



Evaluating the parameters of ArcGIS and QGIS for GIS Applications

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ABSTRACT

The GIS software industry has a boom over the last decade. In this paper, we are investigating two GIS programs which can be used to create GIS solutions —the commercial Esri's ArcGIS and the free and open-source QGIS. It considers applications in sustainable spatial planning by comparing the software quality of the leading, proprietary ArcGIS for Desktop 10.5.1 software with the open source QGIS Desktop 2.18 software. We compare the various parameters for both GIS software's like Costs and Licenses, Development and Distribution, Training and Support. Then we check the features and functionality of both softwares. The utilization of Geographical Information Systems (GIS) brings incredible favorable circumstances for crafted by planners, however the specification and complexity of the program makes it expensive and the purchase must be considered wisely, especially in small planning organizations. This paper gives managing standards to spatial planning organizations concerning the possibility of replacing ArcGIS software through QGIS software depending on their specific tasks as well as skills of their employees. It highlights one of the GIS software but to conduct an evaluation of the two GIS software concerning their suitability for specific cartographic and analytic tasks.

The extent of this paper isn't to expound whereupon programming is the better GIS programming. The appropriateness of one of the GIS programming will dependably be reliant on the client or organization with their needs and assets.

Keywords - GIS, ArcGIS, QGIS, Spatial Planning

1. INTRODUCTION

Most associations like fast-food chains, healing centers, banks and the avionics exchange, the scholarly community, business, and open organization utilize Geographic information framework (GIS). It has developed from custom projects made by government offices on centralized server PCs inside the Nineteen Sixties, to non-open work area based generally programming framework inside the Eighties, to coordinate net based for the most part arrangements inside the 2000s. Work area GIS programming framework keeps on being normal since it grants clients to administer free downloadable data and to shape their own data in a boundless approach.[1]

The reason for GIS is to computerize the way toward capturing, storing, editing, updating, analyzing, and showing a wide range of geographic information.[2]

The desktop GIS market comprises of a modest bunch of organizations, for example, Intergraph, MapInfo, and ESRI, that create proprietary software. ESRI, the makers of the mainstream ArcGIS software, is the biggest organization in the GIS business and gives software, support, consulting, training, and publications. [3]

There is at present a developing development in the improvement and selection of free and open source programming (FOSS) for GIS. Steiniger and Bochner [4] refer to an expanding number of FOSS GIS ventures, developing help of FOSS extends by government elements, expanding downloads of FOSS GIS programming, and a development in the quantity of utilization cases for open source GIS programming for geospatial databases as confirmation of this developing development. QGIS (Previously known as Quantum GIS), is a standout amongst the most well-known Open source GIS programming framework today.

II.PARAMETERS OF ARCGIS AND QGIS

In this segment the parameters of ArcGIS and QGIS will be illustrated. These incorporate the product's development and distribution. Subsequently the topics costs and licenses, training and support.

2.1Development and Distribution

Development of ArcGIS

ArcGIS is a geographic data framework (GIS) for working with maps and geographic data. The restrictive GIS programming ArcGIS was created by the organization "Environmental Systems Research Institute (ESRI). Its home office is arranged in Redlands California, USA and it has workplaces all through the world. The organization was established in 1969 by Jack and Laura DANGERMOND as an exploration gather dealing with arrive utilize arranging. Today they are the organization's leader and VP. In the first place, the organization concentrated on the examination of geographic data to counsel arrive organizers and asset directors in the field of ecological arranging. Amidst the 1970s esri was given the request by the County of San Diego, California to build up a polygon data overlay framework. This was the organization's initial step to build up a geographic data framework. In 1973 esri made the main economically created statewide GIS programming for Maryland. It was just about ten years after the fact, in 1982 that the organization began in the product business with the exclusive GIS programming called ARC/INFO. It was the principal present day GIS programming framework which joined a PC show of geographic highlights with a database administration apparatus which could allot ascribes to the highlights which were put away as arcs. It additionally incorporated a toolbox with command-driven user interface [6].

Today ESRI has around 3,200 employees around the world. It has 10 local workplaces in the US and more than 80 distributors all through the world [7]. ArcGIS is accessible as ArcGIS Online, ArcGIS for Desktop, ArcGIS for Server and Portal for ArcGIS. ArcGIS for Desktop is a GIS program which can perform spatial investigation on vector and raster information, alter and geocode information, and create superb maps. It incorporates the program ArcGIS Online which speaks to a mapping stage to produce intuitive web maps and applications. The present discharge from June 29th, 2017 is ArcGIS for Desktop 10.5.1. ArcGIS for Desktop has been guaranteed for Windows working frameworks (Windows XP, Vista, 7, 8,10). The product can't be utilized on Mac, Linux, or BSD working frameworks. ArcGIS for Desktop can be utilized on Macintosh PCs which run Windows with the assistance of VMWare, BootCamp, or Parallels. ArcGIS for Desktop is accessible for



download in 10 languages: Arabic, Chinese, Japanese, German, French, English, Italian, Spanish, Portuguese, and Russian. ArcGIS Resource Center is meant 7 languages.

