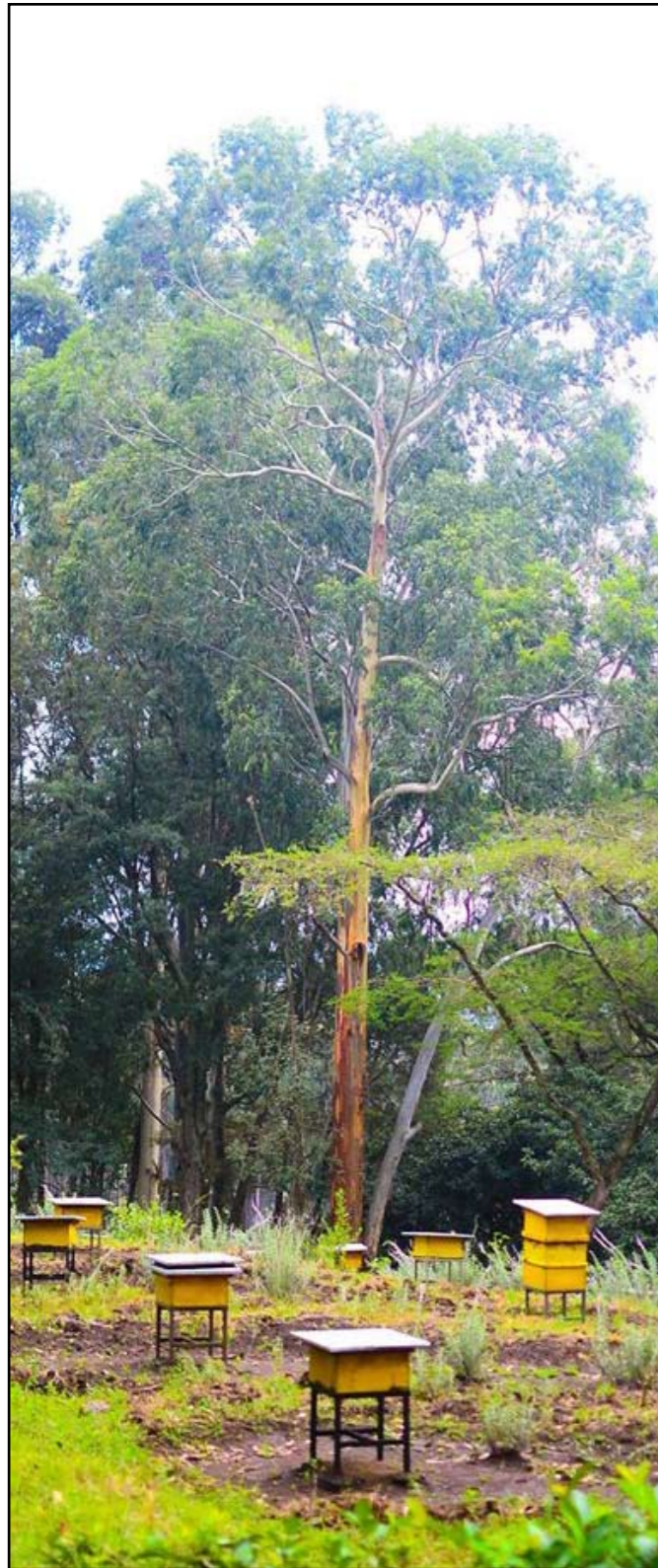# PROTOTYPING NEW FORMS OF TECH INNOVATION FOR SMALL SCALE FARMING

Young Innovators from Africa, Asia and Europe collaborate to explore ICT for agriculture (ICT4Ag) solutions in each of their specific local contexts. The framework is provided by the Innovation Factory programme.

A main aim of the of the Innovation Factory programme in the field of rural development and agriculture is the creation of innovative concepts of how technology can benefit small hold farmers in the local context of each of four selected target countries Ethiopia, Germany, Indonesia and Senegal. This global initiative is commissioned by the German Ministry of Economic Cooperation and Development (BMZ) and implemented by GIZ in cooperation with a network of local organizations and individuals. Since October 2015, the teams have set up national networks of experts and stakeholders including members of small-holder farmer communities, working on the ground to identify needs, to share knowledge and experience and to develop ideas for solutions that are suitable and sustainable within each local setting.

The implementation of novel technologies is often a delicate and difficult matter and small-hold farmers in rural areas are a particularly challenging target group as concerns the adoption of ICT services. Therefore, it is important to develop appropriate technologies based on the actual needs, cultural, environmental and infrastructural constraints of each particular target group.

