The AGI Foresight Study - The UK Geospatial Industry in 2015

An Expert Paper

Crowd Sourcing, Third Sector, Technology, Usability and Education

Muki Haklay, University College, London

In this note I focus on five points that will be influential in the medium term on the geospatial industry in the UK. They are linked to one another in terms of capabilities of GIS (Technology, Usability), the way in which GI is collected (Crowd Sourcing), the way it will be used (Third Sector) and who are the people that are running such systems (Education). The coming five years will consolidate the change that started five years ago – for which the term Web Mapping 2.0 is used – and will lead to significant changes in the way geographic information is used and delivered in the UK.

Crowd sourcing – in the coming five years we will see significant development in the ability to use crowd sourcing to create and update GI. Some of it will be active crowd sourcing where the knowledge, skills, time and resources of the participants are utilised as in OpenStreetMap (OSM), and some of it, as in the case of TomTom MapShare speed tracking, is be passive. The proliferation of sensors in cars, phones and other devices mean that passive crowd sourcing is opening up a very significant opportunity for data update, though the morality and the ethical dimension of this type of data collection must be challenged and questioned.

Importantly, crowd sourcing is not about simplistic view of Amateurs vs. Professionals. The quality of the data can be very high and the data can be robust – especially if passive and active forms are integrated intelligently. All models that are active are merging professional knowledge and data sources with the work of amateurs/volunteers/participants. The significant scaling effect of crowd sourcing means that a small team of professionals with access to high quality data and know-how can leverage their effort by engaging a very large number of participants. Examples for that are available in OSM –Yahoo! imagery encapsulates high end knowledge and understanding of fundamental aspects of dealing with GI, but the volunteer who digitise over it does not need to know any of this to produce high quality maps. In emergency situations this can be very effective – again, an example from OSM – during the crisis in Gaza in January 2009 a core group of OSMers identified suitable data source, while the volunteers who digitised over the image where mobilised by the news and were able to create the map quickly.

Crowd sourcing is especially important to the public sector as a way to reduce costs of data collection and achieving more with limited resources - the most likely scenario for the coming period. Our research is showing that crowd sourcing can be effective in change detection, for example. The biggest challenge in the context of public services is to deal with the digital and spatial bias inherent in crowd sourcing and the need for universal coverage and service delivery. Possibly this can redefine the role of public services – to complete the picture that is available from the crowd through targeted effort.

In the mid term, we will see increasingly hybrid model in which professionally produced datasets are fused with crowd sourced information to create new data sets. We can expect an increased

understanding of how to assess quality of such data sources, how to motivate and engage participants and, most interestingly, what new information can be created by using such sources.

Third Sector use of GI – the need to deliver public services locally at lower costs and in a more effective way has already turned the attention of central government on the Third Sector, which is a tagline for the voluntary sector, charities, not-for-profit organisations and social enterprises. They are based on mixed sources of funding that is a combination of grants, donations and commercial or commercial-like activities. Most of these organisations hold limited resources and use these resources on their activities, delivering services to their community or specific part of society in need.

There are many problems with the current trend of promoting the use of the Third Sector for public service delivery, not least because universality of access is not guaranteed, many organisations are idiosyncratic in their approach to service delivery, and the use of resources is far from optimal. However all political parties are keen to use the Third Sector for this purpose, so the office for the Third Sector which is currently operating in the Cabinet Office is likely to increase in its importance over the near future. This can be viewed as the government 'crowd sourcing' public service delivery.

From the geospatial sector perspective the Third Sector is, by and large, not well versed in GIS and if there is some GIS capabilities, they are still based on individual champion - somewhat similar to the situation with GIS in the public sector in the late 1980s. However, the changes in technology and the ability of such organisations to dedicate resources to GI mean that they are likely to use web-based solutions, and/or free and open source software and data sets to try and minimise costs. Because they are likely to interact closely with the traditional public sector organisations, we can expect that innovations and new practices that are used in the sector will influence traditional organisation too. This is an issue that can create challenges to public sector software and data providers.

