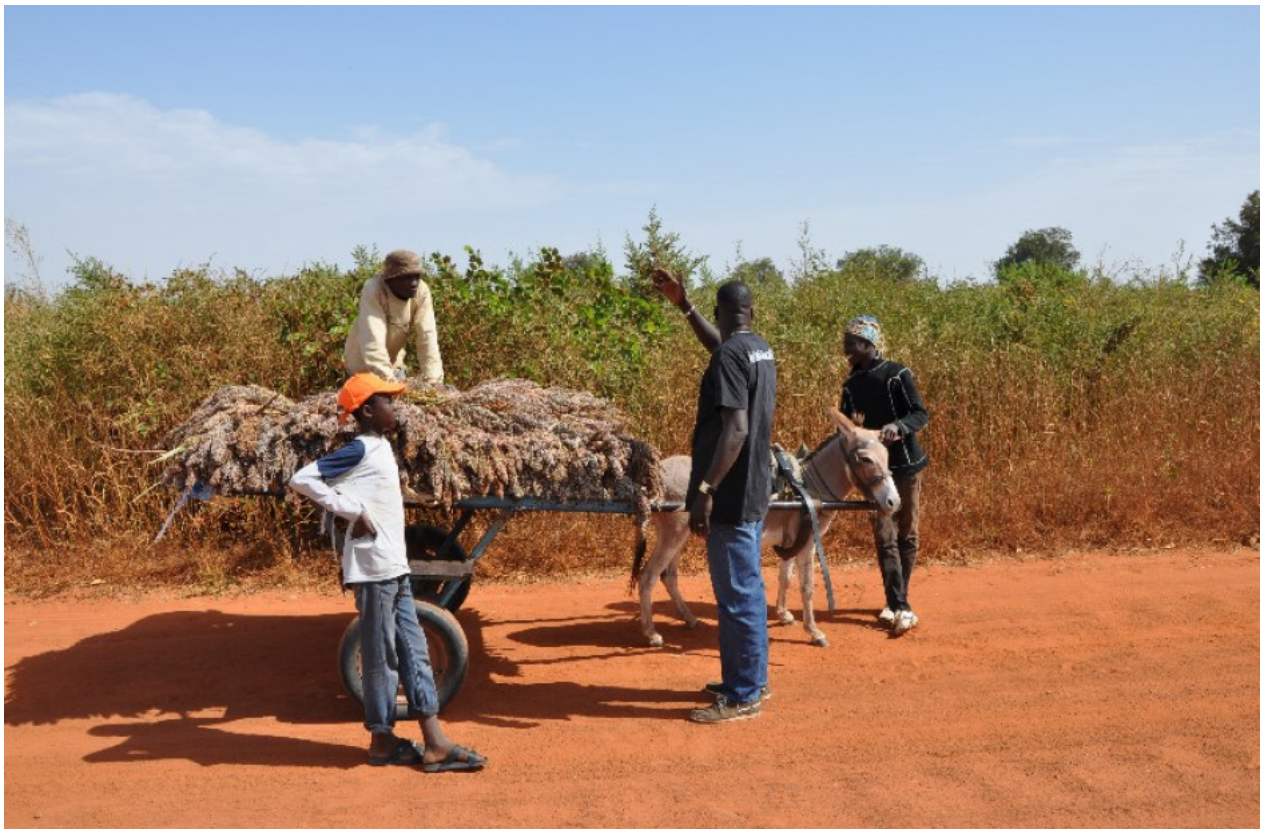
Senegal: using big data to anticipate food shortages