Key to the success of the Innovation Factory approach is the interdisciplinary composition of the local innovation platforms and the bottom-up organization of these same stakeholder networks. Each national team integrates experts from a diverse spectrum of professional fields such as research, business, engineering, design and agricultural production, each contributing with a unique perspective towards the challenge and participating on their own accord in collaboration with each other.

>>> **Youth, ICT & Agribusiness in Senegal**

Although agriculture is commonly predicted to remain the dominant sector to sustain economic growth in Africa for the coming decades, offering a vast array of business opportunities and sources of income for local youth, large amounts of young Africans still chose to leave their families' rural farms in search for uncertain success in the city. On the other hand, young urban professionals from the IT- and related tech-sectors have still not been sensitized to the great need of technological innovations in agriculture and food-production.

To bridge these awareness and knowledge gaps, a community of young people in the Senegalese town of Thiès had the idea to establish an agricultural technology innovation hub named "Yesaal Agrihub" as a focal point for IT-based technological innovation within the Senegalese agribusiness scene. The physical hub space offers a meeting place for interdisciplinary experts, entrepreneurs and agricultural and livestock producers, as well as a space for project collaboration, training and mentorship to network young ICT and agribusiness innovators and support startup businesses with an agricultural focus. Youth that are already working in, or just simply interested in the sector can join Yeesal Agrihub to interact with likeminded people, learn from best-practice and hatch new ideas together. Promising first steps have been taken in this ambitious and exciting community driven project, including the public inauguration through an ICT4Ag focused hackathon event, the legal registration of the hub as a community owned organization, the hosting of a variety of events and activities, as well as first probes towards establishing a complementing online community of practice.

>>> **Indigenous Culture and Rural Techies in Indonesia**

While the recent large-scale introduction of new affordable and accessible ICT hardware and software solutions to most economic sectors across the globe promise benefits of prospering economies and rapid societal development, they also carry with them a great risk of destroying prevailing cultural and social structures and thereby pose a threat especially to the continued existence of vulnerable indigenous cultures and traditional rural communities in developing countries. What have made ICTs especially prevalent and interesting recently are their dramatically increased afffordability, accessibility, and adaptability, most notably considering the boom of mobile communication devices and networks. On the other hand, the awareness is gaining strength, that to better mitigate negative effects of climate change and uncontrolled development, we should recognize, conserve and further develop local knowledge and wisdom especially in the agricultural sector, assuming sustainable development, inclusive growth and climate smart agriculture as a common agenda in both a local and global context.

In the mountains of West Java in Indonesia, the community of Kasepuhan Ciptagelar has both strong roots in the history of agriculture and ancestral traditions of farming, as well as a curiosity towards new technological innovations. The Indonesian Innovation Factory team collaborate with the community of Kasepuhan Ciptagelar to experiment with open source technologies that both integrate local knowledge and traditional wisdom while attempting to improve the productivity of farmers and to sustain the continued development of the community and its fruitful integration within the West Java context. The ultimate aim thereby is to develop and implement realistic and genuinely helpful tech innovations in full ownership of the villagers themselves.

>>> ICT Entrepreneurship and the Honey Value Chain in Ethiopia

Honey has allways been very important for Ethiopian small-scale farmers, both for their own nutrition but also as an added source of revenue diversification, improving their long term income security. Due to market and distribution inefficiencies, as well as lack of awareness, skills and access to modern equipment for high quality honey production, the Ethiopian honey sector remains substantially underdeveloped, especially as regards the great potential for export earnings.

The Ethiopian Innovation Factory team has examined in-depth all stages of the honey production value chain and their related stakeholders with the intent of identifying potentially fruitful challenges of technology-based interventions. The team intends to both support the further development of existing apicultural techniques and traditions, but also to involve the private sector in bolstering of the honey value chain by developing a new ecosystem for entrepreneurship and innovation around the value chain in order to facilitate the sustainable development of context appropriate ICT solutions for the Ethiopian honey production sector.

