



# Planning smart, working hard: unveiling the ‘hidden’ labour behind digital connectivity in Tanzanian agriculture

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## ABSTRACT

Digital connectivity is touted as a smart solution to spatial, informational and economical ‘problems’ at the global margins. At the threshold between development discourse and practice, (under)valued labour and (in)visible infrastructures, two case studies of digital connectivity projects in Tanzania’s agricultural sector illustrate the interplay of smart plans and hard work when digital infrastructures are set up between firms and farms. A conceptual emphasis on structuring labour contributes to highlighting and scrutinising the supposed smartness of digital solutions in relation to the inherent hidden, frugal and precarious work required for their construction and maintenance.

## KEYWORDS

digital connectivity; infrastructure; labour; agriculture; development; Tanzania

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## 1. INTRODUCTION

Against the backdrop of climate change, food security and calls for agricultural revolutions in the Global South, digital infrastructures such as digital extension tools, marketing platforms and precision farming applications are seen as all-in-one solutions that can be seamlessly integrated into agricultural landscapes (see Aker et al., 2016; Brooks, 2021). Digital connectivity has been lauded for its transformative potential in agriculture in the Global South as it looks to overcome geographical (e.g., lack of economies of scale and physical infrastructures), informational (e.g., lack of agricultural knowledge and market information) and relational (e.g., lack of market integration) gaps (Aker et al., 2016; Foster et al., 2017; Kudama et al., 2021). Accordingly, development actors and other decision makers attempt to transform economies at the global margins through digitalisation (Ouma et al., 2019).

Contrary to these optimistic visions of digital agrarian futures, media reports provoke with headlines such as ‘Why Africa’s Digital Strategy is Failing’ (Nyakarundi, 2024, n.p.) or ‘South Africa is failing to ride the digital revolution wave’ (Andreoni & Avenyo, 2021, n.p.) and ‘Africa faces significant internet disruptions and a widening digital divide’ (Mathekgga, 2024, n.p.). They

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point out that digitalisation on the continent is slow, uneven and prone to monopoly structures, unstable investments, political overregulation or shortage of supply. Critical scholarship has helped to contextualise digital connectivity through more nuanced perspectives between the 'grand visions of connectivity' (Friederici et al., 2017) and the actual outcomes on the ground (Hartmann et al., 2021; Wyche & Steinfield, 2015). Chaudhuri (2019) points out the paradox that many analogue practices are required to create digital connectivity. She describes the human mediation to build the digital biometric identity infrastructure in India as 'infrastructuring'. For the Solomon Islands, Hobbis and Hobbis (2020) trace networks between cables, brokers, files and SD cards to discuss the analogue and informal detours of online access for rural populations. Mann and Nzayisenga (2014) problematise the social and economic situation of mobile phone credit vendors on the streets of Kigali, as informal networks have proven to be an invaluable resource for multinational telecommunication companies and their network expansion. At a global level, access to unpaid labour is becoming a systemic mechanism of accumulation in digital value networks, and cloud-workers in the Global South are doing more unpaid work than in the Global North (Howson et al., 2023). International humanitarian aid is increasingly based on digital innovation and data practices that reproduce unequal power relations along colonial lines (Madianou, 2019).

Digital infrastructures are comprehensive and affecting many facets of farmers' lives such as farming, retail, finance, insurance – and yet these digital connections are not just 'out there'. Digital infrastructures must necessarily be built by someone. Drawing on the studies above, we make use of a central aspect of the so-called 'infrastructural turn': The labour involved in the creation, maintenance and repair of infrastructures enables us to recognise and explore them. In two case studies of digital connectivity projects in the Tanzanian agricultural sector, we trace the manifestation of existing and new labour relations throughout their construction processes. Two companies use digital infrastructure solutions to gain access to Tanzanian farmers' fields and improve their living and working conditions. The first vignette describes the YaraConnect platform. The digital marketing infrastructure is operated by Yara International, an international fertiliser supplier. The second example is about the establishment of an e-extension system called iPlus by the East African technology company mShamba. For both case studies, we respond to the following research question: What forms of infrastructuring labour are provided by whom? And who is benefiting from it?

After presenting qualitative insights into the building of digital infrastructure in the Global South in two vignettes, we discuss three intersecting forms of labour involved in the construction of digital connectivity between firms and farms in rural Tanzania. We take representational, relational and informational labour as entry points to continue conceptual discussions on the implementation gap in development projects, (under)valued labour in constructing digital connectivity and (in)visible data infrastructures. The third section illustrates the representational work on digital infrastructures. On the international stage, it aims to gain support from the development sector as the digitalisation of agriculture in the Global South is a risky and large investment. The construction of digital infrastructures then overlaps with project structures in development aid and their unequal employment conditions across scales. Against this backdrop, the fourth section discusses how traditional issues of agricultural work are inevitably intertwined with emerging digital ones. Relational labour between firms and farms are ultimately stripped of their supposed smartness and purely digital nature. Our studies show that the necessary unpaid and hidden labour is being systematically but subtly diverted from local communities and intermediaries. Even if their supposed invisibility in traversing space and time is part of the framing of digital connectivity as 'tools for development' (Ouma et al., 2019, p. 353), making its (inter)national flows, labour processes and impacts on rural life visible paints a different picture. Thirdly and finally, the question arises as to what new (in)visibilities the informational work on digital infrastructures creates. By thinking through the dynamic re-making of infrastructures, but also

by recalcitrantly engaging with and bridging sometimes unfashionable dichotomous heuristics such as smart vis-a-vis hard work, or 'world-changing' versus 'failed' infrastructure projects our article contributes to a more critical engagement not only with digital connectivity in particular, but also with development practice in general.

## 2. PLANNING SMART AND WORKING HARD BETWEEN FIRMS AND FARMS IN RURAL TANZANIA

In rural Tanzania, our empirical insights on building digital infrastructure between firms and farms urge us to view digital infrastructure neither as a silver bullet nor as an outright failure. To investigate the construction of desired but contested connectivity, we have adopted a qualitative approach that combines two different perspectives – that of smart planning on the firm side and that of implementation on the farm side. By taking a closer look at the labour involved in building digital connectivity between firms and farms, we use two case study vignettes to explore how discourse, collaboration and information flows are negotiated, framed and implemented.