Technology – The assumptions about the continued development of Moore law is starting to change. The issue is not any more the speed of the computation but the way in which they are handled. One of the most significant changes that will influence the geospatial industry over the coming five years will be the increased popularity and use of General Purpose Graphic Processing Units (GPGPU) computation. This form of streamed parallel processing seems to be especially suited for GI processing, as this type of processing lends itself to parallelisation using such processing. Software implementations such as CUDA and OpenCL are enabling development of applications that use these abilities and software packages in remote sensing and GIS are starting to use them. The acceleration that can be gain from the use of GPGPU will change the ability to deal with very large remote sensed datasets and gradually all kind of vector based processing applications.

Another aspect of technology development is usability and user interaction. For me, one of the core reasons for GIS to be niche industry is that the sector was focusing on functionality and not on users. There are many examples, but one of the most striking is between the usability of GIS based Web

Mapping Servers (WMS) implementation by major GIS vendors and applications such as Google Maps and Bing Maps. Similarly, although geographers and cartographers called, for many years, for a 'wizard' approach to assist users in the process of creating thematic maps, only with the creation of GeoCommons detailed and clear four stage process of creating such maps we are seeing a working example in which the system is assisting the user in creating high quality cartographic outputs. In general, Web Mapping 2.0 applications are showing higher level of attention to user needs and interaction design. This is also now happening in the mobile geospatial applications such as iPhone or Android consumer applications. Personal Navigation Devices are also using different paradigms of interaction and use of GI.

Over the next period, we can expect an increase use of tactile interfaces in both mobile and desktop systems. Simple design will continue to dominate the development. Maybe we will see better design of high end systems and desktop GIS applications, although considering the lack of 'usability culture' in mainstream GIS vendors I would classify this more as a hope than a likely outcome.

Education – the death of the 'ArcInfo/Mapinfo/Geomedia driving licence' model of GIS education? For the last 20 years the route into the GIS sector was defined by the need to learn how to control complex software packages. This required postgraduate level of education, and therefore MSc level courses provided the needed personnel to the geospatial industry.

This model has changed. The software is now usable enough to be mandatory within secondary schools Geography curriculum which means that at the basic level there is no need for the specialist operator with an MSc degree. While it is very impressive to see how the Leeds Grammar School students manage to operate ArcGIS (a task in which I would fail easily) there is a vast range of accessible GIS-like application that are emerging and it is likely that school leavers, especially if they had an exposure to geography, will be able to operate such systems.

Google Maps, Google Earth, OpenStreetMap, GeoCommons, and FindMaps demonstrate that already cloud computing provide the needed bandwidth and server capacity to run GI as a service so an organisation can focus only on their limited (usually point based) local information. This is software and data as service, which reduces the need for specialist staff within the organisation. Easy to use Application Programming Interfaces (APIs) are also changing the way in which bespoke applications are being developed, as they allow non-specialist to integrate geospatial capabilities in their applications.

The changes in needs of users mean that we will see different needs around the geospatial sector. There will remain a need for some computer developers with the knowledge of developing geospatial application. Organisations will still need few system managers and geographical information specialists who can organise the data on behalf of the organisation and integrate it with other sources – but this is increasingly integrated with other roles as GI is part of the general data management of the

organisation. There will be a limited need for GIS analysts who will work at decision making level to deliver bespoke analysis that utilises the high end capabilities of GIS packages.

This fragmentation, which is already in motion, will intensify over the coming period. There is already an interesting fragmentation within the education sector with proliferation of courses that offer some element of GIS analysis within a specific domain, such as environmental studies but not as specialism; significant drop in numbers of dedicated, full time 'MSc in GIS' students and some increase in distance learning, continual professional development and evening studies of GIS – probably by people who joined the sector and want to improve their knowledge.

This change is both an opportunity and a challenge to the geospatial sector as a whole. With the disappearance of the 'core' with specialist GIS groups in organisations, and the mainstreaming of GI in organisation – who are the people that will be part of the sector and will they feel special affinity with geographical information applications? What will they study? Who will provide the education that they need?