Although Ersi's product is restrictive, the improvement procedure incorporates components of open source advancement. Esri gives a framework to revealing programming blunders and has set up an Esri User Experience Improvement Program. At the point when the product closes out of the blue with the message "ArcGIS has experienced a genuine application blunder and can't proceed with." a mistake report document (.dmp) is naturally created on the hard drive and can be sent by means of a Send Error Report catch. The User Experience Improvement Program goes for enhancing the cooperation and route inside the product. At the point when clients take part in the program, by actuating it amid the establishment procedure, information about the utilization of apparatuses, equipment and working framework data is gathered [8].

Development of QGIS

QGIS (beforehand known as Quantum GIS) is a free and open-source cross-platform desktop geographic data framework (GIS) application that backings survey, altering, and investigation of geospatial information. It exists for the working frameworks Windows, Mac OS X, Linux, BSD and Android (beta). QGIS programming is created by utilizing the programming dialect C++ and the modules of the open source venture Qt Project which is a cross-stage application and UI structure. The "Q" in QGIS identifies with the one from Qt Project. Before the 2.0 discharge in September tenth, 2013, the program was referred to as Quantum GIS and additionally QGIS and is solely called QGIS from that point forward. QGIS is accessible in 42 dialects. QGIS comprises of four components, QGIS Desktop, QGIS Browser/Mobile, QGIS Web Client and QGIS Server. QGIS Desktop is the proportionate to ArcGIS for Desktop as it gives GIS capacities to information creation, review, altering, and examination. QGIS Server speaks to a standard-consistent WMS 1.3 server that can be designed with venture records from QGIS Desktop. As QGIS is open source, the advancement procedure is altogether different to that of ArcGIS. QGIS venture was begun in 2002 by the Alaskan software engineer Gary SHERMAN who was searching for a quick geographic information watcher which keeps running on Linux and backings a few information designs. Because of his unsuccessful pursuit he chose to begin his own GIS venture. In June 2002 QGIS was formally enrolled as a task of the Open Source Geospatial Foundation (OSGeo), a not-revenue driven association with the point "to help the communitarian improvement of open source geospatial programming, and advance its boundless utilize".

The second designer in October 2002 was Marco HUGENTOBLE from the University of Zurich. The product is being composed by a center improvement group and an overall group. There are more than 50 designers of which 30 are consistently dynamic. The real advancement is directed in Middle Europe. QGIS has for example client bunches in Switzerland, the UK, and Austria [9]. The improvement of QGIS committers by the task's author SHERMAN demonstrates an expansion in designers that crests in 2008. From that point forward the quantity of new committers is contracting which demonstrates that the center improvement group is steady. QGIS has a module design that empowers the including of new highlights. Modules can be composed by engineers in Python or C++ with the assistance of the coordinated Plugin Builder in QGIS, or through the formation of their own fork on QGIS store at Github, a site for code survey and administration for open source and private tasks. QGIS establishment will affirm modules with the goal that quality control is ensured. On the



authority QGIS modules online interface [<http://plugins.qgis.org>] engineers can discover a rundown of all steady and exploratory QGIS modules and in addition a manual for making their own plugin.

In 2014, the QGIS advancement group chose to have another discharge each fourth months. The present form is QGIS 2.18. 'Las Palmas' and was discharged on Jan 19th, 2018. The advancement design anticipates a three-month improvement stage and a one-month stage for bug settling, interpretation, and testing.

Distribution of ArcGIS and QGIS

ArcGIS, "pioneer in the GIS programming industry" [10] has the greater piece of the pie among the two GIS programming. ArcGIS programming has more than one million clients worldwide and is introduced at more than 5.000 colleges [7]. It is prevalent for government and business organizations. As QGIS is open source programming and doesn't have enlisted licenses, the quantity of dynamic client is difficult to foresee. The originator SHERMAN led an investigation in 2011 in which he utilized the log records from the QGIS contributed storehouse and geocoded the IP locations of every passage that recovered the module list from the QGIS server. Along these lines he could appraise the quantity of dynamic QGIS clients to at least 100.000 clients [11]. Thusly, QGIS has a little piece of the overall industry than ArcGIS. In any case, its ubiquity has been becoming generally quick in the most recent decade. It is particularly well known in the scholarly world and open source programming client circles. All things considered, there are likewise cases for QGIS executions out in the open organizations. As of now in 2006, the Swiss Canton of Solothurn chose to utilize QGIS rather than Esri items [12].