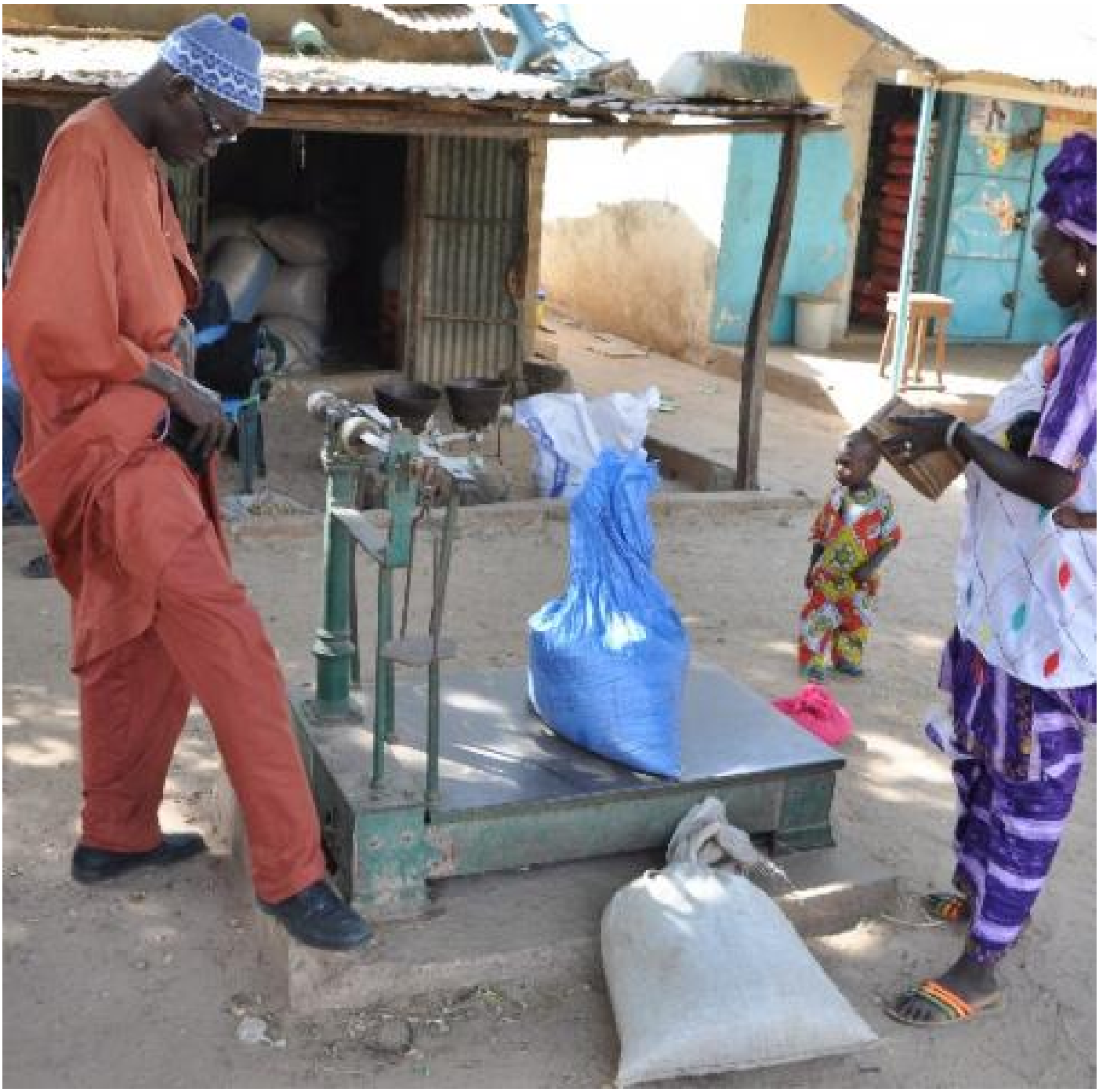
SCTODAY



Four young researchers of the Environmetrics and Geomatics Laboratory, led by Prof. Pierre Defourny of the UCL Earth and Life Institute (http://www.uclouvain.be/eli.html), have been recognised by the Massachusetts Institute of Technology (MIT) for their innovative work on the flow of information between markets in Senegal and its influence on the price of millet, one of the country's staple foods.

What if **big data** made it possible to help disadvantaged populations in the countries of the South? A few years ago, the Orange telecommunications company launched a challenge, Data for Development (D4D). The idea: share **phone data** with researchers so they could create an innovative project that aimed to improve quality of life. Following the latest and second edition of the D4D, a team of four bio-engineers of **UCL's Earth and Life Institute** and a Brazilian economist were recognised by the **Massachusetts Institute of Technology** (MIT) for their unprecedented work in Senegal, which combined **analysis of satellite data**, national statistics, the road network and **mobile data**.

The challenge, organised by Orange and Sonatel (Senegal's National Telecommunications Company), with the United Nations and MIT, and under the auspices of Senegal's Ministry of Higher Education and Research, was based on the release of 2013 data on the number of calls and text messages received by Senegalese antennae. 'Anonymous data, of course!' insists Damien Jacques, one of the four UCL researchers. 'Moreover, we had no access to content, only to data such as location, call duration, etc. This information is an important indicator of population and community mobility: we can perceive social groups, or that user A speaks with user B.'



