

# Geospatial expertise, cooperation networks and development potential in Tanzania

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## Abstract

Tanzania is a country of declining poverty lines and income disparity with high development potential economically and socially. Rapid economic growth, rising middleclass, and growing access to mobile technology has made East-Africa desirable new market for geospatial solutions. At the same time, countries face severe development challenges in land management, urbanization and loss of natural resources, to mention a few. It will be crucial how Tanzania is able to use digitalization and economic growth potential towards sustainable management of the country, and geospatial solutions play an important role in this development. As a cooperation between four Tanzanian universities and University of Turku from Finland, we organized a survey in targeted to Tanzanian geospatial experts so that we can better understand the current expertise of the actors, their cooperation networks and visions for the development potential. The survey collected 75 answers and these show that the geospatial actor network is rather juvenile in Tanzania. Most of the respondents have been active in the field between 3-5 years. However experts come from wide range of public and private organizations and NGO's and are most active in geospatial data management and analysis, and training related activities. Private sector consists of few key companies, whose expertise is not yet specialized. Actors identify several positive signs for the development, such as growing number of experts, access to data and technology and increasing investments. At the same time, many challenges are confronted from lack of coordination and infrastructures to lack of understanding of the geospatial sector importance.

*Keywords:* Geospatial expertise, mobile technology, cooperation networks, open-source solutions, geospatial data, development

## 1 Introduction

During the last decade, open access to various global data repositories, public access web-mapping solutions and simultaneous diversification and accessibility of ICT/GIS (Geographical Information Systems) technologies has shifted geospatial business to core strategical role. It has been estimated that as high amount as 80% of the world's information has reference to location and this has made location-based (geospatial) business as one of the most prominent field on innovation development. The current estimates show that GIS business grows globally at an annual 8-10% rate.

Much of this growth has related to societies becoming agile and responsive due to fluent access to reliable and up-to-date location-based digital information through technologies such as Global Positioning Systems (GPS), cloud-based satellite image archives, telecommunication and mobile technology. Geospatial information has become an enabler for many mass-market applications, and through public participation, consumers have become not only flexible and adaptive users of geospatial information but also producers of new information (crowdsourcing, Open Street Map, social media). Increasingly, the business is moving from conventional expert data production to data generation by the public, development of various consumer services based on accessible data repositories and integrating GIS into any field of business, where location matters (geospatial business intelligence).

Simultaneously, rapid economic growth, rising middleclass, and the extensive distribution of and access to mobile technology have made developing countries in Sub-Saharan

Africa desirable new markets for high technology geospatial companies.

According to the forecasting of World Bank's Global Economic Prospect (World Bank, 2016), six out of the twelve countries with the highest projected compounded annual growth rate (CAGR) between the years 2014 and 2017 are from Sub-Saharan Africa. The main driver of success has been the increased demand and price increase of the continent's commodities such as oil, minerals and tropical agricultural products. Another driver of the economy has been the favourable demographic development, the external debt reliefs, decline in intra-African conflicts and rapidly urbanizing young population (Weeks, 2010:10). New communication technology has boosted the local access to services, knowledge and markets, and Africa has even become a forerunner in some mobile-based technologies, such as mobile banking and health services (Déglise et al., 2013; Källander et al., 2013; van der Boor et al., 2014).

Tanzania is a country of declining poverty lines and income disparity with high development potential economically and socially. There is urgent demand for geospatial innovations to solve daily challenges especially in rapidly developing cities and for better natural resources mapping and monitoring and related risk-assessments. Local economies could also benefit greatly from innovative location-based service solutions. Tanzania has expressed its aims to become knowledge-based society. Its mobile space grew 30% to about 18 million mobile phone subscribers between 2000 and 2010. The number is much higher to date. There are plenty of private, public, NGO, and university stakeholders dealing with geospatial expertise and business. This means that there is an

emerging geospatial business ecosystem already in Tanzania, but the roles, synergies, actions and benefits are not that well identified, planned or marketed.