2.2 Costs and Licenses

ArcGIS is an exclusive programming item. There are distinctive renditions with differing costs accessible. Concerning ArcGIS for Desktop, there are three variants with various costs and expanding functionalities. These are ArcGIS for Desktop Basic, ArcGIS for Desktop Standard and ArcGIS for Desktop Advanced. They were called ArcView, ArcMap, and ArcInfo before the 10.0 discharge. ArcGIS for Desktop Basic is appropriate for building maps and investigating geographic data, ArcGIS for Desktop Standard furthermore holds devices for multiuser altering and propelled information administration and ArcGIS for Desktop Advanced empowers propelled examination and information change. By and large, a form of ArcGIS will cost around 2.500€ - 25.000€ for every permit, in addition to extra yearly expenses for discretionary help which can be up to 4.000€, contingent upon the variant and the status of the organization or association. Be that as it may, Esri gives a 21 days trial adaptation of ArcGIS Desktop Advanced for private clients and in addition organizations.

As opposed to ArcGIS, QGIS is an OS venture which infers that the product is accessible for nothing out of pocket. This is likewise valid for refreshing old renditions and the establishment of modules. The product can be downloaded without enrollment on the authority QGIS venture site or the OS people group site Sourceforge (<http://sourceforge.net>) on which QGIS is enlisted since December second, 2011. It is the biggest OS registry where IT experts create, download, audit, and distribute open source programming (Sourceforge 2014). Concerning the source code, ESRI ensures its source code in the permit assentment as it is a restrictive programming organization. "Esri Software source code is unpublished, and all rights to Products are saved by Esri and its licensors". Along these lines, the source code is ensured and may not be utilized to construct



different applications on it. "Permit may not furnish outsiders with guide access to Esri Software so the outsiders may utilize the Software specifically, build up their own GIS applications, or make their own answers in conjunction with the software".

QGIS is licensed under the GNU General Public License which was created by the FSF for the project GNU operating systems in 1989 [13]. In specific it holds the Creative Commons Attribution-ShareAlike 3.0 license CC BY-SA (QGIS 2014). This means, that users can share and adapt the software. More precisely the term "share" means to "copy and redistribute the material in any medium or format" (CREATIVE COMMONS 2014) and "adapt" means to "remix, transform, and build upon the material for any purpose, even commercially". The task "ShareAlike" indicates, that the user must distribute his product under the same license as the QGIS license in case a new product is created by remixing, transforming, or building upon the QGIS source code. In addition, it is not possible to use legal terms or technological measures which legally restrict others from doing anything the license permits.

2.3 Training and Support

Trainings

"Esri offers hundreds of training options on GIS, ArcGIS technology, and related topics". These training options include free and chargeable trainings, individual virtual campus training and instructor led trainings. To learn ArcGIS for desktop there are 169 options available. Esri provides a free Resource Centre which is available in seven languages. It includes the ArcGIS help (<http://resources.arcgis.com/en/help/main/10.5/>) which is structured by ArcGIS versions and products. Trainings date back to ArcGIS version 9.1. Esri's Resource Centre also hosts a blog (<http://blogs.esri.com/esri/arcgis/>) and forums (<https://community.esri.com/community/arcgis-ideas/>) which are systematically organized by different categories. Furthermore, there is a section with videos available on <http://esri.com/videos>.

For ArcGIS it is possible to receive ESRI Technical Certificates by taking exams. These can be obtained for a fee 225 USD [~160 Euro] via Esri's partner Person Education in approximately 5,000 test centers worldwide. Vienna for instance hosts five testing institutions. There are also many books available. A search request on online warehouse Amazon from Oct 2014 revealed more than 30 books.

Likewise, there are trainings for QGIS available. The QGIS Website provides several guides and tutorials to work with the software. Like ArcGIS Resource Centre, QGIS has a User Guide which is a structured documentation about the QGIS functionalities available as online manual or .pdf print version. It is updated with every update of QGIS but is also available for older versions. Additionally, there is a training manual with different courses available and for GIS beginners a Gentle introduction to GIS. A possibility to solve concrete QGIS issues is the "Qgis-users mailing list" where specific questions concerning the installation and use of the software can be asked. In this way user questions reach a broad audience and answers can benefit several users. The QGIS development team also maintains a presence on the Internet Relay Chat IRC where users can exchange ideas. It can be joined by users via a specific QGIS channel on the website freenode.net. All discussions are being logged and can be viewed on the QGIS homepage (<http://qgis.org/irclogs>). Furthermore, the QGIS community maintains a blog (<http://planet.qgis.org/planet/>) which contains articles for users and developers.



