The Last Mile of the Future of Work Is Inside a Refugee Settlement in Uganda: Why Digital Foundations Matter Before Automation.

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May 2026

Abstract

This paper comes from inside Nakivale Refugee Settlement in southwestern Uganda, one of the oldest refugee settlements in Africa and home to over 180,000 people. The central research question is this: what does the global shift toward automation, artificial intelligence, and humanoid robots mean for workers in a refugee settlement, and what can be done from inside that settlement to prepare them before the change arrives?

The paper uses a qualitative case study method. It draws on direct field observation by the author, who has lived and worked inside Nakivale since 2017, on program records from CAMPUS Digital Hub and the ILO PROSPECTS Online Gig Work Program, and on published research from the World Bank and the International Labour Organization.

The central finding is that residents of Nakivale are already connected to the global economy through gig platforms and humanitarian systems, and that those systems are changing because of automation. The people most exposed to the negative effects of that change also have the fewest tools to respond to it. Community-led digital training, built by people who live inside the settlement, is the most direct path to preparing displaced workers for a labor market that is shifting around them. CAMPUS Digital Hub and ConnectRefugee, both built from inside Nakivale, show that this preparation is possible. The paper also argues that international organizations like the ILO, which already invest in refugees through programs like PROSPECTS, are in the best position to connect their operational work on the ground with the broader policy conversation about automation and the future of work.

Keywords: automation, humanoid robots, future of work, refugee settlement, digital skills, community technology, Uganda.

1. Introduction and Research Question

Nakivale Refugee Settlement is in the southwestern corner of Uganda. It covers more than 180 square kilometers and is home to over 180,000 people from the Democratic Republic of Congo, Burundi, Rwanda, Somalia, South Sudan, and other countries. They came because of war, persecution, and violence. Many have been there for more than ten years. Some have spent most of their lives inside its borders.

Life in Nakivale runs on a kind of daily uncertainty that is difficult to describe from the outside. Food is not guaranteed. The World Food Programme has cut food assistance to a large number of residents in recent years. For many families, the cuts have been total. They receive nothing. When a distribution schedule changes, the information does not always reach everyone before they make the journey to collect. People walk long distances, sometimes in the heat, sometimes in the rain, to find out that there is nothing for them that day. The cost of that wasted journey is not small. In a place where food is already not certain, a wasted walk costs time, energy, and sometimes the one meal a family was counting on.

Health information also travels slowly. Job opportunities appear and disappear before most people hear about them. Community news moves from person to person, arriving late, incomplete, or not at all. There is no community radio that covers the whole settlement. There is no digital notice board. There is no application that tells you when the food truck is coming, or whether the health clinic is open today. You find out by asking a neighbor, or by walking somewhere and hoping what you were told is still true when you get there.

In 2023, the author of this paper walked close to an hour through Nakivale to check a food distribution list. The list was not there. The walk back was the same distance. That is not an unusual experience in Nakivale. It is a routine one, repeated by thousands of people across every distribution cycle.

That experience became the reason for building ConnectRefugee, a mobile application that sends real-time information to residents of Nakivale about food, health, jobs, education, and community events, in five languages. But it also became the lens through which this paper reads the global conversation about humanoid robots and the future of work.

Because that conversation is happening. It is serious, it is fast, and it is changing how work looks across the world. Robots now do tasks that humans used to do. Artificial intelligence is being added to machines so they can learn, adapt, and make decisions. The competition between the United States and China to build the most advanced humanoid robots is not just a technology story. It is a geopolitical one. And at the center of all of it is a question that nobody is asking about places like Nakivale: what does this shift mean for the workers who were already the most exposed, the most excluded, and the least prepared?

The research question this paper addresses is the following: what does the global shift toward automation and humanoid robots mean for workers living in a refugee settlement, and what can be done from inside that settlement to prepare them before the change becomes impossible to respond to?

