

The potential of digital tools to foster production, and thus availability, of healthy diets for city dwellers in secondary cities

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Abstract. Urban population growth and strong rural-urban migration are continuing in sub-Saharan Africa. Similarly, traditional farming is no longer attractive to many young people despite its importance for food security. Digitalization can be an ally to make the agri-food system more attractive. The Nutrition in City Ecosystems (NICE) project aims to increase and better link the production and demand of safe and healthy foods in two secondary cities each in Bangladesh, Kenya and Rwanda. Two digital tools called Soluta-ag and GATE are introduced in NICE. Soluta-ag keeps records of business transactions in online and offline mode and provides marketplace facilities and automated business analytics in real-time for Farmers' Hubs, the social business model implemented in NICE. GATE, on the other hand, serves as a selection, screening and validation platform as well as repository for climate smart agri-food system innovations. Preliminary experiences from NICE show that digital tools can A) attract youth for farming, B) connect farmers' produce to market, and C) facilitate the delivery of context-adapted innovations. Ensuring ways of production are modern and efficient and sufficient employment opportunities are available in urban agri-food systems are crucial to maintain food sovereignty and adequate, diversified nutrition for all city dwellers.

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1 Background

Sixty-six percent of the world's population is expected to live in urban areas by 2050 [1]. In sub-Saharan Africa, the number of medium-sized cities is expected to double by 2030 compared to 2015 [1]. Urban population growth and strong rural-urban migration are important drivers of these changes [2]. Many young men and women in rural agricultural communities do not see farming as an attractive occupation anymore [3]. All too often, these young people migrate to urban areas in search for other opportunities [3]. However, also in urban and peri-urban areas, for food security and other reasons, it is important that an adequate number of young people actively choose to continue working in farming [3]. Digitalization can be an approach to keep youth engaged in the agri-food system and at the same moment increase agri-food system practices.

Food and nutrition security are essential for sustainable and equitable city ecosystems, but degradation of natural resources, as well as pollution and poor waste management often go hand in hand with rapid and unplanned urbanization [4]. (Informal) low-income urban neighborhoods are often characterized by very limited or difficult access to supermarkets or high-quality food choices due to poor transportation routes [1,5]. Fragmented market structures (street traders, kiosks etc.) which are often not regulated, add another layer of complexity to the city food system [1,5,6]. Also, as a consequence of changes in lifestyles including, but not limited to, moving out of a farming household, different relative prices for food, and often increased income, men and women in cities follow a different diet than in rural areas [7]. While rural diets are typically characterized by traditional staples such as millet or pulses requiring long cooking times, urban diets are characterized by staples prepared more conveniently (rice, pasta, or bread), and

higher amounts of packaged food as well as high-sugar foods [7-13].

While many consumers assume that producers have the final say on how food is produced, distributed or even priced, most producers, especially smallholder farmers, are influenced by the cost and availability of inputs, varying weather patterns aggravated by climate change, and political interests that dictate policies and what form of food production is supported through legislation, public financing and incentives [14]. Physical access to markets, the structure of available markets and smallholder farmers' lack of skills, information and organization also often impair smallholder farmers' livelihoods [15].

In many food systems, producers (often smallholder farmers) and consumers (including the entire population from young children to old women and from urban and rural poor up to the wealthiest, all with their own needs and requirements) are not adequately connected, but both suffer from food systems impairments [14]. Suboptimal diet is responsible that one-third of the world's population suffers from malnutrition [16]. Still, it is not only physical and economic access shaping food and nutrition outcomes in urban contexts [17], but also the considerations of how households utilize what sort of food, clean water, and sanitation and health care are important factors defining the populations' nutrition status [18]. Poor urban households in low- and middle-income countries (LMICs) tend to spend a large portion (up to 70%) of their income on food, making these households particularly vulnerable to food price crises, especially when they are female-led [19-21]. By forcing households to substitute nutritious food such as fruits and vegetables, nuts and seeds or animal products with less nutritious, less expensive, and less nutrient-dense staples, food price volatility immediately affects diet quality [1].

The Nutrition in City Ecosystems (NICE) project connects the demand and supply side of food systems, engages women and youth - including through social business models - and builds local governance capacity initially in two secondary cities each in Bangladesh, Kenya and Rwanda. Emphasis is placed on increasing and better linking the production and demand for safe and healthy foods, and on making food value chains more nutrition-focused so they contribute to better health.

2 Digitalization as an important approach to overcome current food systems challenges

Current food systems cannot guarantee sustainable availability, accessibility and affordability of nutritious foods for all city dwellers in many urban areas and require immediate transformation towards more sustainable ways of producing and consuming food [16,22]. Digitalization can be a key driver for such transformations, offering technology and innovation contributing to improved livelihood for both, urban consumers as well as urban and peri-urban farmers producing the majority of food in LMICs.