Concerning literature, there is only one book about QGIS on the market so far which is “Learning QGIS2.0: Use QGIS to create great maps and perform all the geoprocessing tasks you need” by Anita Grasser published in 2013.

Support

In terms of commercial support, “Esri has a well-established knowledge base, peer support forum, and technical support system for its ArcGIS product” [14]. Support is available for the versions 9.x and higher. ESRI’s support structure for the US is divided into standard, and premium types of support. Furthermore, there is the Customer Support which oversees addressing issues concerning licensing and registration of ArcGIS software. Countries outside the US have authorized international distributors that are listed on ESRI’s website <http://support.esri.com/en>.

Comparable to ArcGIS, there are several companies that focused on commercial support for QGIS software. In total there are 30 companies, twelve of them are so called “core supporters” for which QGIS foundation takes the full responsibility for their “accuracy, reliability or completeness of the provided information”.

III. SOFTWARE STRUCTURE AND FUNCTIONALITY

3.1 Installation

On Esri’s site data on the distinctive ArcGIS for Desktop adaptations and their substance can be found. A permit itself must be obtained by reaching the nearby ESRI distributor. In the event of the Student permit, the approval code and an ArcGIS variant were bought at the college. As ArcGIS is an exclusive programming, aside from the establishment procedure an approval is required. For the approval it is important to make a client account on Esri’s landing page <https://accounts.esri.com/information> exchange. In the wake of enrolling with the full name and a substantial email address the client will get an email from Esri with a connection to initiate his or her record. To do as such the information Full name, Organization, Address, and Phone Number must be uncovered and a permit assent should be acknowledged. In the following stage the client can either introduce an ArcGIS for Desktop form by means of an outside circle or download the variant from the landing page after the bought approval number was entered. In this test the product was downloaded as it empowers the establishment of the most recent form ArcGIS 10.5.1 for Desktop. Aside from the GIS program, the Service Pack Microsoft .NET Framework should be downloaded and introduced including refreshes. Microsoft will additionally suggest introducing the most recent Internet Explorer and Microsoft Windows Malicious Software Removal Tool. Along these lines, ArcGIS for Desktop programming can be introduced. The establishment with an establishment wizard takes roughly 20 minutes. The establishment bundle incorporates Python 2.7.5, Numerical Python 1.7.1 and Matplotlib 1.3.0. After the product’s establishment the item can be approved by means of the Internet whereby the indistinguishable approval data should be included that had been utilized for the Esri User Account. Extra data on the client’s association, industry and individual is required.

QGIS programming can be downloaded from the official venture site <http://qgis.org/>. As QGIS is an open source programming, the client can choose introducing the most recent stable discharge rendition and the designer variant (ace) for the coveted working framework. There are two choices for the QGIS establishment accessible. The independent installer is one extensive download (358MB) in which a QGIS discharge and in

addition GRASS GIS and SAGA GIS are incorporated. The second alternative which was utilized as a part of this case is OSGeo4W installer. It is a little establishment apparatus (878KB) which empowers the download and establishment of QGIS yet in addition other OSGeo devices and encourages future refreshing procedures of QGIS and its conditions [15]. Aside from QGIS, GDAL, and GRASS GIS were introduced with OSGeo4W installer.

The establishment time was 20 to 30 minutes in QGIS and over 20 minutes in ArcGIS. In any case, the whole establishment process set aside twofold the ideal opportunity for ArcGIS because of the modern enrollment process and the establishment of Microsoft.NET Framework. In addition, there was no establishment manual required for QGIS as the procedure is somewhat simple. For ArcGIS the establishment manual was required however. QGIS was later refreshed from QGIS 2.16 to QGIS 2.18 with OSGeo4W installer. In that way the setting of QGIS 2.6 like toolbars and modules were naturally connected for the new QGIS 2.18 adaptation. All ventures that were spared with QGIS 2.16 could be utilized as a part of the new form without challenges.

In the below table 1, we use ArcGIS for Desktop 10.5.1 software and open source QGIS Desktop 2.18 software.