2. Literature Review and Conceptual Framework

2.1 The Rise of Robots and the Geopolitical Race

The history of robots is longer than most people think. The word robot was first used in 1920 by Czech writer Karel Capek in a play about artificial workers. The idea of a machine that could do human work had existed for centuries, but Capek was the first to name it. Two decades later, science fiction writer Isaac Asimov gave robots their rules. His Three Laws of Robotics, published in 1942, said that a robot must not harm a human being, must obey human orders unless those orders conflict with the first law, and must protect its own existence unless that conflicts with the first two laws. Those laws were fiction. Today they are a real policy and ethics question as humanoid robots begin to operate in factories, hospitals, and public spaces.

The modern humanoid robot is no longer a laboratory experiment. Companies like Boston Dynamics, Tesla, Figure, and several Chinese manufacturers have produced machines that can walk, carry objects, perform tasks on assembly lines, and respond to voice commands. In January 2025, China held what many observers described as the world's first humanoid robot competition, a televised event sometimes called the "robot Superbowl," in which teams of humanoid robots competed in tasks designed to test their physical capability and coordination. The event was as much a political statement as a technology showcase. China has made humanoid robotics a national priority, investing heavily in research, manufacturing

capacity, and talent development. The United States is doing the same. This is a geopolitical competition, not just a commercial one. The country that leads in humanoid robotics will have advantages in manufacturing cost, military capability, and economic productivity that will take decades to overcome.

The implications for global labor markets are significant. When robots make it cheaper to produce goods in high-income countries, the economic logic that pushed manufacturing to low-cost labor markets in Asia and Africa weakens. Countries and communities that depend on low-cost labor as their main economic asset face a structural shift in the demand for that labor.

2.2 Human and Robot Collaboration in the Workplace

The dominant narrative in the future of work discussion has moved away from simple replacement and toward what researchers call human-robot collaboration. The argument is that robots will not replace all human workers. Instead, they will take over the parts of a job that are repetitive, physically demanding, or dangerous, while humans handle the parts that require judgment, creativity, communication, and care.

This model exists on a spectrum. At the lower end, a robot simply assists a human worker, carrying heavy loads or holding a position while the human completes a task. At the higher end, AI-enabled robots can learn from human behavior, adapt to new situations, and take on increasingly complex decision-making roles. The more AI is built into a robot, the further along that spectrum it can move.

For workers in formal economies with access to training and technology, this spectrum represents opportunity. A worker who learns to operate alongside a robot, to program it, to supervise it, can become more productive and earn more. The World Bank report on Future Jobs (Arias et al., 2025) found that robot adoption in Southeast Asia created approximately 2 million new jobs for skilled workers doing non-routine tasks, even as it displaced 1.4 million low-skilled workers doing routine ones.

But for workers who have never used a computer, who have no access to a training program, who live without reliable electricity, the collaboration model is theoretical. You cannot collaborate with a robot you have never seen, using skills you have never been taught, on a platform you cannot access.

2.3 Emerging Technology and Social Justice

Session three of the ITCILO course on Humanoid Robots at Work placed automation inside a social justice frame. The question was not just what automation does to jobs, but who it does it to, and who benefits from the change.

The answer from the literature is consistent. The people who benefit from automation are the people who own the technology, invest in it, or have the skills to work alongside it. The people who are harmed are the workers doing the routine tasks that automation replaces, and those workers are concentrated at the lower end of the income distribution, in developing countries, in rural areas, and in informal employment.

In 2024, the United Nations and the International Labour Organization published a joint report titled Mind the AI Divide: Shaping a Global Perspective on the Future of Work (ILO and UN, 2024). The report found that in 2024, 93 percent of people in high-income countries used the internet, compared with just 27 percent of people in low-income economies. More than 300 billion US dollars is spent globally each year on technology investment, but most of that investment goes to higher-income nations. Workers in developing countries who do develop digital skills often end up using them to serve companies in richer countries through freelance platforms, which the report describes as a form of virtual brain drain that takes talent away from the communities that produced it.