Digital tools, besides other approaches and technologies, offer immense potential for the improvement of the mutual understanding between producers, consumers and all sort of food systems stakeholders (such as traders, sellers, researchers etc.). However, especially when it comes to consumer understanding and malnutrition, data are often scarce [23]. The lack of relevant data is often a considerable obstacle to motivate small and medium enterprises (SMEs) designing context-appropriate strategies for food fortification practices [24] although food fortification is considered the most cost-effective strategy to prevent micronutrient deficiencies [25]. The lack of data

regarding malnutrition not only reduces producers' opportunities but also widely breaks the development of public health policies [23]. In Rwanda, to close this data gap and to contribute to a better mutual understanding between food producers and consumers, the global Consultative Group on International Agricultural Research (CGIAR) in partnership with the Rwanda Agriculture and Animal Resources Development Board (RAB) and the VIAMO company, are piloting an innovative mobile phone-based system for high-frequency collection of diet quality data to better inform producers' decisions [26]. In the first 15 weeks of data collection, the system communicated by SMS with more than 150'000 Rwandans from across the country and 25'000 completed responses could be received at costs of less than \$1 per respondent and even from difficult-to-reach communities [26]. The SMS administered questionnaire took around 10 minutes to complete and provided invaluable information guiding context-specific policy decision making [26]. Similar systems can readily be mainstreamed into broad health and nutrition data collections, supporting data-driven decision-making everywhere.

Furthermore, similar technologies can also be used for information and capacity provision, especially, but not only, among producers. SMS based communication can for example be used to inform or remind farmers on best planting moments, current market prices, important weather forecasts etc. or to share small context- and instant-specific capacity building episodes [27-28]. However, it is still estimated that 3 billion people, mainly in LMICs, currently remain unconnected and hard to reach by traditional media or the internet, meaning they are excluded from many information available and with voices often not heard [22]. With a farmers society getting older everywhere, and often living in remote, traditional areas with low women empowerment, reaching of the (female) farming society and respective education

on and dissemination of digital tools still requires further fostering.

2.1 Digitalization in the Nutrition in City Ecosystems project

The NICE project is applying digital tools mainly to enhance production. Specifically, two digital tools already used in other settings are being introduced, Soluta-ag and GATE. The general social business model applied in NICE to strengthen the production of safe and healthy foods is called Farmers' Hub. Developed by the Syngenta Foundation for Sustainable Agriculture (SFSA), a Farmers' Hub is a 'one-stop-shop' run by an independent, often young, agri-entrepreneur that offers a range of services to farmers, e.g. access to quality inputs, mechanization, advisory services and market linkages [29]. By aggregating agriculture produce in a central location, a Farmers' Hub helps farmers to tap into existing and new markets [29].

Soluta-ag is a digital tool developed as a joint venture between SFSA and LightCastle Partners, currently in use by 800 Farmers' Hubs serving more than half a million farmers across six countries in Africa and Asia. Soluta-ag serves as a local ecosystem builder by enabling more efficient connections among various value chain players such as agri-entrepreneurs, input suppliers, off-takers, agri-enterprises and development partners [30]. The tool improves transparency and traceability by allowing stakeholders to easily interact. It supports buying and selling activities, provides price information and monitors Farmers' Hubs performance metrics [30]. As an agri-business intelligence tool, Soluta-ag provides agri-entrepreneurs with data-driven insights on market trends, including price volatility, profitability and pricing, enabling them to make more informed decisions [30]. Within the NICE project, Soluta-ag will establish designated market channels that facilitate safe and healthy foods from rural and peri-urban farmers to urban food markets. Ten-

thousand Rwandan and 16'000 Kenyan farmers will be connected to specific marketplaces in secondary cities promoting safe and healthy food through the intermediary of the Farmers' Hubs. Functioning as a business management tool, Soluta-ag enables agri-entrepreneurs to manage their operations more effectively, thus reducing associated business costs and risks. The tool is particularly adapted for young agri-entrepreneurs, who possess familiarity with mobile-based technologies [30]. Since the initiation of the NICE project in 2021, 92 Kenyan agri-entrepreneurs have been trained on the utilization of Soluta-ag. The majority of them are currently using the tool, serving 1239 farmers. Overall, the cumulative revenue generated by all Farmers' Hubs during the period January to April 2023 approximates 275'000 US dollars, solely representing sales of agri-inputs to farmers.