#Installation	ArcGIS 10.5.1	QGIS 2.18
CPU speed	2.2 GHz minimum	2.0 GHz
Memory/RAM	Minimum: 4 GB Recommended: 8 GB	4 GB or less
Disk space	Minimum: 4 GB Recommended: 6 GB or higher	1.56 GB
Installation time	More than 20 minutes	20 to 30 min
Authorization required	Yes	No

Table 1 Benchmarks for Installation

3.2 Graphic User Interface

ArcGIS and QGIS have similar Graphic User Interfaces (GUI). They consist of five elements, namely the main menu bar on top, tool bars, the map legend or table of contents, the central map view, and the status bar at the bottom. As the GIS programs offer a huge set of functionalities the required toolbars and windows can be added, scaled and arranged according to the specific task. The same can be seen in ArcGIS. Both programs are similar in terms of structure and use the same color scheme with blue and grey as dominant color. The color grey generally has the effect to appeal elegant and slick to a user. In the following two figures we're showing the Free spatial data of Nigeria (free sample data).

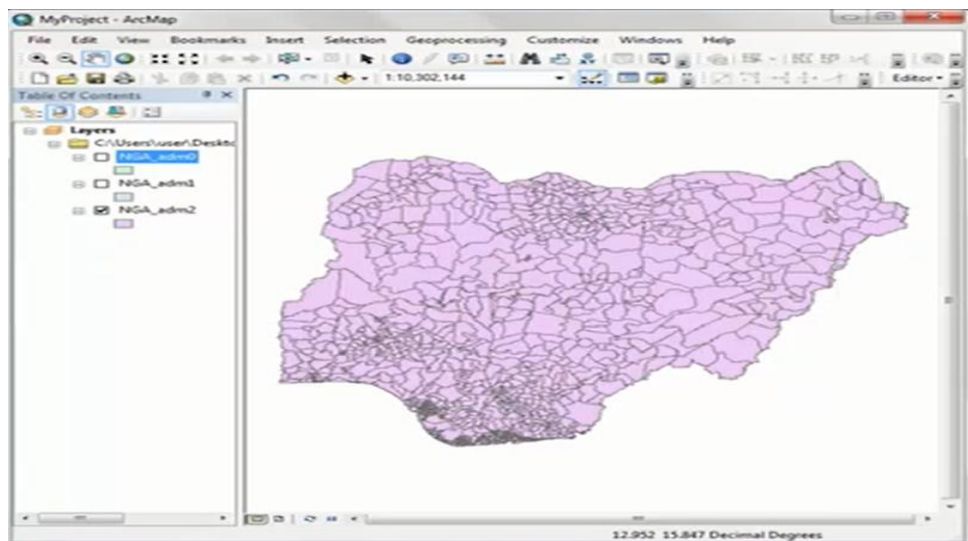


Figure 1 ArcGIS GUI

The two programs use direct manipulation and menu selection. Symbols facilitate the access to the functions. Moreover, color schemes, shortcuts and commands icon can be individually adapted. The map can be zoomed with the Mouse Wheel and panned with arrow keys and space bar.

When installing the software, QGIS applies the operating system's default language. However, the language can easily be changed to one of 42 languages in the menu settings.

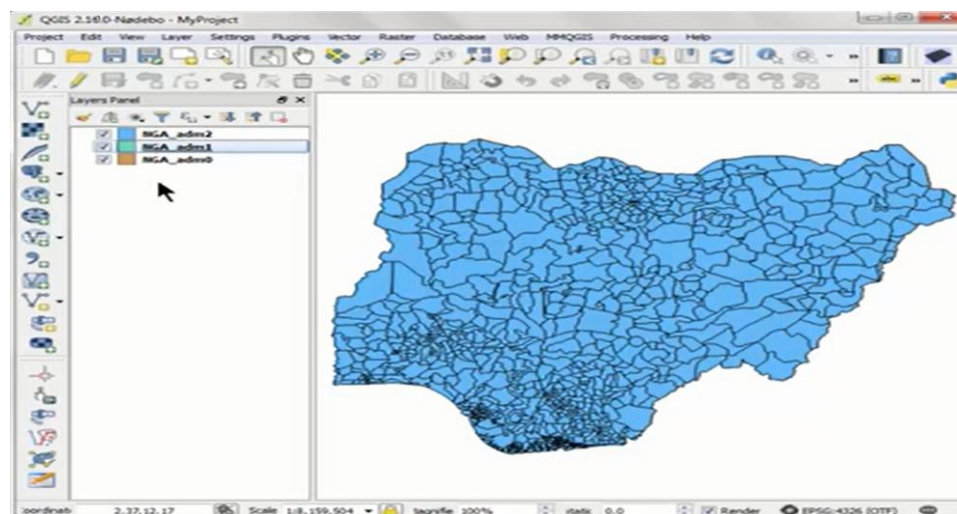


Figure 2 QGIS GUI

After selecting a different language, only a restart of the program will be necessary to work with the GUI of the selected language. In ArcGIS the user will order the software with the preferred language. A change of language at a later moment is not possible.