The first vignette addresses the YaraConnect digital marketing platform, a marketing infrastructure operated by fertiliser multinational Yara International. The vignette is based on the first author's field research. It uses interviews and observational data from two fieldwork phases (July–August 2022 and June 2023). These fieldwork phases are further complemented by his long-term work on the fertiliser industry in Tanzania since 2018 (Tups & Dannenberg, 2021; Tups & Dannenberg, 2023).

The second vignette shows the example of the iPlus e-extension system of an East African technology company called mShamba (see also Matejcek, 2024). The second author has conducted extensive ethnographic fieldwork in Tanzania (Morogoro and Mbeya regions) on digitalisation as part of the broader Green Revolution agenda in Africa. She engaged with pioneering, tech-savvy precision agriculture programmes over a 14-month period between 2019 and 2021. For this vignette, she also draws on interviews with farmers, agricultural extension workers, agro-dealers, non-governmental organisation (NGO) staff, technology companies, programmers and policy makers among others.

Throughout both case studies, the building of digital connectivity at the 'firm site' versus the 'farm site' does not seem as different as one might assume. Some elements come to fruition, while others are fundamentally altered when what appears to be a purely technological solution is subjected to the complexities of rural life. For both case studies, we pose the following research questions: What forms of infrastructuring labour are provided by whom? And who is benefiting from it?

### 2.1. The digital marketing platform YaraConnect

The YaraConnect platform is a digital marketing infrastructure operated by Yara International, one of the world's leading fertiliser suppliers. While Yara cooperates on a global level with the tech-firm IBM to digitally monitor approximately 10% of all arable land worldwide using remote sensing and AI tools, Yara is also increasingly investing in regionally adapted online platforms that digitise fertiliser logistics from plant to farm to create new income streams via digital farming services.

Integral to these regional investments, Tanzania is among a handful of Yara's first pilot markets (similar pilots are in Kenya, Thailand and Indonesia). Remarkably, the platform originates from an impromptu fertiliser donation scheme. During the COVID-19 pandemic, Yara kick-started the Action Africa Initiative together with the Norwegian government and the World Food Programme to react to rising fertiliser prices in Africa. In total, the public-private partnership (PPP) donated 40,000 tonnes of fertiliser in seven East African countries in 2021 and 2022 (Kenya, Uganda, Tanzania, Malawi, Rwanda, Zambia and Mozambique). To document the

fertiliser donation, Yara developed an SMS-based lottery which was launched in June 2020. Until August 2020, more than two million smallholder farmers and 450 fertiliser retailers became registered. 250,000 farmers were eventually selected to pick up their fertiliser donation at the registered retail shops. Shortly after, Yara used the collected dataset consisting of basic contact and farming information to set up the YaraConnect platform. The digital platform serves two purposes. Firstly, it offers a range of digital business to client (B2C) services to farmers. It displays crop nutrition plans tailored to farm characteristics and promotes product packages which can be ordered online and picked-up at the stores of registered retailers who, in turn, receive in-kind gifts for pulling users on the platform through a reward system. Secondly, it offers business to business (B2B) services by linking multinational agribusinesses such as Corteva and Wilmar (seeds and chemicals) and credit institutions (Equity Bank) with local retailers at the 'last mile' of the fertiliser chain in Tanzania. In sum, the YaraConnect app is a fully-fledged digital infrastructure to promote farming knowledge, gather information and sell agri-inputs.

When I revisited Yara's Tanzanian headquarter in 2022, Kamis, one of Yara's commercial managers, recapitulated the last years of trading fertiliser with enthusiasm. To him, the Action Africa Initiative was a game changer for Yara's operation in the market. Kamis summarises:

What I can say is that we have made a dent to the Tanzanian food system. Our supply chain is now digital and thanks to technology we are leading the agricultural revolution in the country. (Interview, Yara staff, Dar es Salaam, 1 August 2022)

This enthusiasm about the transformative nature of digital infrastructures is not exclusive to Kamis. In July 2021, at the Presidential Summit of the African Green Revolution Forum in Nairobi, panellists were asked what they see as the big game changer for turning African agriculture around. The CEO of Yara, responded swiftly: 'If I answer this in one word it would be: Technology!'

Both statements point towards the discursive dimension of constructing Yara's digital platform in Tanzania and other East African countries. Even prior to having made any impact or even creating and sustaining an active user base, Yara mobilised an expansive promotional campaign to demonstrate the disruptive nature of its digital intervention by crafting a compelling narrative of benevolence with a certain degree of white-saviourism. Social media campaigns featuring portraits of involved actors followed a dualism of Yara staff reaching out to farmers, as the portrait of the Yara Regional Coordinator for Africa on the homepage shows, whilst farmers are narrated as passive and grateful recipients (see [www.yara.com/actionafrica](http://www.yara.com/actionafrica)). Crafting this narrative of benevolence amid crisis had two purposes which become more eminent in terms of the partnerships and data collection involved in setting up YaraConnect.

Given the origins of Yara's digital platform in a PPP with public institutions such as the Norwegian government and the World Food Programme, coordinating stakeholder networks was an important condition on various scales. As Yara's regional coordinator for Africa raised in his portrait: 'This is not a small intervention; it's a massive operation. I hope others will join us'. Indeed, all fertiliser donations in Tanzania and neighbouring countries were flanked by flag-off events involving politicians and agricultural functionaries to demonstrate unity and legitimacy for the initiative. But also, when the initial donation programme was turned into the commercial YaraConnect platform in 2022, the same stakeholder networks of political representatives, business elites and development actors continued to promote the platform. For instance, Tanzania's Deputy Minister for Agriculture, raised at the launch event:

'Your basic business is the importation, manufacture, and distribution of fertiliser in the nation, but you have gone a step further by improvising various projects that promote farmers'. (Speech transcript, Tanzania's Deputy Minister for Agriculture, Dar es Salaam, 31 May 2022)

This work was, however, not only about gaining political legitimacy and support. Especially at the last mile of the fertiliser chain, that is the link between farmers and local retailers, substantial work was necessary to reach a broad user base. Firstly, under the Action Africa Initiative, regional Yara staff used local retailers as intermediaries in the mass registration of farmers for being eligible for the donation. Secondly, the very same retailers needed to be fully registered as Yara retailers in the platform. Registering hundreds of thousands of farmers and hundreds of retailers by hand was a work intensive endeavour, demanding face-to-face interaction by thousands of intermediaries even despite pandemic conditions. Davies, a regional manager from Yara reflects on this time:

We wanted to register as many users as fast as possible. So, I told my foot soldiers to visit our partners and village shops. We motivated them to register customers for the fertiliser gift because awareness was lacking. (Interview, Yara staff, Iringa, 29 June 2023)

Especially at the local level, pooling support and gaining scale was therefore systematically provided by non-firm actors in making the digital infrastructure tangible. Yara's 'foot soldiers' are typically jobless and young people volunteering on in-kind basis as they hope to become promoted into a formal job. These foot soldiers were crucial for gaining scale among farmers. This applies also to local retailers. Retailers are operating small shops and surviving on the small margin made between fertiliser wholesalers (contracted Yara partners) and farmers. In scaling the digital platform, they were expected to do the dangerous extra work of mobilising and registering farmers, as well as of distributing the donated fertiliser. Relational work was, therefore, mobilised at different stages and levels to gain stakeholder support as well as to quickly scale the Action Africa Initiative and, shortly after, the YaraConnect platform.

Especially when turning the Action Africa Initiative into the YaraConnect platform, substantial work was required to initiate the first flows of data. While registered farmers only had to provide their basic information (contact data, farm size, cultivated crops), retailers distributing the fertiliser donation were required to manually collect more detailed data (geodata, input-usage practices, yields) to allow Yara to measure its impact, but also to refine the YaraConnect platform. When I visited, Rehema, a shop owner in Iringa in 2023, she explained her duties as follows:

I had so many farmers coming to my shop. And you must check their ID and their notification on their phone. So many came without proper documentation, but they were hopeful for the gift. [...] The company [Yara] wanted me to collect the information of every farmer. I am telling you it was very hectic. (Interview, fertiliser retailer, Iringa, 23 June 2023)

By creating more user data density and feeding the data into the YaraConnect app, Yara promised to increase local farming practices and access to high-standard inputs. However, shortly after being registered and receiving the first notifications on farming practices or sales offers, many farmers complained about the superficial messages leading Yara to rely more on face-to-face interaction mediated through the platform. Elibariki, a farmer featured in one of Yara's portraits explains:

After registering by phone, the agricultural officer visited us, courtesy of Yara, and trained us on how to use the fertiliser, as well as how to plant and take care of the crops we grow. We are limited in our understanding of farming since we do it traditionally, so we require their expertise. (Farmer portrait, [www.yara.com/actionafrica](http://www.yara.com/actionafrica))

Elibariki's actual experience of the digital infrastructure, that is a real person coming to his real farm to discuss his farming practices on the ground, stands for the widespread experience of

YaraConnect so far. Whereas the platform is still under construction and merely offering some few services, the last three construction years have been shaped by tedious work either on political level or and involving thousands of paid and unpaid intermediaries on farm level. While this work adds to Yara's ambition of scaling an asset positioning the firm better in Tanzania's growing fertiliser market, farmers and subordinated retailers have (so far) received little more than the initial fertiliser donation or in-kind rewards.

Taken together, the vignette of the YaraConnect platform is concluded as follows. While the conversion of the initial lottery into a fully-fledged marketing platform required substantial infra-structuring labour, its impacts are below modest. Not only is the platform far from being adopted widely, but it should also not be forgotten that the actual business of Yara, and the struggles of subsequent retailers and farmers, has barely changed. Moving fertiliser from plant to farm remains an inherently tangible business requiring hard manual work by all actors involved.

## 2.2. The e-extension system iPlus

iPlus is an e-extension system invented by the East African tech-company mShamba, which stands for 'mobile farm'. Through iPlus agronomic information should be made accessible to farmers via text, images and videos in various African countries. What started as a simple market information service in 2004 has evolved over the years into an e-extension system (iPlus) complemented by SMS services (Digital Farmer Services), enhanced with information on farming practices, weather information, marketing tips and tablets with interactive training tools. In addition to what Robert calls a 'gateway to the world for farmers', an extensive database (Insyt) fed by a farmer registration app, compiles detailed data on users.

As the services have grown, so has the content department, which can now monitor the market prices of crops, seeds or fertilisers, provide up-to-date weather forecasts and best practices for intensified agriculture for different crops. To this end, mShamba collaborates with universities, ministries, government research centres, agricultural cooperatives, agricultural traders, NGOs and the farmers themselves. They all represent different pieces of the puzzle in the composition of the content conveyed to farmers. For example, the government institutions provide information on licensed seeds, fertiliser companies on input prices and selected farmers who are considered progressive are filmed to explain their field practices.

At the beginning of October 2018, I met the CEO of mShamba, Robert, over lunch at the 'Big Data in Agriculture' conference in Nairobi. Hosted by the CGIAR, this is where large companies from agriculture and technology sectors, development agencies, entrepreneurs and start-ups come together to network, share hands-on experiences and, in the best-case scenario, secure funding for the implementation of a new digital innovation. The 'Inspire Challenge' is part of this conference and a contest for aspiring innovators in the field of digitalisation for agricultural development, endowed with 100,000 US dollars. Robert and I sat at a table with the young innovators. On this day, Robert only had his technology banner on display at the Innovation Safari because his business was doing well. In contrast, the nerves of the young entrepreneurs and start-up founders were on edge as their pitches for their digital innovations were still awaited. There were rumours about a favourite of the jury, which was made up of representatives from large development institutions, agribusinesses and technology firms. They were ostensibly looking for someone who combined 'the best of both worlds': the spirit of Silicon Valley and a less politically problematic background for agricultural development efforts in the Global South. The candidates discussed their chances based not only on their innovations and, more importantly, how much data they would produce. They also imagined their prospects in terms of their gender, skin colour, origin and company location. All were aware that the racialized and sexist assessments of their person would play a decisive role in whether they would win funding for an implementation phase of their digital infrastructure in agriculture in the Global South. In this conversation, Robert also tells his story with mShamba. The start-up was initially based in Accra and then moved to Nairobi because of the reputation of 'Silicon Savannah'.

There, he once messed up a pitch to an important potential client and was therefore transferred to Tanzania in the 'digital desert'. With reassuring words, Robert concludes, and even in Tanzania things went on. (Diary Entry, Nairobi, 7 October 2018)

In addition to competing for prize money, young innovators seeking funding for digital infrastructure show solidarity for this difficult task of always being in the right place for a technology and company's reputation, facing the pressure of peculiar valuations or being moved to the wrong place if you do not prove yourself. Everyone at the lunch table agreed that pitching for digital infrastructure is hard work.