>>> Low-tech for community supported agriculture in Germany

The German country unit of the Innovation Factory programme has chosen to focus on the growing movement of a variety of small groups of citizens who aim to organize local and regional food self sufficiency. Under the terms of Urban Gardening, Transition Town or Community-Supported Agriculture, people with and without an agricultural background gather to realize a "non-industrial and market-neutral" agriculture. In this form of alternative agriculture, the use of large-scale machinery and industrial production processes is not wanted and often not financially feasible. Instead, a wide variety of already available or yet to be developed low-tech and small-scale mechanical and ICT solutions could potentially serve the particular interests of this alternative target group, yet it remains difficult to

gain and maintain the appropriate overview and detailed knowledge about these tools for all those who are not techies themselves. A service is missing, which would continuously validate, refine, evaluate and appropriately communicate the multitude of small-scale technology innovations available on the market or as open source construction plans for DIY. The aim of the German team is therefore to bridge this gap by developing some sort of science-based and needs-focused service to bring suitable technologies closer to the selected target group.

The Innovation Factory global initiative is commissioned by BMZ and implemented by GIZ. This overview is provided by icebauhaus, technical advisors to the programme in the field of ICT4Ag. For further information about the initiative, please contact us at icebauhaus.com. To contact each individual country unit, please see details at the end of each following section.

"" THE ONLY WAY TO FAIL, ITS TO GIVE UP WITHOUT HAVING TRIED "

PAPE OUSMANE NDIAYE

CEO
Fruitech

#YeesalAgriHack

>>> THE CASE SENEGAL
AN AGRIBUSINESS RURAL TECHHUB TO SUPPORT THE LOCAL TECH INNOVATION COMMUNITY

Senegal has a huge potential to create jobs in the agriculture sector, especially in horticulture where the country has an advantage in several factors such as the favorable weather and water conditions, the proximity to European markets with the availability of competitive transport by sea and air or the access to quality inputs. As part of a growth strategy based on ICT and telecom services, the Senegalese agricultural sector has in these last years shown an interest to modernize and take advantage of innovative tools to push the development of farmer incomes and job creation and to reduce crop losses, which significantly affect the income of farmers.

The public institutions need to support these kinds of initiatives and put in practice a national e-agriculture strategy, while the youth need to be empowered and trained to this field. Therefore, the aim of the Senegalese country unit is to respond to this need and create a concrete possibility to explore the agribusiness sector in Senegal through an innovative perspective, where the youth will be the protagonist of the process and the local stakeholder institutions will be actively involved.

A psychical space and a virtual community

The selected pilot area of intervention is the region around Thiès, east of the capital Dakar and the envisioned platform of innovation is represented by Yeesal AgriHub, founded in 2016. The team has handed in the application documents for Yeesal Agrihub as a legally registered association with 22 founding members, representing the core multidisciplinary community. With the legal identity, Yeesal will now be able to act as an official partner in collaboration and projects with other stakeholders.

Their aim is to develop a synergy among young experts in ICTs and the farmers who practice livestock and agriculture in Senegal, in order to help them develop innovative solutions for the local needs of the community. They also

want to raise awareness and sensitize the youth about the business possibilities in agriculture through the creation of a network to link them with successful local start-ups and training services.

YessalAgriHub à Dakar
Institut africain de Management (IAM)
Aujourd'hui à 15h30 mn

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First areas of interventions

A first needs assessment by the Yesaal members among small hold farmers in early 2016 for the agricultural innovations and services yet to emerge from the agribusiness tech-hub still needs to take place in a strong systematic fashion with more resources. But first indications of problem areas were identified as follows:

• The general situation of the land issues, where lands are abandoned in the countryside while they could very well be exploited by youth who want to practice agribusiness
• Organic farming and the lack of information for farmers to use alternative fertilizers and products to grow fruit and vegetable. A place of sensitization and a market of these products are also missing.
• Senegalese people consume imported powder milk at the expense of local fresh milk. There is not a solid va-

lue chain of the sector, while there are several breeders around Thiès who could produce and sell milk within the region.

A living network of experts and makers

Several events and activities have been organized in the physical hub and the team is further developing its program for the community, for instance with a summer school on food security together with partner MakeSense and other events and trainings around entrepreneurship and agricultural concepts. They also aim to develop an online community platform providing access to agricultural information to Senegalese youth and representing the virtual space of the Yeesal community. As currently focused next community projects, the team has chosen to further develop a concept for an application as a solution to the aforementioned milk value chain challenge and potentially the development of a market-platform for organic food, requested by a local partner organization.

The Yeesal Agrihub project has within short time garnered a lot of attention through the efficient use of online social media, traditional mass media channels and pro-active networking with local stakeholders both from public, private sector and NGO. Still, the journey has only yet begun – a lot more can be expected from this community driven experiment once it gathers pace.