3.3 Data Formats and Data Management

ArcGIS and QGIS can both handle diverse sets of vector, raster, and tabular data as well as web services.

Raster Data

ArcGIS for Desktop supports around 70 raster data formats. The full list of supported raster data formats can be viewed in Esri's Resource



Center http://resources.arcgis.com/en/help/main/10.2/index.html#/Supported_raster_dataset_file_formats/009t000000q000000/. QGIS used the GDAL/ORG library to read and write raster and vector formats. GDAL supports more than 133 raster formats. The complete list can be viewed on the website http://www.gdal.org/formats_list.html. Popular raster formats which are supported by both programs are for instance IMG, TIF, TFW, JPEG, JPEG 2000, JPGW, GIF, PNG or BMP. However there also differences. The proprietary ArcSDE Raster is read only in QGIS, the Arc/Info ASCII Grid is fully supported. On the other hand, QGIS works with GDAL Virtual and SAGA GIS Binary format which are read only in ArcGIS or GRASS Raster [read only], GRASS ASCII Grid and R Object Data Store which are not supported in ArcGIS.

Vector Data

ArcGIS and QGIS both support popular vector data formats like DXF, SVG, GML, GPX or KML. Nevertheless, the most frequently used vector format is ArcGIS shapefile [.shp] which represent a non-topological format for storing the geometric location and attribute information of geographic features. QGIS also uses the ESRI shapefile as a standard vector file format. However, the performance can be improved by creating a spatial index [.qix extension]. When saving a shapefile, QGIS creates two projection files. The first one [.prj] contains limited projection parameters and is compatible with ArcGIS and the second one [.qpj] holds the full information for the CRS. Additionally, GDAL supports 79 vector formats. The complete list can be viewed on gdal's website http://www.gdal.org/ogr_formats.html.

Tabular Data

Concerning Tabular Data in QGIS CSV/TXT, WKT and MS Office Open XML spreadsheet are fully supported. MS Excel format can only be read. In ArcGIS CSV/TXT files are read only. Data from MS Excel spreadsheets can be read directly in ArcGIS or through OLE DB, Microsoft Access only through OLE DB (ESRI 2014).

3D Data

ArcGIS can handle 3D data with the help of the Extension 3D Analyst. COLLADA, lidar, SketchUp, OpenFlight data, and others can be used to create and analyze surface data in raster, terrain, triangulated irregular network (TIN), and LAS dataset. In QGIS 3D data is not supported. So far there is only the plugin Qgis2threejs exists. It combines terrain data, a map image and optional vector data in an html file which can be viewed in 3D in a WebGL supported web browser.

Web Services

In ArcGIS solely WMS and WMTS, WCS can be added via the Add Data Dialog box or the Catalog Window. To work with WFS contents in ArcGIS for Desktop the extension Data Interoperability is needed, and an Interoperability Connection to the WFS service has to be added. QGIS supports the access to, and writing of several web services, namely WMS, WMTS, WFS, WCS, WPS, and CSW. Adding Web Services in QGIS works the same way as adding a regular vector layer by clicking the adequate symbol and adding the web-address. WMS is handled like a raster layer and WFS like vector layers. WPS and CSW can be handled with the

help of plugins. Furthermore, there is a plugin for OpenLayers which enables to work with Google Maps, Bing Maps, and OpenStreetMap. ArcGIS provides an Editor for OpenStreetMap Add-on.

3.4 Scripting and Automation

ArcGIS and QGIS both hold options to automate process and adapt existing functions. ArcGIS Model Builder and QGIS Graphical Modeler provide the option to create workflows without programming skill. The use of the python console allows for further automation and adoptions.

3.5 Visualization and Mapping

As the cartographic functions in ArcGIS and QGIS are very complex, CartoEvaluationMethod was applied for the measurement of their functionality.

IV. FEATURES OF QGIS AND ARCGIS

4.1 Transparency control

ArcGIS have transparency. It's in the Display tab, in the layer's properties exchange. You can just set transparency at the layer level. In QGIS on the opposite end, you can set transparency at layer level, highlight/image level, and shading level. You can even set transparency in hues by utilizing the RGBA work in an expression.