The response in the village of Mandera, Tanzania, to the first pitch of iPlus has been more enthusiastic. Mandera lies in central Tanzania and has a population of about 1000 people who live primarily from maize and sesame farming. Since most of the villagers have never seen their extension officer, their training is to be provided by iPlus. Therefore, a Tanzanian sales representative from mShamba went to the village to demonstrate the digital infrastructure. The presentation of iPlus, however, is not an isolated incident. One day later, small drip irrigation systems were presented at the village meeting. During my stay in Mandera, I heard of planters, containers and weigh scales being demonstrated, too.

This rush to Mandera residents is due to their way of organising themselves and strategically partnering. The contact between mShamba and Mandera residents came through the Norwegian Church Aid (NCA). NCA, in turn, has been funding the Diocese of Morogoro for some time, which has established several Village Community Banks (VICOBA) in Mandera. The weekly VICOBA-meetings were the first contact of the representative of mShamba, who introduced iPlus at one of these meetings. mShamba anticipates that the farmers, who are organised in savings groups, will be able to cover the costs of the digital services themselves after they received a taste of the digital information for free.

The construction of iPlus in Mandera is funded by NCA, like any other NGO-project. The financial risk for a purely commercial approach is high given the low smartphone adoption and willingness to pay in rural Tanzania (Interview, CEO mShamba, Dar es Salaam, 5 March 2020). In addition, the NGO arranges contact between farmers and iPlus. In return, mShamba collects monitoring and evaluation data for NCA to be used for their respective representational work. Furthermore, mShamba can use the data financed in this way for its actual B2B2C (business-to-business-to-client) sales model with fertiliser and seed companies. These companies are not only interested in their customers' data, but also in seeing them recommended in the digital content.

As mentioned, at one of the VICOBA-meetings where villagers come together to jointly strengthen their financial base and make small investments, the mShamba representative also demonstrates iPlus. Once farmers are excited by all the information iPlus can deliver, their personal data is collected to sign them up for the agronomic information service and tailored text messages. This registration is a lengthy process and includes data such as age, gender, land size, crops grown and income. mShamba circumvents this task as this farmer describes:

mShamba people arrived and asked for those who had smartphones. [...] They installed an mShamba-internal registration app on our phones. We were told to register as many farmers as possible until the mShamba representative returned to the village after three weeks. Some did the work, some did not. Later, they selected those who had registered the most farmers, and they were given these tablets as a reward to teach the farmers. (Interview, female farmer, Mandera, 23 March 2020)

The strategy, according to the mShamba representative, is not only to gamify the data collection but also to use the trust within the village. As farmers know each other, trust and social pressure help alleviate untruthful information in the registration process. Thus, mShamba's database

grows with little workload for the company's staff. The work involved in this 'participatory approach' (Progress Report mShamba, 2022) of building the digital infrastructure iPlus is largely carried out by unpaid and hidden labour.

In a conversation about datafication with the CEO of mShamba, Robert proudly describes the reach of iPlus by saying, 'Farmers are farmers. Whether in Malawi, Ghana or Uganda, farmers and their problems are the same everywhere' (Interview, CEO mShamba, Dar es Salaam, 5 March 2020). He shows the training literature from which the content is taken, as well as a list of prepared text messages on maize cultivation that are simply adapted to the season and language. Unlike local customisation of content about agricultural information and practices, the individual messages appear to be a ploy to collect farmer data. Since individual farmer data is needed to sustain mShamba's business model. The data is an asset of great value for agricultural input retailers, seed companies and machinery manufacturers to know the key data of their potential customers and to tailor their products and services to them.

Even if the farmers in Mandera are not fully aware of this business model around their data, their enthusiasm for the digital content cannot be denied. They believe that the educational materials on the tablet are much more comprehensible and convincing, especially because of the technical mediation (Male Farmer, Mandera, 28 March 2020). This expresses the great confidence and trust of the farmers in the digital infrastructure, as this female farmer states:

Those messages were really helpful. First, we were told to prepare the land on time, find modified seeds, plant on time, weed on time, apply fertiliser ... Eh! Before we were lying to ourselves because of financial hardship, and we delayed all those practices. Whereas when you don't weed on time, it lowers your harvest this and that percentage! For this reason, the messages insist: Weed during this and that week! (Interview, Female Farmer, Mandera, 25 March 2020)

Nevertheless, although she has adjusted the timing of her work in the field, the weeding is still as strenuous as before. As the conversation continues, the farmer tells me that the harvest has not turned out much richer, although she has organised her field work better and invested more money in inputs. She did buy improved seeds and fertiliser, as it says in the SMS and in the videos, but then a small drought came at the end of the season and the maize suffered a bit.

In the following season, the agricultural advisory messages stopped coming and the training videos on the tablets show errors because the tablets urgently need internet and updates. The mShamba salesperson promised to come by again to add an internet bundle to the tablets. The farmers are still waiting for this. In the meantime, work in the fields continues as usual.

### 3. REPRESENTATIONAL WORK: DISCURSIVE INFRASTRUCTURES OF DEVELOPMENT

The establishment of YaraConnect and iPlus shows how two companies are using digital infrastructure solutions to gain access to Tanzanian farmers' fields and improve their living and working conditions. Framed by our perspective on infrastructuring labour, both case study vignettes demonstrated how digital infrastructures in Tanzania's agrarian landscapes rely on substantial work. In this and the following two sections, we explore the main modes of labour involved. A consideration of the work with the discourses, partnerships and data of digital infrastructures will highlight the conceptual in-betweens of development discourse and practice, valued and undervalued labour, as well as visible and invisible infrastructure. A typological approach, in which we distinguish between representational, relational and informational work, illustrates which forms of labour are required by whom and for whom they are ultimately mobilised.

Regarding representational work, both vignettes showed the tedious work required to create and maintain a compelling story that sells in front of various actors at different scales. Here, work

is far from being split into smart activities such as promoting and pitching a digital infrastructure vis-a-vis the hard work of implementation on the ground. Rather, both pitching work in front of investors and conviction work in front of local communities can turn out to be incremental, tedious and subjected to self-exploitation among hopeful tech workers and local intermediaries.