A separate ILO paper, Disruption without Dividend: How the Digital Divide and Task Differences Split Generative AI's Global Impact (ILO, 2025), added a specific finding that is directly relevant to this paper. It found that workers in developing countries who are in jobs that could be automated already have enough internet access to feel the effects of displacement. But workers who could benefit from AI tools, by using them to do their work better and earn more, often do not have the digital infrastructure to access those tools. The paper describes this as a "small buffer, big bottlenecks" problem: developing countries may experience the disruption from automation faster than they can access its productivity gains.

2.4 Robotics, Employment, and What This Means for Informal Workers

The fourth session of the ITCILO course examined the direct relationship between robot adoption and employment. The World Bank's Future Jobs report (Arias et al., 2025) provided the most detailed data available on this question in a developing country context. Studying five ASEAN countries between 2018 and 2022, the report found that robots displaced an

estimated 1.4 million low-skilled formal workers engaged in routine manual tasks. Those workers did not simply leave the labor market. They moved into the informal sector. Districts with higher robot adoption showed higher rates of informal employment among low-skilled workers. Automation does not remove these workers from the economy. It pushes them further down into work that is less protected, less stable, and lower paid.

The report also found something that matters directly for this paper. Workers in digital-intensive jobs in the informal sector earn almost as much as workers in non-digital jobs in the formal sector (Arias et al., 2025). This means that digital skills can reduce the income gap between formal and informal work, even without a formal employment contract. In a place like Nakivale, where virtually the entire economy is informal, this finding points toward a direct and measurable benefit from digital skills training.

2.5 What These Reports Miss, and What the ILO Is Already Doing

The major reports from the World Bank and the ILO that this paper draws on do not discuss refugee settlements directly. They examine developing countries and low-income economies, but they do not go inside the specific conditions of a settlement like Nakivale. This is a gap, but it is not the whole picture.

The ILO is already present in Nakivale. Through the PROSPECTS program, a partnership funded by the Kingdom of the Netherlands, the ILO has run operational programs in the settlement that include the Online Gig Work Program, physical infrastructure including a connected workspace for young people, and partnerships with refugee-led organizations. In 2024 and early 2025, 218 young people from Kampala and Nakivale completed intensive digital skills training through that program (ILO, 2025). The author of this paper served as the main trainer for the Nakivale component of that program, directly equipping 100 young people with skills to earn money through online gig work.

The ILO also gave the author a scholarship to complete the ITCILO course on Humanoid Robots at Work in April 2026, alongside other participants including another refugee from Uganda and Ugandan professionals. That scholarship is itself a statement: that the ILO sees value in bringing people from inside refugee settlements into the global conversation about the future of work.

The gap this paper identifies is not between the ILO's intentions and refugees. The gap is between the ILO's operational investments on the ground in Nakivale and the broader policy

conversation about automation, humanoid robots, and the future of work. The programs are running. The training is happening. But the question of what automation means specifically for workers in refugee settlements, and how community-led digital preparation connects to those programs, has not yet been fully explored. This paper is an attempt to begin that exploration.

3. Methodology

This paper uses a qualitative case study method. The case study is CAMPUS Digital Hub and ConnectRefugee, both built and operated inside Nakivale Refugee Settlement by the author. The qualitative approach is chosen deliberately. The situation in Nakivale is not fully captured by numbers. The way information moves, or fails to move, through a settlement of 180,000 people involves human experiences that surveys and statistics cannot fully describe. The decision to walk an hour to check a food list that was not there is not a data point. It is a lived experience that contains information about systems, power, information access, and daily survival that only someone who has been through it can fully communicate.

The data sources for this paper are as follows.