Grain price as a factor

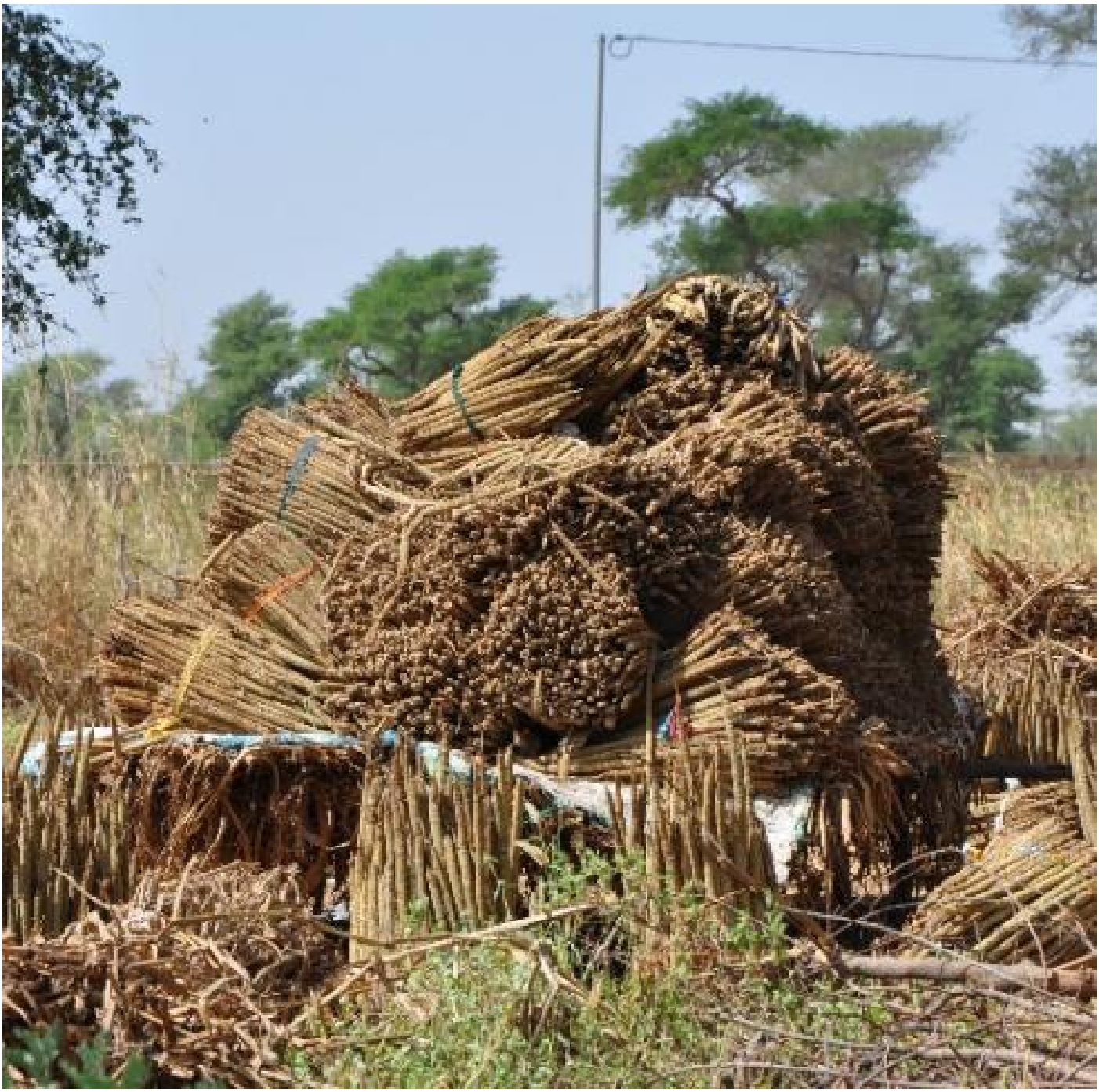
The **UCL team's** project aimed to better understand the mechanism of grain transfers to markets by studying the flow of information obtained by **analysing mobile data**, combined with satellite information and analysis of the road network. 'Food security is determined by the availability of resources and access to them', says Mr Jacques. 'Price is a factor that can restrict access. We were interested in the price of millet. It's a subsistence grain for a large section of the Senegalese population. We noticed that its price fluctuated a lot during the season and among markets. We tried to better understand this process by studying supply and demand beginning at the end of the harvest.'