Our participant observation at events such as the Presidential Summit of the 'African Green Revolution Forum' or the CGIAR 'Big Data in Agriculture Convention' enabled us to experience the discursive dimension of building the digital platforms YaraConnect and iPlus in Tanzania and other East African countries. The stages of such events connect a community of practice and commit them to shared discourses. By moving the Silicon Valley-inspired logic of pitching and acquiring funding for potentially disruptive but per se juvenile technologies and digitisation projects into southern agriculture (Graham et al., 2015), the setup of digital infrastructures is promoted as fast, unpredictable, repeatable and scalable. Promoted under the umbrella of disruption, especially the technology scene plays a role in introducing narratives that are intended to offer alternatives to 'traditional' agriculture as well as to industrial agribusiness, conventional market logics and undifferentiated value chains. Sensor-mediated, standardised and digitally transmitted data on environmental parameters are intended to provide the basis for high-quality production, while new forms of digital immediacy, proximity, and locality are expected to reshape the economy (Preininger & Hafner, 2021). Thereby representational work makes a substantial difference in terms of what infrastructures are funded and built and what infrastructures are not. Hence, an important step in building digital infrastructures is the convincing selling of a story (Fairbairn et al., 2022).

The discursive representation of digital agri-food technologies is increasingly turning the growing number of agri-tech start-ups into attractive investment opportunities for venture capitalists and investors. In the process, these dynamics are burgeoning into an 'agri-food tech investment rush' – which Sippel and Dolinga (2023) compared to the land and gold rushes of the past. Big hypes for transformative investments in (agricultural) infrastructure has a historical continuity. In post-war colonial Africa, the East African Groundnut Scheme was touted as an 'epic plan' to reclaim ~1,000,000 hectares of land for groundnut cultivation (Rizzo, 2006, p. 208). The hype, however, is also the cause of disappointing unmet targets and wasted investment. Once one of the largest investment programmes, it is now regarded as 'the most dramatic and widely cited failure of the ambitions of British late colonial developmentalism' (Rizzo, 2006, p. 205). In the end, not even half of the planned land could be planted by the end of the 4-year period because the manpower needed, and the sheer labour involved in constructing this agricultural infrastructure was completely underestimated (Coulson, 2013, p. 80 f.).

Today, the narratives around digital transformation of agriculture in the Global South are designed to hedge against great risks. They are presented not only as a profitable investment opportunity but also as a moral obligation that enables food production to feed a growing world population and save a degraded environment (Sippel & Dolinga, 2023). They emphasise the hope to overcome productivity gaps, inequalities and ecological impacts associated with southern food systems. Buzzwords such as 'Agriculture 4.0', 'Precision Farming' or 'Smart Farming Technologies' circumscribe narratives of profitability, sustainability and social responsibility of digital infrastructures across scales (Matejcek & Verne, 2022). Creating moral narratives of benevolence, problem-solving and aid does not only contribute to attracting venture capital, but rather to convincing another group of stakeholders at these pitching events: the development sector. Even though YaraConnect and iPlus are private sector innovations, they are being implemented in PPPs. Yara cooperates with the Norwegian government and Action Africa. mShamba cooperates with the Norwegian Church Aid.

In addition to their material functionality, infrastructures have always been charged with the symbolism of modernity (Stokes, 2020). There is a long history of performative work deliberately deployed to rhetorically make infrastructures for development (Appel et al., 2018). Connectivity-

increasing infrastructures such as roads, railways or fibre optic cables are complemented by the fabrication of high modernist imaginaries alluring with a teleological translation of connectivity into increasing production, trade and access to resources (Graham et al., 2015; Harvey & Knox, 2015). With half of the world's population living in cities, and a rising trend for the future of the urban age, the rhetoric and role of infrastructure is taking on a new shape in the development context (Amin & Thrift, 2017, p. 116). As infrastructural services provide the livelihoods for urban societies, the World Bank, among others, proposes to place them as hubs for sustainable investment, economic growth, job creation and poverty alleviation at the core of development efforts in the Global South. Accordingly, digital infrastructures are another dent in the long pipeline of various infrastructures being deployed at the global margins and 'technoliberal boosterism' (Carmody, 2012, p. 12) emerges as a crucial practice to ensure digital infrastructures being adaptable to and transformative for local contexts, at least rhetorically (Rodima-Taylor, 2021).

In academia, meanwhile, this 'infrastructural moment' is not assumed to be a universal solution to urban poverty as well as global inequalities but rather taken as a starting point for making infrastructural processes, practices and policies visible. Water, energy, waste, even sanitation, are products of power, relationships and imagination, fulfilling strategies of accumulation and underpinning collective everyday lifeworlds. Who finances, constructs and maintains certain infrastructures must be critically examined in this case, as well as the question of who infrastructures should serve and under what conditions (for example, Graham & McFarlane, 2014). Although development institutions minimise the financial risk for companies, they also integrate the construction of digital infrastructures into inequitable project structures between discourse and practice, the tension between global policy and local implementation, and between promise and action in development (Lewis & Mosse, 2006). The 'implementation gap' has been highlighted as one of the biggest challenges facing the field of development. In this article, we support the thesis of Lewis and Mosse (2006, p. 4) who describe that the rhetoric of the gap ignores the 'in-between' as an empirical field of public and private institutions, communities and (inter)national to local collaborations. Donovan (2015) also uses the term 'infrastructuring' to describe the local tensions between politics, people and materials in the often-overlooked construction of the social and technical infrastructure of project work in development. Development project infrastructures offer unequal labour conditions: Local staff experience more insecurity (due to unemployment), perform more caring and affective labour and suffer more from racialised and classed relationships in daily project work (Pascucci, 2019). This applies not only to the representational work that is used at various scales to build digital infrastructures if we think back to the discursive push of YaraConnect prior to achievements on the ground, the racialised or sexist scoring schemes of pitches at the CGIAR convention or the iPlus sales demonstrations.

Notably, representational work is neither solely done by tech and development agents, nor only directed towards potential funders (Matejcek, 2022). It is a means of spurring excitement and interest among potential users whilst simultaneously pre-empting resistance, scepticism or non-interest (Heeks & Krishna, 2016; Matejcek & Verne, 2022). Intermediaries, such as extension workers, project staff or local governments, typically adapt stories about disruption and feasibility between developers, funders and users and vice versa (Baumüller et al., 2023; Matejcek, 2022). It is becoming increasingly delicate how disruptive a digital infrastructure is portrayed or how costly it appears to be to set up on site. Representational work happening in direct proximity to the targeted user base adds to maintaining and reaffirming a narrative once the actual building work of a digital infrastructure commences.