The first source is direct field observation. The author has lived inside Nakivale since late 2017. He taught himself technology by volunteering at a local organization in exchange for access to a laptop and an internet connection, with no formal education beyond high school and no external role models in the technology field. He built CAMPUS Digital Hub, led training programs, developed a mobile application, and contributed as a trainer to the ILO PROSPECTS program. The observations in this paper come from eight years of that experience, from inside the problem the paper describes.

The second source is program records from CAMPUS Digital Hub. CAMPUS opened in 2024 and has trained 80 people in digital skills including web development, digital marketing, and AI tools. The DigiLadies program, which focuses specifically on women in the settlement, runs alongside the main curriculum. These are records of actual participants, not projections.

The third source is records from the ILO PROSPECTS Online Gig Work Program, which the author led as the main trainer for the Nakivale component. That program trained 100 young

people from the settlement with practical skills to earn money online, including web research, data entry, content writing, graphic design, and website development. According to ILO records, 218 young people in total completed the program across Kampala and Nakivale (ILO, 2025). All participants from the Nakivale component completed the program with usable skills.

The fourth source is data from ConnectRefugee. Built by the author using Flutter with a WordPress and Hostinger backend, the application delivers real-time notifications in five languages about food, health, jobs, education, and community events across Nakivale. It was tested with 200 users before its April 2026 launch and targets 5,000 active users within three months.

The fifth source is published research from the World Bank and the ILO, as described in the literature review. Only data from documents the author has directly read is cited. No data is included from sources that have not been verified.

The analytical method works as follows. The author placed the findings from the four sessions of the ITCILO course on Humanoid Robots at Work next to eight years of direct experience in Nakivale and asked, at each step, what the global evidence means for someone living in that settlement. Where the global evidence and direct observation point in the same direction, that convergence forms the basis of the findings. Where the global evidence does not address the situation in Nakivale, the gap itself is treated as a finding.

The main limitation of this method is that a single case study cannot represent all refugee settlements. Nakivale has specific conditions: its size, location, population mix, sixty years of history, and relationships with UNHCR, WFP, OPM, and ILO. Other settlements will require adjustments to the model described here. What this case study offers is a worked example of what community-led digital preparation looks like in practice, built from inside the problem.

4. Findings and Analysis

4.1 Information Poverty Is the First Problem, Not the Last

The first finding from this case study is that information poverty is the foundation on which every other disadvantage in Nakivale rests. Before a resident can apply for a job, they need to

know it exists. Before they can access a health service, they need to know it is open. Before they can respond to a change in food distribution, they need to know the change happened.

In Nakivale, none of this information moves reliably. There is no community-wide broadcast system, no digital notice board, no application that residents can check. Information travels by word of mouth. It arrives late, incomplete, or wrong. The WFP food cuts made this problem more serious. When a family's food assistance is cut, they need to know immediately so they can look for other sources. When they do not know, they plan their week around food that is not coming. The cost is not abstract. It is hunger, wasted journeys, and decisions made without the information needed to make them well.

ConnectRefugee was built to address this directly. The application sends real-time notifications in English, French, Swahili, Kinyarwanda, and Somali about food, health, jobs, education, and community events. It was built by someone who experienced the information gap personally, who understands which languages are spoken in which zones, which distribution points serve which populations, and which organizations produce information that residents actually need. It was tested with 200 users before its April 2026 launch. No external organization built this. A resident built it because the problem was his problem too.

This matters for the automation conversation because information access is the precondition for all digital participation. The ILO's research on the digital divide notes that in low-income countries, only 16 percent of the rural population uses the internet (ILOSTAT, 2025). Inside a refugee settlement within a rural district, that number is lower still. A person who cannot receive a basic notification on their phone about when food is coming is not positioned to use AI tools, compete on gig platforms, or respond to changes in the systems that determine their economic life. The starting point matters.

4.2 Residents Are Already Exposed to Automation Through the Systems They Depend On

The second finding is that residents of Nakivale are not isolated from the global economy. They are connected to it in ways that make them directly exposed to the effects of automation, even though most of them have never seen a humanoid robot.