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>>> THE CASE INDONESIA
BRINGING URBAN AND RURAL TECH DEVELOPMENT TOGETHER – TECH AND INDIGENOUS KNOWLEDGE

West Java, with its current 46 million inhabitants, is one of the most densely populated provinces in Indonesia and considering its strong population growth rate, it is likely to even reach 100 million inhabitants by 2045. Currently there is a widening gap between the lives of the people in urban and rural areas. Urban areas are shadowed by their growing populations with increasing needs for resources, while rural areas embedded with distinct cultural and environmental identities increasingly struggle to maintain their traditional identities while at the same time increasing their capacity to develop their own potential.

The Innovation Factory project in Indonesia aims to connect the mountain community of Kasepuhan Ciptagelar to the larger society of West Java applying their local wisdom and cultural roots as a foundation to enhance their ability to increase their livelihood through sustainable agriculture. The project also aims to bridge the urban/rural gap through a platform of creativity, research and innovation that is based upon multi-stakeholder collaboration. With the strategic use of ICT and digital media, the network expects to increase the ability of farmers in Kasepuhan Ciptagelar to develop local products and sustainable business plans, as well as to gain better access to the market for their agricultural and artisanal production.

Tradition and Innovation

Farming culture and tradition in Kasepuhan Ciptagelar are still based on ancestral practices, but apart from their strength in maintaining ancient beliefs and tradition, the Kasepuhan Ciptagelar villagers are also known for their openness in utilizing modern knowledge and technology. The IF project builds upon a previously existing collaboration between Common Room, an NGO based in Bandung, and the community of Kasepuhan Ciptagelar through which many needs have been continuously assessed and reassessed.

Participation through technology

Based on the knowledge and experience that has been gathered through the initiated needs assessment and the continuous interaction within the multi-stakeholder network, two main focal ideas have been identified for further development at this stage of the project:

• Strengthening local ICT infrastructure to enhance community communication and coordination. A prototypically established mini data-centre will form the basis for a further expansion of information access using open source technology. So far, the mini data center contains photos, videos, documents, and other media files of relevance to the community of Kasepuhan Ciptagelar. This data will be shared and distributed to the people of Kasepuhan Ciptagelar through the utilization of Raspberry Pi (RasPi). RasPi is a low-cost minicomputer that can for instance enable the villagers to change their own TV screen into a computer so they can experience direct LAN-based interaction between each household within the neighborhood. By strengthening the data center at Kasepuhan Ciptagelar, it is hoped that the indigenous community in the whole village can preserve their own collective knowledge, including their unique culture and tradition.

As part of the data center installment, the country team in Indonesia also aims to set up a maker media lab and involving the youth in the community. The inclusion of local groups of youth is considered beneficial in terms of greater creative input in the community as well as the expected contribution to strengthening a sustainable agriculture strategy for the future of the village.

• Mapping of the indigenous territory. Recognizing the cultural territory of Kasepuhan Ciptagelar that has been inherited from their ancestors is a minimum requirement for creating a harmonious life for the community. The territory is part of their identity. The aim is to map the indigenous lands to secure tenure, manage natural resources, and strengthen the culture. The methodology applied to this mapping process will likely involve participatory approaches with data provided by the villagers themselves in combination with more technical methods, including geographic information systems (GIS) and remote sensing. Through this approach, the people of Kasepuhan Ciptagelar can work together with researchers in data collection and interpretation to transform and communicate their cognitive knowledge and thereby enhance their ability to manage their own lands.

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>>> THE CASE ETHIOPIA
IMPROVING BEEKEEPING AND HONEY PRODUCTION THROUGH ICT BASED METHODS AND TECHNOLOGIES

Ethiopia, a country of 92 million, has over 80% of its population employed in the agricultural sector, mainly as smallholding farmers, while industrial farming is in its budding stages. This large number of small holding farmers who heavily rely on rainfall is extremely susceptible to drought and food insecurity. Meanwhile, Ethiopia has the highest number of bee colonies and surplus honey sources of flora in the world (Gidey and Mekonen, 2010).

The Ethiopian team recognizes the possibilities for a thriving apiculture sector in Ethiopia and wants to explore the existing systems of honey production and its value chain. But the team also recognizes the gap hindering smallholder farmers to integrate and make use of Information and Communication Technologies (ICT). So they want to make a significant contribution in closing the gaps between ICT and apiculture in combination with private sector business development methodologies.