Overall, representational work is about filling the in-between with compelling stories. It is not just about incentivising and convincing farmers to use a digital infrastructure once it is online, but mostly about creating and making legible new market frontiers (first vignette) as well as evaluating and legitimising its existence to funders and supporting stakeholders (second vignette).

Conversely, digitalisation is changing the representational work of development institutions. As designers and programmers focus on the data that a digital infrastructure can produce, but less on the actual changes in agriculture or livelihoods it is intended to target (see also Schurman, 2018), the newly acquired socio-economic data of farmers is readily used in reports. Registration figures or the number of messages sent are often forwarded to the headquarters of development agencies. However, these figures only show that the digital infrastructure has been established in one way or another, but not what it has achieved on the ground. The discursive work makes the actual infrastructure an end in itself.

#### 4. RELATIONAL WORK: (UNDER)VALUED LABOUR

Managers, tech consultancies and fieldworkers are involved in forging and affirming hope-filled narratives about digital infrastructures as well as mobilising and stabilising these between scales. The infrastructuring labour thus consists of creating and disseminating narratives on digitalisation. However, the performative work of ‘skilled brokers’ (Lewis & Mosse, 2006, p. 5) does not end on a discursive level but includes further ‘situated practices of infrastructure making’ (Blok et al., 2016; see also Aalders & Müller-Mahn, 2025). As the forging of such partnerships suggests, building (digital) infrastructures also means making ‘things and also the relation between things’ (Larkin, 2013, p. 329). In the context of agricultural transformation in Africa, the African Green Revolution agenda is known for funding and institutionally supporting digital infrastructures via PPPs. These blur the boundaries and reshape the power differentials between governments, parastatal agencies, philanthropists and agripreneurs and afford constant reassembly (Brooks, 2021; Mann, 2018). Importantly, relational work does not only consist of the obvious work of diplomatic and strategic planning at political and institutional levels of PPPs (Hayes & Westrup, 2014). Assembling supportive stakeholder networks at political and institutional level is primarily done by managers, planners and policy makers who are typically formally employed and explicitly tasked to do so. Relational work closer to the aspired user base is provided under contradictory circumstances.

Operating staff ‘on the ground’ such as the Yara retailers or the salesperson from mShamba as well as local communities (like the VICOBA) form and maintain important relationships. A range of actors who have connections to rural populations through ongoing project work are valuable strategic partners. Typically, community participation in the provision of infrastructure services and labour in the development sector is demanded at the local level due to scarce resources and promoted as core for empowerment and participation (e.g., Cooke & Kothari, 2001).

Community-based, participatory and empowering programmes required by democratic and development principles generate contradictions between development aspirations, state responsibilities, democratic governance, value creation and (the organisation of) human labour (Cooke & Kothari, 2001). A crucial component of these projects indicates not only the promoted ownership and involvement of the residents in these infrastructures – but also the required unpaid work as a devaluation of infrastructural labour in terms of additional obligations of already marginalised people manifests this way (Stokes, 2020, pp. 11–13).

While in the past development challenges have revolved around questions of ‘access to’ infrastructures, concepts such as ‘people as infrastructure’ (Simone, 2004), assemblage (McFarlane, 2011) and heterogeneity (Jaglin, 2014; Lawhon et al., 2018) stress interpreting infrastructural practices, relationships, policies, as well as activities of residents as forms of infrastructuring labour (Stokes, 2020, pp. 11–12). This is also the point of departure of calls for a labour geography that allows for a particular consideration of racialised or socially reproductive labour, unequal working conditions across space and classed capitalist systems (Strauss, 2020). Although they are essential for planning functioning infrastructure and understanding state provision, representations of infrastructuring labour often privilege formal wage labour along with

privatisation processes. Meanwhile, in many countries, wage labour, which refers to work in registered institutions within the confines of social security and labour law, is the exception. Workers usually must support their reproduction through precarious, oppressive and scarce wage labour or a range of small and insecure jobs in the informal sector (Alba & Kanesu, 2024; Owino & Schetter, 2025). These are often diverse and complex combinations of employment and self-employment, including in agriculture (Dinler, 2018, p. 1840). Specifically for the Global South, Ferguson (2020) also raises the question of which existential activities of precarious actors, often embedded in their own power relations and customary rights and based on redistribution, are recognised and valued as such.

Similar is the case for the conditions of security, formality and income for labour in Tanzanian agriculture. The literature on rural labour addresses the agrarian question and the fate or response of peasants in the face of capitalist expansion (Moyo et al., 2013). In addition, specific issues such as the ongoing self-exploitation of the peasantry, social differentiation and class formation, gendered labour regimes and the integration of rural workers into global value chains have been examined (Nyantakyi-Frimpong & Bezner Kerr, 2016). With the digitalisation of agriculture in the Global South, one of the most analogue sectors, traditional agricultural labour issues are inevitably intertwined with emerging digital issues.

Digital work is characterised by digitally mediated standardisation, flexibilisation, manageability and non-Fordist organisation in the gig economy. It forms bite-sized tasks performed by an atomised workforce in offices and at home, controlled and mediated by digital platforms (Anwar & Graham, 2020). Studies on networked digital infrastructures have already problematised, through the platform economy and gig workers, how formal and informal, paid and unpaid, productive and reproductive as well as human and non-human labour contribute to the relational production of precarity (Strauss, 2020, p. 8). Accordingly, social inequalities are reflected, condensed or culminate in the infrastructure of digital work (Stokes, 2020, p. 23). Consequently, digitisation not only does not make less work necessary, but enables or creates new forms of hidden and precarious work (Gilbert, 2023; James, 2022). Further, fleets of Uber drivers and food delivery workers creating value for digital platform monopolies (Gebrial, 2024) and armies of click workers aligning the algorithms of big tech firms (Tubaro et al., 2020), not only add their labour power to the smart solutions offered by digital platforms and value networks with unequal territorial exploitation (Howson et al., 2022), but also serve as an important tangible entry point to create new perspectives in the study of digital infrastructures. They attest to the fact that even the smartest, seemingly purely digital infrastructure relies on various forms of physical, risky and 'tedious' labour (Straughan & Bissell, 2022).

