Bringing Knowledge Graphs to the Rural Poor

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Challenges While thinking about the Semantic Web emerged in the early 2000s, the field recently has seen increased interest and uptake. Large industry players experience significant advantages in representing heterogeneous data and knowledge in Knowledge Graphs, allowing for knowledge sharing both internally and with external partners[1]. In the humanitarian domain, we have seen various examples of NGOs, governments or international organizations such as the UN using Semantic Web principles and Knowledge Graphs to combine heterogeneous data related to international development [2, 3]. While such initiatives are quite successful and can lead to analyses and actions that can benefit the rural poor, the technologies and applications themselves are often not designed or suited for these users. Following [4], we identify three challenges for Knowledge Graphs (KGs) to be made a truly *universal* way of sharing knowledge:
challenge 1: Make KGs usable in low-resource, low-connectivity contexts;
challenge 2: Make KGs accessible for users with various (cultural) backgrounds and levels of literacy;
challenge 3: Develop knowledge sharing cases and applications relevant for the rural poor

Solutions We here present three case studies conducted in an ICT for Development research context that show how we aim to address these challenges:

Market information. In most rural communities, small holder farmers' economic success depends to some extent on local produce markets. In many cases, physical distances to markets are large and farmers are helped by timely and up-to-date information about product availability and market prices. In [5], we developed KGs representing users, products, availability and prices for local markets in rural Mali (addressing challenge 3). Moreover, to allow stakeholders to directly access the information represented in the KG, we investigate approaches to using Voice technologies to interact with the KG in local languages (challenge 2). Currently, this approach is transferred also to seed markets in Burkina Faso.

Veterinarian services. For small farmers, animals are crucial assets and the loss of an animal is devastating. In the Digivet project [6], animal health knowledge elicited in rural Northern Ghana was represented in a KG, relating animal species, diseases and symptoms (challenge 3). Here too, we made this information accessible through voice services for low-literate users and using simple touchscreen interactions (challenge 2). Furthermore, we developed these solutions on low-resource hardware based on raspberry Pi's and GSM dongles (challenge 1)[7]

Semantic Web without the Web. To more fundamentally address challenge 1, we investigate alternative channels for knowledge sharing. Here we keep the core principles and layers of the Semantic Web in tact, but deploy the model not on the Internet and Web infrastructure but on alternative. In [6], we experimented with using SMS as a infrastructure layer on which SW knowledge sharing is implemented. Here, SPARQL queries and result responses are sent over SMS rather than HTTP. This showed that for specific rural cases, this presents a sustainable solution. In [8], we investigate sneaker net solutions for knowledge sharing in a similar way.

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