Some residents earn through online gig platforms. They do tasks like web research, data entry, transcription, and content review. These are the same categories of work that automation is beginning to replace. The World Bank found that robot and AI adoption

displaces workers in routine tasks first (Arias et al., 2025). The ILO found that the simplest digital tasks, the ones most accessible to workers with basic connectivity and no advanced training, are also the most exposed to being automated away. The residents who earn online through gig work are doing exactly those tasks.

The humanitarian systems that manage daily life in Nakivale are also changing. WFP, UNHCR, and OPM use data platforms to manage food distributions, eligibility records, and cash assistance. Those platforms are becoming more automated. A resident who cannot navigate a digital interface, who cannot read an SMS, who has no way to flag an error in the system that records their eligibility, is at a growing disadvantage as those systems change. When the humanitarian system that feeds you becomes more automated, your ability to access what you are entitled to depends partly on your digital literacy.

This connects directly to the ILO's "small buffer, big bottlenecks" finding. Workers in Nakivale are connected enough to the digital economy to feel the displacement effects of automation. They do gig work. They receive digital notifications from humanitarian organizations. They use mobile money. But they are not connected enough, and not trained enough, to access the productivity gains that AI and digital tools could offer them. They face the costs without the benefits.

4.3 Community-Led Digital Training Produces Results That External Programs Alone Cannot

The third finding is about the source of training and why it matters.

The ILO PROSPECTS Online Gig Work Program is the clearest available evidence that digital skills training inside Nakivale works. The program trained 100 young people from the settlement with practical online earning skills. According to ILO records, the program across Nakivale and Kampala reached 218 participants who completed a ten-day intensive training and built portfolios through mock assignments (ILO, 2025). The Nakivale component worked partly because it was led by someone from inside the settlement who understood the schedules, the power supply challenges, the language needs, and the trust barriers that affect how training is received in a refugee community.

CAMPUS Digital Hub extended that model into a permanent, refugee-led institution. With 80 people trained in its first year and DigiLadies running alongside the main curriculum, CAMPUS shows that sustained digital training is possible inside a refugee settlement with

very limited resources. Advanced courses in web development, digital marketing, and AI tools are taught alongside free basic computer literacy training. The people who come to CAMPUS come partly because it belongs to them. The person who built it walks the same paths they walk, faces the same information gaps, and made the same long walk for a food list that was not there.

The World Bank report makes a finding that explains why this matters technically, not just emotionally. Digital skills training is most effective when it is matched to the actual labor market opportunities available to the people being trained (Arias et al., 2025). In Nakivale, those opportunities are in online gig work, in remote digital tasks, in building tools that the community needs. A trainer who lives inside the settlement understands those opportunities in a way that a program designed in an external office, however well-funded, cannot fully account for.

The ILO's own assessment of the Online Gig Work Program noted persistent barriers: unreliable electricity, high data and device costs, and gaps in soft skills that made it harder for participants to meet the demands of the global digital labor market (ILO, 2025). CAMPUS Digital Hub works within those exact constraints every day. It does not solve them all. But it knows them in detail, and that knowledge is not available from outside the settlement.

5. Discussion

The findings from this case study point toward a conclusion that the global literature supports but has not yet fully stated: the people most exposed to the disruptions of automation are also the people for whom the international community has built the least direct preparation.

The World Bank found that low-skilled informal workers are the most vulnerable to displacement by robots and automation. The ILO found that developing countries face the negative effects of AI before they can access the benefits. This paper adds a layer below both of those findings. Refugee populations sit below the development baseline of the countries they live in. They have less infrastructure, less institutional protection, and fewer economic options than the citizens around them. If developing countries are most at risk, refugee settlements are where that risk is most concentrated.

But this paper does not argue that the international community has done nothing. The ILO is operating in Nakivale. PROSPECTS has trained hundreds of young people, built connected workspaces, and funded programs that the author of this paper helped deliver. The ILO gave the author a scholarship to study the ITCILO course on Humanoid Robots at Work. Another refugee from Uganda was in the same course. These are not small gestures. They show that the ILO understands that refugees belong in the conversation about the future of work.