Digital labour faces major challenges in a data desert like rural Tanzania, too (Fairbairn & Kish, 2022). Both digital platforms of our vignettes are designed not only to provide farmers with information based on digital technologies and data analytics, but also to connect them with a range of stakeholders and agricultural technologies. Whether it is contacts with retailers, agribusinesses, credit institutions, insurance companies and 'progressive' farmers – if not directly made through the platforms, these will be at least recommended. Mann and Iazzolino (2021), looking at the history of Kenya, have noted that the actor arrangement on digital platforms around smallholder farmers is one of many steps in the performative spread of market logics in rural areas of the Global South. We followed the sales staff, shop owners and development assistants into the villages to accompany the volunteers' tasked with establishing the digital connections. They initiated the first data streams either in the hope of employment, small gifts or presents. For weeks and months the farmers' registration data (contact details, farm size, crops grown, geodata, input utilisation practices, yields) is elicited in lengthy enquiries and often entered into personal devices. Farmers give out their data on account of trusted social relations in the village, as is the case with mShamba, and in hope of winning fertiliser in the case of YaraConnect.

Even if volunteers and the rural population are incentivised to participate in the building of digital infrastructures, this work is far from being valued. Rather, the labour associated with data collection represents an unequal exchange between firms and farms, exploiting social relationships and existing trust. The actual value of this work lies in the data. Agricultural suppliers, seed companies and machinery manufacturers benefit from knowing the key data of their potential customers. Hackfort et al. (2024) identify three main strategies of data assetisation for agricultural companies based on literature research. Big data enables agricultural companies to secure relationships and dependencies. It asserts their dominant position in pricing and data sharing and helps them to drive product development and targeted marketing. While they conclude that this promotes asymmetric power relations in the agri-food industry. Digital infrastructures are not only prone to being designed and operated in a top-down manner that is decontextualised, abstract and rendering smallholder farmers as non-knowledgeable actors (Schurman, 2018, p. 181), but they also come with the risk that already existing workloads such as managing the farmers' fields are not only not simplified, but even expanded by additional work to build and maintain an infrastructure. Pierce et al. (2018) remind us that data-driven tasks, automation and Taylorist labour control systems enabled by digital infrastructures do not directly displace labour. Technological change merely alters the ratio of skilled to unskilled labour, changes employment prospects for younger people, and enables capital to break labour tasks more easily into small parts that can be relocated to the places and social classes with the lowest labour costs in the gig economy. Digital infrastructures thus remix the antagonistic relationship between capital and labour.

The question for whom infrastructuring labour is effectively mobilised is, therefore, not at least a question about power between firms and farms. Both vignettes have shown the required labour is being systematically, but unnoticeably, diverted from local communities, subcontractors and public employees. Especially, the tedious, incremental infrastructuring practices of building, and the lack of remuneration for it, may explain why digital infrastructures collapse once crucial intermediaries leave rural areas as short-term project cycles come to an end. We reiterate, therefore, that digital connectivity cannot simply function as a solution *sui generis*. Only as long as substantial hard work can be maintained, so can the digital infrastructures be operated and capitalised on.

## 5. INFORMATIONAL WORK: (IN)VISIBLE INFRASTRUCTURES

Extensive manual labour embedded in physical contacts on site is required to feed in and feed back data. Relational work of feeding tasks such as manually registering users by entering or prompting them to enter their basic information into a database circumscribe thereby the non-digital and not-so-smart practices of digitisation. In order to gain scale and let data flow, the monotonous work of field staff and communities to create lists and registries as well as the catch-up work of facilitating interactive and ongoing use of data obtained from and provided to farmers are typically not a negligible remnant of manual work under an otherwise work-less digital infrastructure. Rather, hard work remains the fundamental and necessary condition thereof.

Working with data overshadows many other logics in agriculture and development (Madianou, 2019). The digital infrastructures in our YaraConnect and iPlus vignettes are designed to make connections and information based on data immediately available. The Tanzanian smallholder farmer of today should be able to make the right decisions and apply more productive practices through key contacts and information. Following the information services all the way to the fields gives insight into how difficult it is to translate information into increased agricultural productivity. As explained in the iPlus vignette, although one farmer changes her practices based on iPlus recommendations in terms of temporality of the practice and her investment

behaviour in agricultural inputs – digging the field, levelling, sowing, fertilising, weeding, protecting crops from pests and diseases, irrigating and harvesting – all remains heavy physical work. Further, even if the farmer knows (via digitally mediated services) that a drought is approaching, it does not mean that she has access to irrigation. The field and its risks remain as arduous as ever.

The vignette on YaraConnect illustrates not only how the fertiliser trade remains a heavy logistical task, but also how dissatisfied farmers can be with the digital information they receive. As the advice provided lacks depth and practicality, they demand training from their extension officers. For advice and help they turn to physical information infrastructure or local digital networks, such as WhatsApp groups among farmers. Ultimately, the farmers have no choice but to do so. As discussed in the previous chapter, once the relational work of intermediaries ceased, digital connectivity to farmers and their fields fell asleep. The idea of privatising digital information infrastructures fails because farmers do not take over the financing. After the funds from the development partners have dried up, the farmers themselves should feed their data into the digital infrastructure themselves, but they lack the appreciation for this additional work.

Even if the data collected does not provide much actionable information for agricultural practice on the ground, the agricultural land is to be made suitable for investors elsewhere through the stories from Chapter 3 as well as through the imputed 'evidence' of digital data. Digital infrastructures should thus transform farms into 'investable assets' equipped with comprehensive data on agricultural productivity and economic returns (Sippel, 2023). Working with data and information from YaraConnect and iPlus demonstrates how data and digital farming technologies should not only integrate land and agriculture into a predictable financial system by creating stable returns for investors. It also shows how land remains a recalcitrant matter in the face of financialised capitalism (Li, 2014). Agriculture remains a biological and thus volatile system that partly resists formalisation and standardisation (Sippel, 2023).