The supply of millet available in markets at the end of the harvest was estimated based on national production **statistics** and observing **satellite images**. Demand was extrapolated from **demographic data**. 'We simulated millet transfers from production areas to consumption areas, taking into account that the price difference between two markets has to be greater than the cost of transport. That's where telecommunications data intervened: they allowed us to simulate the flow of price information between two markets. Indeed, a trader can be misinformed of another market's conditions and thus some transfers that to him would be profitable don't end up being so.'

The model implemented by the researchers can predict the price up to eight months in advance. This is a certain advantage for relevant institutions, which can more effectively plan their food security activities.

Field research

The UCL bio-engineers, who included Mr Jacques, Raphaël D'Andrimont, Julien Radoux and François Waldner, and the Brazilian UCL graduate Eduardo Marinho, an expert in the rural economy of West Africa, presented their project at the **NetMob Conference** on network analysis, at MIT. They won the best project **award in the 'agriculture' category** and received a research grant from the **Bill & Melinda Gates Foundation**. Their objective is to progress from an experimental project to an operational tool in the field. To do so, Mr Jacques visited **Senegal** twice. 'I met a maximum of stakeholders to explain our approach, identify their needs, discuss the value of our work and see how we can collaborate. Beyond the project itself, it's a good experience, which makes it possible to progress to field research, to go out and look for the demand and try to respond to it. The idea is to make sure our model is relevant, and to create solid leads for using it as a decision-making tool that helps authorities and the Senegalese people.' But it's not so simple. 'We came here to look for complementary data for validating our results, but it's very difficult to get access, despite Sonatel's support. We also perceived that it's sometimes much more basic than we thought, that the real needs aren't necessarily those we imagined.'



