB Padang Besar	26 mosques	25.5
Total	**102 mosques**	**100**

Meanwhile, the population projection and demography stated by Kangar Local Plan 2035 were categorized into two which are 85.2% of Muslim and 14.8% non-muslim. The population of Perlis in 2000 was recorded at 204,400 people. The number of populations grows up to 251,500 people in 2017. The average annual growth rate by the KPPT for the state in 2018 is (2.19%) if projected until 2035. According to Kangar Local Plan 2035, the current supply of cemetery land is 66.06 acres, which exceeds the current demand for cemetery land which is only 43.33 acres. Table 6 shows the projection extracted from the technical report.

Table 6. *Cemetery projection needs until 2035*

Planning Block	Muslim Cemetery Standard (1:5,000)			
	Population	Supply (hec.)	Demand (hec.)	Surplus (hec.)
Kangar	80,481	29.87	16.10	(-13.77)
Arau	48,444	12.30	9.69	(-2.61)
Kuala Perlis	44,901	11.56	8.98	(-2.58)
Padang Besar	42,839	12.33	8.57	(-3.76)
Total	216,665	66.06	43.34	(-22.73)

Source: Technical report of Kangar Local Plan 2035

4. DISCUSSION

Based on the literature study, the waqf land in Malaysia can thus be said to have been indirectly monitored by JAWHAR at the federal level with the establishment of MyGOS a few years ago, and this includes MAIPs that have shared their online database for this research purposes. However, the data there is nowhere near completion as compared to what had been stored in the form of words and pdf files. Under the current practices of MAIPs

Perlis, there is an urgency to completely recorded all the waqf lands into their database to protect and manage the waqf properties efficiently. On the other hand, the onsite cemetery management should be improved in a way that it should have a more systematic management of recording the land's location and related details either manually or digitally. This will, later on, ease the process of completing the database to be recorded in the system by the religious councils and simultaneously assist them in making a development decision. Moreover, the need to have more manpower and capacity building in the geospatial unit should be expanded in managing religious matters. Planning on development is usually more focused on the economic benefits while religious matter is not given that much concern. This effort could be one of the ways to improve the efficiency of decision-making as its process will be able to benefit the ummah, which is the community itself in general.

Throughout the study, it can be observed that some of the lands that had been waqf with for specific purposes are not in line with the land use zoning of the local plan. The study finds that there are quite a large number of MAIPs reserved land that was not similar to the plot for the land zoning reserved for the cemetery by the local authority. As such, the local authority needs to be aware of this matter and consider this waqf land as part of their zoning local plan. In land use planning, the placement of cemetery land is quite a sensitive issue that might cause the surrounding land price to fall. This may not include yet the other criterion for cemetery land suitability such as the topography, types of soils, and water runoff on the site which will bring out many other issues for the site selection. The study finds out that the main issue for the difference in reserved land for cemeteries between the MAIPs and PLANMalaysia was due to their lack of communication between the two agencies. Not only in terms of data sharing but also the database system that should be improved to have an online system to be accessed by several agencies. Therefore, there is a need to have a centralized database for all the parties involved in the waqf land management such as the SIRCs, the Ministry of Land and Natural Resources, Planning Authorities, and JAWHAR for a better and standardized administration system that works more efficiently. While each of the agencies should have its centralized databases that allow them to track locations, sort out data, and identify the surrounding land use and condition, this centralized system should be started at the local level and the readiness of the database system will lead to the integration at the regional and state level. This will also help encourage more agencies to be involved with waqf planning and not rely only on the SIRCs alone.

With the use of the GIS application, the distribution of both cemetery land and its qariah area under the mosque can easily be seen when overlaying these layers in the database. Most of these qariah areas that had been identified are mostly based on the data provided by MAIPs, site visits, and interviews at the mosque in several places. However, for those qariah areas that had not been identified, an estimation of the area can be made based on the distance between the cemetery land and their nearest mosque. Though it might be some conditions imposed for a mosque to own a cemetery under its qariah, this analysis can be a rough view of the possibility of the cemetery being under the qariah area for the mosque. Furthermore, GAP analysis was used in determining the demand and supply for cemetery land in finding the difference between the current supply of land use with the expected demand of the population in the targeted future. The need for a cemetery space for an area depends on the size of the graveyard, the death rate, and the views of the residents towards the reuse of the old cemetery site. The graves of the Muslims can be used after 90 years of the last burial made on the grave (JAIS). In short, the projection until the year 2035 by the local plan does have oversupply issues on cemetery land supply which exceed its demand based on the population and Muslim Cemetery standard guideline, 1 acre: 5,000 populations. Since there are still incomplete data that need to be acquired from the MAIPs, the current supply of cemetery land might be higher than the projection data used in this study. Thus, any additional charity act of waqf for the specific uses of the cemetery will cause more oversupply and be unsustainable for waqf and cemetery management. In terms of planning for the state, it is unwise to have an oversupply of land focusing only on one matter, especially the public facilities as waqf land should also be beneficial for other uses such as economic purposes to generate income for the Muslim community.

5.   CONCLUSION

This concludes the study on the management of waqf land and cemetery in Perlis with the implementation of Geospatial Information Technology (GIS) in land management and administration. The implementation of Information Technology (IT) is very much needed to enhance the management and performance of every organization within their administration system to keep up with the growing needs. In a nutshell, the study had successfully achieved the research objectives with the findings and analysis discussed above, and also proved that the land for the cemetery was still sufficient, such as the act of waqf for cemetery uses should be discouraged any further. The application of GIS in managing the Waqf is property expected to benefit the Waqf institution thus enhancing the level of efficiency and

effectiveness of the management team assigned to the role of monitoring the land. Although such a suggestion will come with its issue where there will be difficulties in centralizing the data due to the different agencies managing the waqf property in Malaysia. Not only the JAWHAR as the main agency monitoring all the other State Religious Agencies, but the other related agencies as well may face difficulties in data retrieval which caused it too time-consuming and inefficiency in the overall waqf property management. Hence, the implementation of GIS into the waqf management system to manage the waqf property by the waqf institution is very crucial in ensuring the efficiency of the management.

LIMITATIONS AND STUDY FORWARD

This study only focuses on Muslim cemeteries and waqf land in Perlis. Some of the data acquired from the MAIPs had not been completed yet, therefore, there might be a possibility for the study to further be improved with the latest data in the near future.

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