Calls to closely integrate food production with data production and drive decisions in the field through data analytics face major challenges. Bronson and Knezevic (2016) urge food scientists to pay more attention to the digital revolution in agriculture. A number of data applications and analytical tools in the agri-food sector today aim to achieve new levels of connectivity and precision. Yet the informational work of product designers and programmers remains rather disconnected from agricultural practice. Design and programming work is often outsourced to companies in high-tech clusters in Africa's emerging digital tech hubs or even to service companies abroad (Friederici et al., 2017). From this distance, data is seen as a 'given' rather than acknowledging the work and its underlying complexities. For programmers and technology designers' data can be harvested from landscapes and societies with the right tools, standards and analytical skills. Increasing automated analytics, data can provide relevant information to build business models (Matejcek & Verne, 2022).

Given its externalisation there tends to be a conspicuous disconnect between the sphere of smart work, that is designing and coding, and the grounded hard work, that is feeding-in and feeding-back data in agricultural landscapes. Food scientists have long studied the impact of certain technologies on farmers, which often lead to further inequalities between food production actors and value chains (Bronson & Sengers, 2022). Therefore, the authors emphasise the importance of data scientists addressing the material consequences of digital applications. Musik and Bogner (2019, p. 6) further argue to consider the non-digital matter, manpower, and effort that data takes in its creation process or that it takes to make technologies work in the right place. This includes looking at everyday database work performed behind mathematical computational models and invisible information infrastructures (Özden-Schilling, 2016, p. 68, 71). Understanding what it is like to work with the very 'raw material' behind IT-generating, cleaning, compiling and making data usable for analytics – does illustrate what digital infrastructures are, what they do, and what is done with them (Furlong, 2020, p. 577 f.).

The rural population involved in YaraConnect and iPlus, however, is left completely in the dark. Farmers are not learning how to programme, analyse data or understand the basis on which certain information is provided to them. Rather, by building digital infrastructures in rural areas, programmers are potentially becoming the new agricultural experts of these areas. Even if YaraConnect and iPlus are no longer active, an invisible and hard-to-trace access to rural areas and livelihoods has been ensured through initial data flows. This data infrastructure remains invisible to farmers.

Finally, the (in)visibility of digital infrastructures provides a critical basis for discussion based on the two vignettes and our perspective on infrastructuring labour. Although the claim that infrastructures are 'invisible by definition' (Star, 1999, p. 380) has generally been rejected in the literature on critical infrastructure studies (Larkin, 2013), for the majority of Tanzania's rural population, their data infrastructures remain invisible. For rural areas in particular, digital technologies are promoted as a leap into connectivity without massive material constructions of spatial structures: Digital infrastructures appear less tangible and tend to leave a smaller material footprint than roads or railways. However, we have seen that digital infrastructures involve a lot of work and can leave a significant material footprint (Au, 2022). Our perspectives on infrastructuring labour contribute to visibility beyond the materiality of infrastructures and technical processes of connectivity. Visualising the embodied infrastructure and the work done by farmers, volunteers and intermediaries with discourses, relations and data allows us to trace the intertwined social, political, economic and physical dimensions of digital infrastructures (Aalders & Müller-Mahn, 2025; Fredericks, 2021; Truelove & Ruszczyk, 2022). Making the construction processes visible in one place, however, does not help us to know what is happening with this data elsewhere. In the end, it remains uncertain which further journeys the narratives and data that render parts of Tanzanian agriculture visible will take. As for digital connectivity, its supposed invisibility in transcending space and time is part of its framing as 'tools for development' (Ouma et al., 2019, p. 353). At this point, they should rather be framed as tools for vulnerability.

## 6. CONCLUSION

The rise and promise of digital connectivity are what we approached through a perspective on infrastructuring labour in this article. Informed by two grounded vignettes of digital infrastructures constructed between Tanzanian farms and internationally operating firms, we scrutinised which forms of labour had to be mobilised by whom and we have discussed for whom often unrecognised and (under)valued work is done.

Based on qualitative approaches, we have shown how, firstly, the pitching and demonstration of digital infrastructures in agriculture in the Global South is at the forefront of their construction. Discourses on profitability, sustainability and social justice secure funding and minimise risk in implementing digital infrastructure through links between firms and development aid. Managers, technical advisors, development workers and field workers are all involved in forging and reinforcing hopeful narratives about digital infrastructures and mobilising and stabilising them between levels. The representational work makes the actual infrastructure an end in itself.

Secondly, we have shown the often-overlooked tensions between politics, people and materials in building the social and technical infrastructure of project work in development cooperation, which intersect with similarly unequal forms of digital labour in agricultural fields. Digital connectivity projects between firms and farms are ultimately stripped of their supposed smartness and purely digital nature when the different forms of labour involved are examined. Manual, unpaid and hidden labour dominates the non-digital practices of digitalisation. Our studies show that this required labour is systematically but subtly diverted from local communities, subcontractors and public employees. This means not only that existential work and obligations in agriculture are jeopardised by additional work, but also that digital infrastructures

collapse again when the work required to maintain them is no longer performed. Lastly, we have shown that rendering visible the (inter)national flows, labour processes and impacts on rural life that digital infrastructures enable contradicts the notion that digital connectivity is particularly suitable as a 'tool for development' due to its supposed invisibility in transcending space and time.

Approaching digital connectivity through this perspective helps to move beyond idiographic accounts that focus solely on the promises and outcomes or limitations of digital connectivity in southern agrarian landscapes. Understanding digital connectivity as inherently relying on substantial work and as reorganising rather than straightforwardly replacing work shifts the analytical focus on the practices and their mechanisms rather than the promises or (lacking) impacts of digital connectivity initiatives. By thinking through the dynamic re-making of infrastructures, but also by critically and recalcitrantly engaging with and bridging sometimes unfashionable dichotomous heuristics such as smart vis-a-vis hard work, our article contributes to a more critical engagement not only with digital connectivity in particular, but also with development practice in general.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available as they contain information that could compromise the privacy of research participants.

## DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s).

## ETHICS

Human research participants are involved in this study. The study was conducted mainly with agribusinesses, technology companies, NGOs and farmers in rural Tanzania after obtaining permission from the relevant authorities. Permission was obtained from the relevant institutions to conduct interviews and participant observation. Participants were informed that the study was conducted as part of an academic research project and that the research findings would be published. Informed consent was given verbally by the study participants after they had been informed about the aims of the study. Anonymisation and pseudonymisation were used to ensure that the privacy of the individual was not violated and that the rights of the participants were protected.

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