Expression: {color_rgba(32, 121, 172, "Number" * 80)}

4.2 Blending modes

This is one of QGIS's immaculate gems. The capacity to join layers the way you would do in any plan/photograph altering programming. At layer or at include level, you can control how they will "collaborate" with different layers or highlights underneath. Other than the ordinary mode, QGIS offers 12 other mixing modes: Lighten, Screen, Dodge, Darken, Multiply, Burn, Overlay, Soft light, Hard light, Difference, and Subtract.

An exceptionally basic application for this usefulness is the point at which you need to add shadows to reproduce the alleviation by putting a slope shade over different layers. In ArcGIS, you can just control the layer transparency, and the outcome is dependably somewhat pale. In any case, in QGIS, you can keep the quality of the first hues by utilizing the increase mode in the slope shade layer.

You can likewise utilize mixing modes in the print writer things, enabling you to consolidate them with different things and surfaces. This gives you the chance to make more "creative" things without the need to go post-handling in a plan programming.

4.3 Colour Picker Menu

Controlling shading is a critical arrangement for a cartographer and QGIS enable you to control it like the expert you are. You can choose your hues utilizing a wide range of interfaces. Interfaces that you may perceive from programming like Inkscape, Photoshop, Gimp and others alike.



Utilizing color picker, you can pick hues from anyplace on your screen, either from QGIS itself or outside. This is very convenient and gainful when you are attempting to utilize a shading from your guide, it's legend, a Color lover's palette or an organization logo.

4.4 Vector symbols renderers “powertools”

In ArcGIS, you have a couple of extravagant approaches to image your vector layers. QGIS offers significantly more adaptability when you should symbol your layers.

First, it enables you to utilize fields or articulations on any of the images renderers, while ArcGIS just permits the utilization of fields. Fueled by several capacities and the capacity to make yours possesses in python, what you can do with the articulation manufacturer has no restrictions.

4.5 Label and Style dialogs

This one is even more a User Experience thing than a genuine element, yet you won't envision that it is so invigorating to have all Style and Labels choices in two single exchanges (with a few tabs, obviously).

Utilizing the symbol menu in ArcGIS influences client to crave baffling by opening numerous exchange boxes for a solitary reason and clicking different OK catches for filling a solitary need.

In QGIS, once in the properties menu, each setting is (just about) one ticks way. Furthermore, you simply need to squeeze OK (or Apply) once to see the outcome!

4.6 QGIS consumes all types of data

QGIS has the edge for devouring data. QGIS is flexible. It's front line with regards to devouring information. QGIS utilizes the GDAL/OGR library to peruse and compose GIS information groups. QGIS was destined to work with PostGIS. In any case, the rundown continues for GIS organize utilization... ENC, shapefile, geodatabase, MapInfo designs, Microstation document positions, AutoCAD DXF, SpatiaLite, Oracle Spatial, MSSQL Spatial databases, WellKnownText (WKT).

4.7 Plugins

QGIS has bunches of modules to take care of consistently GIS issues. Modules in QGIS add helpful highlights to the product. Modules are composed by QGIS designers and other autonomous clients who need to broaden the center usefulness of the product. These modules are made accessible in QGIS for every one of the clients. You can investigate <https://plugins.qgis.org/>, and you can peruse and download the modules of this vault specifically from QGIS utilizing the modules supervisor, you can likewise download the modules straightforwardly from the site.

4.8 WFS

ArcGIS Desktop needs bolster for WFS OGC standard unless you purchase an additional augmentation: The Data Interoperability Extension.



In QGIS, such as everything else, WFS is totally free. You should simply include the WFS server's URL, and you can include every one of the layers you need, with indisputably the beyond any doubt that they are as refreshed as you can get.

4.9 Design a cartography in ArcGIS and QGIS

Open source cynics believe that ArcGIS is the main way you can make excellent maps. In any case, QGIS is a feasible alternative to make cartographic gems. QGIS mapping interface is called 'Print Composer'. It acts relatively like another application.

V.CONCLUSION

The point of this paper was to plot the parameters for the two GIS programming resembles Costs and Licenses, Development and Distribution, Training and Support. We likewise checked software functionality and features and was to give spatial arranging associations a logical base to choose whether the usage of the OS GIS QGIS rather than ArcGIS is feasible for their particular errands. QGIS acquires awesome open door making topical maps, charts, plots and other educational substance. QGIS likewise gives a dream, a general evaluation about spatial of oversaw protests by various information hotspots for directors. QGIS is open source programming that is complimentary. Subsequently, the clients don't need to stress over copyright issues and subsidizes for the upkeep of the product. As QGIS is an open source programming and it is anything but difficult to access as contrast with business programming ArcGIS. QGIS has less preparing time and better rendering capacities. For cost and effortlessness, QGIS is a noteworthy contrasting option to ArcGIS for the making of GIS Applications. Contrasting with ArcGIS, QGIS can be introduced on different working frameworks, for example, Windows, Mac OS X, Linux (Ubuntu), and Unix, while ArcGIS just has Windows form. In the educating of geospatial ideas, the greater part of the educational programs utilizes free and open-source programming (FOSS) to accomplish this objective. Open-source GIS programming enables understudies to experience such frameworks without the need to obtain expensive licenses.