Similarly, to enhance the uptake of climate-smart agricultural innovations and other solutions that cater to the needs of smallholder markets, SFSA also digitizes the validation process of agricultural innovations by incubating a web platform and mobile application tool called Global Agri-Tech Evaluation (GATE). The aim of GATE is to accelerate the adoption of innovative agricultural solutions by providing a platform for evaluating their effectiveness and scalability, as summarized in Figure 1. As part of the NICE project, efforts are being made to explore innovative solutions in the following areas: i) nutrition, ii) food safety, iii) agroecology, and iv) introducing new crops and varieties. In Bangladesh for example, the GATE tool is used to evaluate the effectiveness of zinc-fortified rice varieties under improved agronomic management practices. Preliminary results show the superiority of the innovation over existing farmers' practice. Therefore, after successful validation, the best performing variety under improved agronomic management practices is promoted to the

farmers via the Farmers' Hubs. Similarly, more than 14 technologies promoting climate-smart agricultural innovations are currently in the pipeline to be disseminated soon.

exploring various ideas on how to best incorporate digital tools in its demand-generating social marketing campaigns across the three countries, keeping in mind that especially among consumers, age,

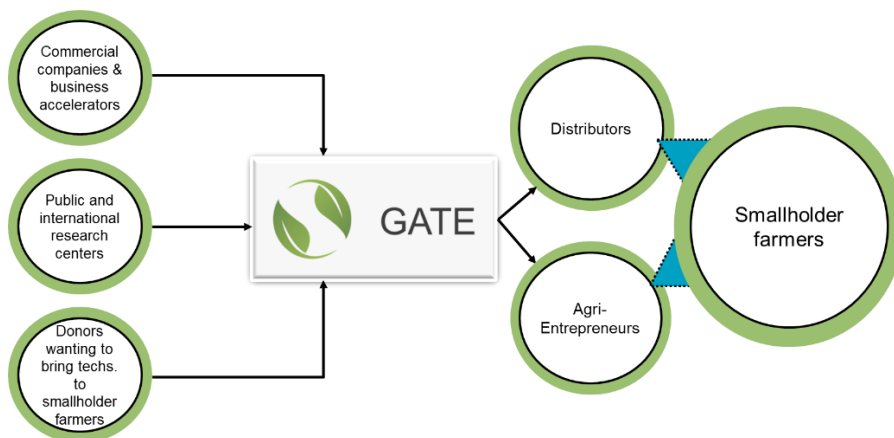


Fig. 1: The place and function of the GATE digital solution in the ecosystem of needs-based climate-smart agriculture innovation sourcing, screening, validation, and delivery to smallholder farmers

Regarding the demand side of NICE, while digital platforms can be used to promote healthy eating, increasing demand for and access to nutritious foods in households may require different strategies and additional efforts. Current demand creation activities in NICE mainly focus on community-based interventions to create awareness and consideration of safe and healthy foods among consumers. Simple digital tools such as digital platforms that provide recipes or guidance on how to shop for healthy foods on a tight budget might be a supplementary boost for these interventions. Many community organizations, such as churches, youth groups, and women's groups, in LMICs are widely using simple WhatsApp groups to facilitate broad information sharing and learning, communication and collaboration among their members [31]. Similarly, managed Facebook groups even provide a platform for discussions, networking, and information sharing [31]. NICE is currently

social, and gender inequalities might be fostered by depending too much on digital modes of communication.

3 Conclusions

A sustainable and equitable agri-food system is a priority to tackle nutrition challenges in city ecosystems. Circling back to the out-migration of young men and women from agriculture, this phenomenon is leaving many farmers without an obvious successor in the family. However, for food security and other reasons, it is important that an adequate number of young people actively choose to continue working in farming [3]. Creating attractive equal employment opportunities and livelihoods in agri-food systems is thus crucial, making it extremely valuable to leverage digitalization wherever possible. The digital tools applied and introduced to foster production, and thus availability, of healthy diets for city dwellers in secondary cities in the NICE project clearly: A)

Attract young men and women to stay in farming. B) Connect farmers' produce to markets ensuring fair prices for all involved. And C) facilitate the delivery of context adapted innovations to overcome common challenges including limited access to credit, farm inputs, agronomic and vocational training, and insurance and lucrative markets. Furthermore, while other challenges like landownership, degradation of natural resources, water scarcity, loss of biodiversity and climate change are more daunting technology can contribute also here. From the consumers' lens, digitalization offers a solution to boost the demand for nutritious food, improve dietary patterns, and track food prices. Ready-to-use platforms (e.g., WhatsApp, Facebook, etc.) can help to improve the community-based efforts in the NICE project. Yet, limited access to technological devices and the internet are still challenges to be addressed among both, producers and consumers as well as men and women, especially in LMICs.

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