Challenges and realities

A solid first needs assessment phase, including several repeated site-visits and well prepared target group interviews conducted by a team of interviewers with representative stakeholders from farmer level up to cooperatives, advisory services and buyers / consumers has taken place and led to the formulation of a few main challenges that focus the continued innovation process:

First of all, the lack of availability of value-adding equipment, such as extraction machines, wax casting mold, queen excluder and other equipment is rarely available and thus reduces the potential of modern hives and bee keeping methods. Further, there is low market accessibility and knowledge sharing as regards honey marketing strategies. Farmers have limited access to market intelligence like price structures and sales channels and need to make sales decisions based on their own intuition. Also challenging is the low awareness of the high market potential of honey products. Only around 20% of farmers are engaged in honey production and even those are not taking advantage of the full potential of beekeeping in Ethiopia as they lack information to boost value, quality and quantity.

The Ethiopian experts have also observed some systemic risks or obstacles for their approach. So organizational systems are already in place but not optimized. The extension worker and model farmer system offers high potential but could be optimized in terms of efficiency of information flow, training effectiveness and accountability. Training all farmers in an adequate way remains a challenge. The collection and selling of honey is not organized or coordinated among and across the individual farmers. This lack of unification and utilization of synergies among the actors within the value chain is also based on the fact that single farmers are having low production volumes, low quality-, packaging- and marketing-knowledge and thus reduced sales potential. And finally it would be a costly process to coordinate the beekeepers. Since farmers are living in dispersed locations and coordination is mostly based on face-to-face communication, the coordination efficiency is low.

Honey or money!

The Ethiopian network developed three idea drafts, which are firmly based on and derived from the local needs established through the needs assessment. The ideas at first appearance rather represent the bundling of needs and demands into info portal & service centre functionality, as well as the transfer of internationally well established technologies and concepts unto the situation of the local honey producers. but in reality, the approach allows for a focused yet flexibly adaptable further iterative development and testing over the next few months by the involved partners to arrive at a unique configuration and design, optimized to the intended target groups and usage context that have the potential of adding clear benefits to the local small-scale honey producers.

One example of these prototype ideas goes under the working title "Honey or Money - crowd funding for Ethiopian honey producers". The aim is to test a financial model based on crowd funding that enables local beekeepers to purchase shared bee-keeping and honey processing equipment. The IF team has identified crowd funding as an instrument that is suitable for interventions on small-scale level. Through a crowd funding campaign, beekeepers are able to access an international market, which helps them to finance their investment in technological development. Besides the more immediate financing opportunities, this instrument provides other benefits for the beekeepers, such as improved branding, media coverage and logistics.

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>>> THE CASE GERMANY
ALTERNATIVE SMALLHOLDER FARMING AND NON-INDUSTRIAL TECHNIQUES

n Germany, there is currently a growing movement of a variety of small groups of citizens who aim to organize local and regional food self sufficiency. Under the terms of Urban Gardening, Transition Town or Community-Supported Agriculture, people with and without an agricultural background gather to realize a "non-industrial and market-neutral" agriculture. In this form of alternative agriculture, the use of large scale machinery and industrial production processes is not wanted and often not financially feasible.

From this situation results a strong demand for alternative methods and techniques which are specially adapted to the needs of small structured forms of production and a corresponding high number of such technologies are developed and featured on a variety of websites and blogs and are published in social networks. However, a service is still missing, which would continuously validate, refine and evaluate the multitude of available small-scale technology innovations.

Creating awareness of alternatives
The aim of the German team is therefore the development of such a science-based and needs-focused online service for the evaluation and dissemination of technologies in the field of urban and alternative agriculture.

The first activities in summer 2016 brought together a multi-disciplinary team including further experts from the fields of online pedagogics, open source collaborative product development, organic farming and community supported farming representing academic institutions, NGOs and private sector. Their motivation and interest in the topic is in general high, although it still remains to be seen, which type of projects can be realized in which constellations.

The country unit in Germany has not yet formulated a concrete idea, but has the general ambition of developing some sort of service to meet technology demands of local small scale organic farmers, as the needs assessment is still necessary for getting a clear picture of the target groups' actual needs and preferred formats of communication.

Discussed until now were potential directions ranging from an eLearning course platform for self-learning of topics related to appropriate technology and methods for small-scale organic farming to an information database, providing a structured and usage context based overview of available technologies, on to tools supporting the collaborative development and adaption of new technologies for farming.

Different formats of crowd-sourced or expert gremial based evaluation and recommendation of appropriate technologies were discussed and, in addition to the actual needs assessment among the farming communities, a thorough evaluation of descriptions of technologies currently available online will be of essence to the process of narrowing options and developing the actual project idea.

For further information please contact:
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