## 2 Geospatial Survey 2017

As a cooperation between four Tanzanian Universities (University of Dar es Salaam, Ardhi University, State University of Zanzibar and Sokoine University of Agriculture) and University of Turku, Finland, we organized a survey in the Internet, targeted to geospatial experts in Tanzania. The aims of the survey were:

- To better understand the expertise profiles of Tanzanian geospatial actors, their cooperation networks and visions for the development potential of the geospatial sector in Tanzania.
- To enhance research and education capacities of Tanzanian universities to meet the current societal needs and opportunities
- To strengthen geospatial business and cooperation networks in Tanzania and East Africa

The survey was launched in August 2017, and it was kept open until February 2018. It was advertised through a WhatsApp group “East Africa Geospatial Forum”, which has around 180 participants, and through various expert networks in Tanzania. The survey was also advertised face-to-face in Tanzania at the ESRI EA User conference on Oct 4-6th, 2017 in Dar es Salaam and at Tanzania GIS Day on November 15th, 2017 in Dar es Salaam, where we also shared preliminary results of the survey with geospatial actors (Figure 1).

Figure 1: Tanzania GIS Day was organized in Dar es Salaam, Ardhi University on November 15<sup>th</sup>, 2017.

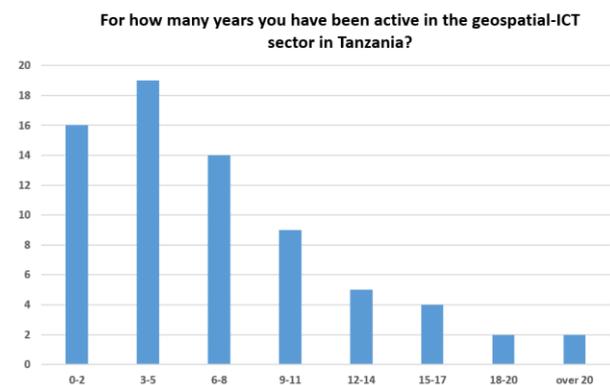


We implemented the survey using Harava -crowdsourcing survey tool developed by a Finnish geospatial company Dimenteq (<https://dimenteq.fi/en/services/harava/>). The survey received 75 full replies from universities, companies, NGOs and public authorities in Tanzania. Also couple of international actors, who have long cooperation in Tanzania, answered the survey.

## 3 Geospatial actors, their expertise and cooperation

Most of the respondents of the survey have been active in the field of geospatial-ICT technologies and application only for some years (less than 5 yrs) (Figure 2). However, the community of geospatial experts in Tanzania is led by few individuals who have substantially long experience (>15 yrs), and who currently either run their own private companies or work as established geospatial experts in government institutions. The Most abundant group of respondents are the university experts, but also private sector and government sector respondents have answered the survey widely. The most common application fields of the respondents are land surveying, geomatics, cadaster, natural resources, agriculture, forestry, environment, planning and health.

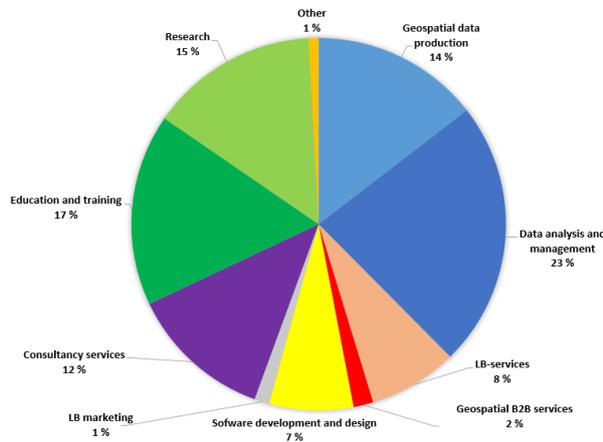
Figure 2: Respondents of the survey are relative new to the field of geospatial and ICT activities in Tanzania.



The respondents’ geospatial and ICT expertise is diverse and very little specialization of the experts into specific geospatial and ICT sector activities exist. Most abundant expertise is found in the sector of geospatial data analysis and management, education and training activities, research, data production and consultancy services (Figure 3). Emerging new fields of expertise are location-based marketing, B2B services and location-based services.

Based on the respondents’ answers, it is possible to identify 4-5 different geospatial expertise profiles in Tanzania. Most of the university experts are profiled expectedly as geospatial educators, researchers and data analysis experts. Some are also very active in the private business side, working as geospatial consultants in various projects. Private company experts possess widest range of expertise, usually offering also data collection services as well as B2B services. Most of the Tanzanian private companies also provide geospatial training services in the form of short courses. One of the emerging expertise profiles is software and LBS services combined with data analytics.