Although this paper presents a method for utilizing the QGIS and ArcGIS together, however more examination is yet required.

In our further examination we should investigate increasingly and demonstrates that QGIS is extremely a total proficient GIS tool.

REFERENCES

Journals/Paper References

- [1] S. Khan, "Empirical Evaluation of ArcGIS with Contemporary Open Source Solutions – A Study", *International Journal of Advance Research in Science and Engineering*, Volume No. 06, Special Issue No. (01), Nov 2017, GKU ICRISAEM-17, ISSN: 2319-8354.
- [2] S. Khan, Dr. K. Mohiuddin, F. Maqbool, "Analysis of Paradigm Shift in Cloud-based GIS Systems", *International Journal of Advance Research in Science and Engineering*, Volume No. 06, Special Issue No. (03), Dec 2017, NIT Srinagar, ISSN: 2319-8354.

- [3] F. P. Donnelly, "Evaluating open source GIS for libraries", *Emerald Group Publishing Limited* 0737-8831, DOI 10.1108/07378831011026742, *Library Hi Tech* Vol. 28 No. 1, 2010pp. 131-151.
- [4] Steiniger, S. and Bochner, E. (2009) "An overview on current free open source desktop GIS developments", *International Journal of Geographical Information Science*, Vol. 23, No. 10, October 2009, 1345–1370.
- [5] Corinna F., "Comparison of ArcGIS and QGIS for Applications in Sustainable Spatial Planning", *Wien*, 2014, urn:nbn:at:at-ubw:1-29158.51814.570765-4.
- [6] MAGUIRE, D.J. (2008): ArcGIS: General Purpose GIS Software System. In: SHEKHAR, S. & H. XIONG (Ed.) (2008): *Encyclopedia of GIS*. New York: Springer. P. 25-31
- [7] SCOTT L. M. & M.V. JANIKAS (2010): Spatial Statistics in ArcGIS. In: in FISCHER M.M. & A. GETIS (Ed) (2010): *Handbook of Applied Spatial Analysis: Software Tools, Methods and Applications*. Berlin Heidelberg: Springer-Verlag, p.27-42
- [8] GLENNON, R. (2012): ArcGIS Resources: Make ArcGIS better by reporting software errors and joining the Esri User Experience Improvement Program.
- [9] NEUMANN, A. (2014): The QGIS Project. Current and future developments, cartographic possibilities, CartoTalk at *Vienna University of Technology*, March 2014.
- [10] PEARSON EDUCATION INC (2014): Pearson. Always Learning: Test Taker Services/Esri. Online. <http://www.pearsonvue.com/esri/>
- [11] SHERMAN G. (2011): QGIS Users around the world. Online: <http://spatialgalaxy.net/2011/12/19/qgis-users-around-the-world/>
- [12] DUSTER, H. (2009): QGIS in the governmental FOSSGIS stack. Online: http://qgis.org/en/site/about/case_studies/suisse_solothurn.html
- [13] RENNERT, E. (2000): Open Source: Ein Stuck, Andere Okonomie. In: EICHMANN, HOCHEGGER & NAHRADA (Hg) (2000): *Netzwerke: Kooperation in Arbeit, Wirtschaft und Verwaltung*. Wien: Falter Verlag.
- [14] MORAIS, C. (2012): QGIS versus ArcGIS, online: <http://www.gislounge.com/qgis-versusarcgis/>
- [15] GRASER, A (2014): Free and Open Source GIS Ramblings, online: <http://anitagraser.com/>

Web References

<https://www.qgis.org/en/site/index.html>

<https://www.esri.com/en-us/home>

<http://www.esri.com/software/arcgis/arcgisserver>

<https://www.esri.com/en-us/arcgis/products/arcgis-pro/overview>

<http://gisgeography.com/qgis-arcgis-differences/>

<https://gisunbound.wordpress.com/2016/01/28/qgis-features-i-long-for-while-using-arcgis/>

<https://plugins.qgis.org/>

<http://www.diva-gis.org/>

<https://github.com>

<http://sourceforge.net>