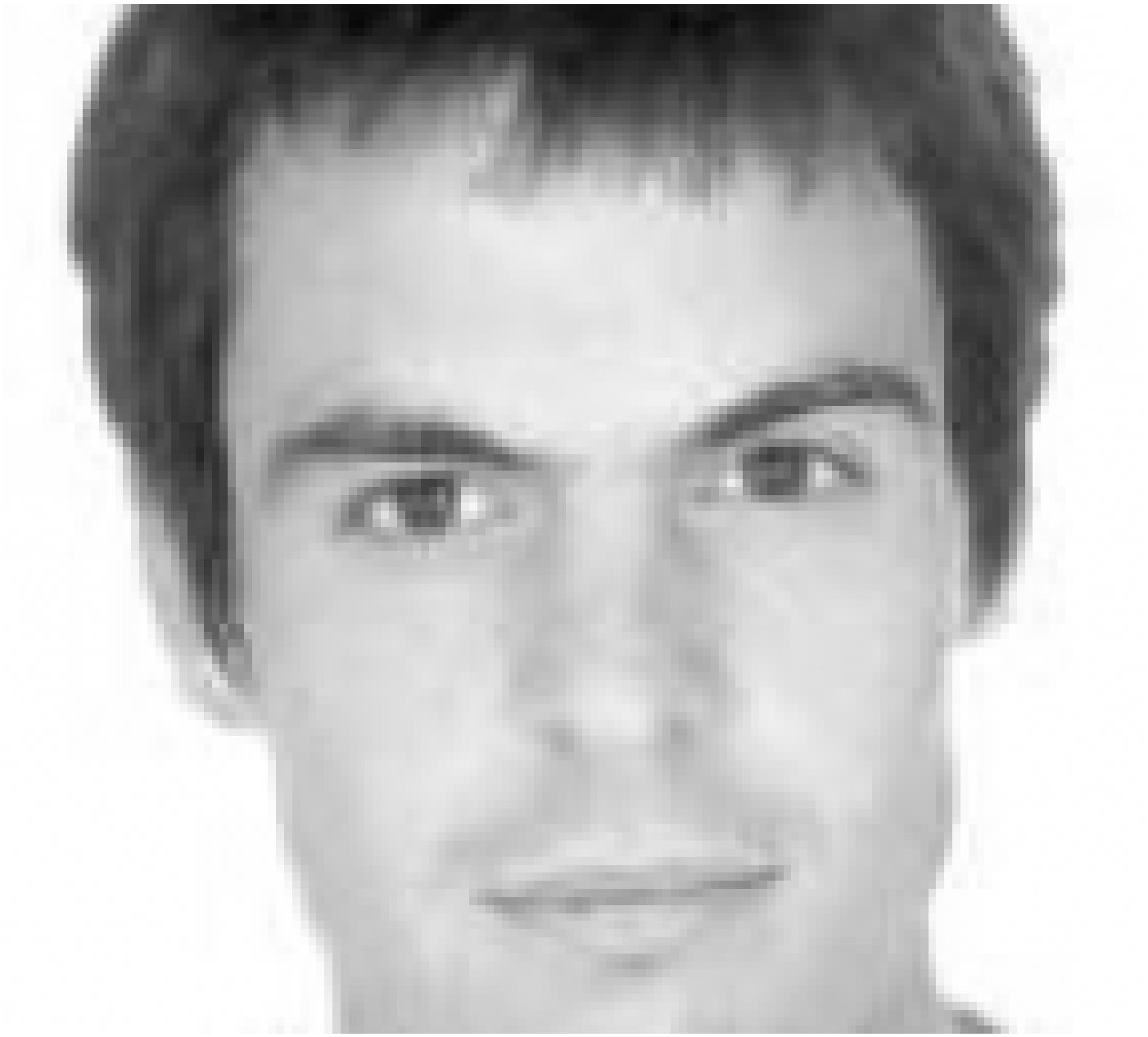
An open and accessible dashboard

The exchanges, however, were fruitful, because the project on the table is **very concrete**. 'Our contributors showed interest in data visualisation tools', Mr Jacques continues. 'With them, we're trying to implement a dashboard that would be a **data visualisation tool**, easy, open and accessible. It should enable rapid analysis of data concerning poverty, epidemics, etc., thanks to precise indicators. So in practice, there's a country-wide **management and monitoring** aspect that would help envisage how to manage food aid, for example. But it could also define how and where to implement certain infrastructure, such as millet storage space and new roads.' The researchers also plan on creating a **feedback document** that showcases elements of their data revolution project. 'We're entering a context in which more and more

data are available', concludes Mr Jacques. 'Many databases are continually updated and unused. **Mobile phone data research has a big future.** It's crucial to address it now because it's at the heart of some concerns such as privacy protection. We have to be able to define a coherent framework so people willingly share their data and thus advance research.'

Anne-Catherine De Bast

A Glance at Raphaël D'Andrimont's bio



Raphaël D'Andrimont graduated in 2008 from the UCL Faculty of Bioscience Engineering. Today he is an assistant and supervises practical work on geographic information systems, geomatics and environmental applied remote sensing in the Faculty of Bioscience Engineering. Simultaneously, he undertakes research projects that monitor agriculture and bodies of water using satellite imagery.

A Glance at Damien Jacques's bio

A 2013 bio-engineering graduate, Damien Jacques is currently writing his doctoral thesis on food security monitoring using, among other sources, earth observation data. He is also a member of Focus Research and a founding member of PhD Hub, a network of young Belgian researchers (phdhub.be). He promotes open access via his involvement in the EURODOC (www.eurodoc-net.com (http://www.eurodoc-net.com/)) dedicated working group. Furthermore, he is a member of the non-profit GOTORO (www.gotoro), in Liège, which aims to stimulate entrepreneurship in and around the city.

A Glance at Julien Radoux's bio

A bio-engineer by training, Julien Radoux earned a Master's Degree in Forest and Natural Areas Management from UCL in 2002. After working in the field of geographic information systems at UCL's Environmetrics and Geomatics Unit, he wrote his doctoral thesis on remote sensing. He then worked on numerous projects concerning forest change detection and global mapping of land use. Today, thanks to a grant from the Fédération Wallonie-Bruxelles, he works in the domain of research infrastructure for biodiversity (Lifewatch).

A Glance at François Waldner's bio

François Waldner graduated from UCL in 2012 with a degree in environmental bio-engineering. Following work on cricket habitat monitoring, he wrote his doctoral thesis on mapping cultivated areas worldwide at UCL's Environmetrics and Geomatics.

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