Figure 3: Respondents expertise according to different sectors of geospatial and ICT activities.



The most commonly used software of the experts are QGIS, ArcGIS and Erdas Imagine. However, the listed software used by the experts is wide and contains several open source solutions combined with mobile phones and novel technologies, such as UAVs. The potential of using drones as an alternative data collection method to conventional aerial photography has been demonstrated widely in Tanzania. For example World bank -funded programme Ramani Huria (<http://ramanihuria.org/>) has shown over the last years concretely how drone imagery can be used as a basis of mapping cities, where base map data is badly missing. Open source software and their potential in advancing geospatial sector development in Tanzanian is increasingly identified by the experts and many ongoing cooperation projects focus on the advancement of OS methodologies, such as Humanitarian Open Street Map activities in severely flooding Dar es Salaam (<https://www.hotosm.org/>).

The respondents have listed altogether 65-70 cooperation partners nationally and internationally. University researchers and teachers have strongest cooperation with other either Tanzanian universities or international academic partners or transnational and global organizations, such as the World Bank and United Nations. Private companies, on the other hand, are small in size, operate more in isolation and they do not have that strong cooperation networks.

#### 4 Future development potential and challenges of geospatial sector in Tanzania

In the survey, we asked respondents' opinions about the development of the geospatial sector in Tanzania via SWOT framework. It seems that actors identify several strengths of geospatial sector, such as growing number of geospatial experts, existing training programmes, willingness and strong motivation to learn, existing institutions who are strong in geospatial capacities and increasing number of practical applications in the society. At the same time many weaknesses are characterizing geospatial sector according to the experts. For example, lack of skilled staff, facilities and up-to-date research environments, lack of coordination and

cooperation, shortage of data and availability of data sets, lack of innovations and development of new solutions.

When the respondents were listing their views of the opportunities related to the development of geospatial activities in Tanzania, issues such as human resources were seen crucial. Pool of researchers and students interested in geospatial technologies are seen as catalysts for positive development together with the improved access to data sources via new technologies, open source options to previously expensive commercial software solutions and increasing investments as well as growing markets in the sector of geospatial businesses. These are all crucial elements in the development of a viable geospatial business ecosystem and shared knowledge and solutions, which many respondents were listing.

Despite of many opportunities, several risks were identified and many of them were related to the actors and lack of interactions. Competition, conflicts of interests, lack of cooperation and coordination between actors and institutions, and poor commitment from the decision-makers were seen as major risks to hinder the development. Also insufficient amount of resources, expensive infrastructure and lack of capital to invest were seen as risks. Since geospatial sector and technologies are developing so fast at the moment, it was also seen as a risk of development, as well as the fact that so often geospatial expertise is in the hands of the external experts coming from other countries. Experts also felt that political decisions are slowing down the adoption of innovations and businesses in Tanzania.

#### References

- Déglise, C., Suggs, L. S. & Odermatt, P. Short message service (SMS) applications for disease prevention in developing countries. *Journal of Medical Internet Research*, 14(1), 2012.
- Källander, K. Tibenderana, J. K. Akpogheneta, O. J. Strachan, D. L. Hill, Z. ten Asbroek, A. H. Conteh, L. Kirkwood, B. R. and S.R. Meek. Mobile Health (mHealth) Approaches and Lessons for Increased Performance and Retention of Community Health Workers in Low-and Middle-Income Countries: a Review. *Journal of Medical Internet Research*, 15(1), 2013.
- Van der Boor, P., Oliveira, P. and F. Veloso. Users as Innovators in Developing Countries: The Global Sources of Innovation and Diffusion in Mobile Banking Services. *Research Policy*, 43(9), 1594-1607, 2014.
- Weeks, J. *A Study for Trade and Development Report 2010: Employment, Productivity and Growth in Africa South of the Sahara*. Centre for Development Policy and Research, School of Oriental and African Studies, University of London, 2010.
- World Bank. *Global Economic Prospects, January 2016: Spillovers amid Weak Growth*. World Bank, Washington, DC, 2016.