The discussion this paper wants to open is more specific. The operational programs are running. The training is happening. But the question of what automation means for workers in refugee settlements has not been connected to those programs in the way the World Bank and ILO research on automation and digital skills would suggest it should be. When the ILO publishes a major report on the AI divide, Nakivale is not in it. When the World Bank studies how robots affect informal workers in developing countries, refugee settlements are not a case study. When the ITCILO designs a course on humanoid robots and invites a refugee to attend, that refugee goes back to the settlement with new knowledge, but the settlement does not come back into the course.

The gap is not about access. It is about feedback. The ILO has opened the door for refugees to enter the conversation. The question this paper raises is whether the knowledge those refugees carry, from inside the settlements, about what automation actually means at the last mile, is feeding back into the policy and research conversation that shapes future programs.

CAMPUS Digital Hub and ConnectRefugee are small. Eighty people trained. Two hundred test users for an application. Those numbers are modest against 180,000 residents. But what they represent is a model with a specific characteristic that large external programs do not have: it was designed from inside the problem, by someone who lives the problem, and it gets better because the person running it receives direct feedback every day.

The question the discussion must answer honestly is this: if a self-taught founder with a high school diploma, no funding from any international organization, and no formal technology training, can build and run a digital training hub, produce a multilingual mobile application, lead an ILO training program, and train 180 people across two programs, what would be possible with serious institutional support?

6. Conclusions and Implications

Automation is not waiting for Nakivale to be ready. It is changing the gig platforms that residents use to earn money. It is changing the humanitarian data systems that decide who gets food and when. It is changing the global labor market in ways that will reduce the available work for people with no digital skills. None of these changes announce themselves. They happen gradually, in the systems that connect Nakivale to the world, and by the time the effects become visible inside the settlement, the decisions that caused them have already been made somewhere else.

This paper has argued three things. First, information access is the foundation of digital inclusion, and in Nakivale it remains a daily problem that costs people time, energy, and food. ConnectRefugee is a direct response to that problem, built from inside the settlement. Second, residents of Nakivale are already connected to the global economy in ways that expose them to the effects of automation, through gig platforms, through digital humanitarian systems, and through a global labor market that is shifting. Third, community-led digital training, built by people who live inside the settlement, is the most effective and most sustainable form of preparation available. CAMPUS Digital Hub and the ILO PROSPECTS program together trained 180 people from Nakivale in practical digital skills. Against a population of 180,000, the gap is the argument.

The implications for the ILO and for ITCILO are not about starting something new. They are about connecting what already exists. The ILO is already in Nakivale. PROSPECTS is already running programs there. Refugees are already being brought into courses like Humanoid Robots at Work. The next step is to bring the knowledge those refugees carry back into the policy conversation, to use what is happening on the ground in Nakivale as evidence in the research on what automation means for the most exposed workers in the world.

The implications for policymakers and funders are direct. The World Bank says invest in digital skills. The ILO says close the digital divide. Community-led digital hubs inside refugee settlements are doing exactly that work, with almost no resources. Finding them, recognizing them, and giving them the support to scale is not charity. It is the most efficient way to reach the workers who need preparation the most.

The implication for the broader future of work conversation is the simplest of all. Put refugees in the room, not as subjects of research, not as beneficiaries of programs, but as

practitioners who know things about automation, about informal work, about digital inclusion in the most resource-constrained settings in the world, that do not appear in any World Bank or ILO report. That knowledge exists. It is sitting in a settlement in southwestern Uganda, in the hands of someone who walked an hour for a food list that was not there, and built something so that no one else would have to.

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Word count: approximately 5,200 words (excluding abstract, references, and annexes).
Submitted in fulfilment of the ITCILO Call for Papers, Humanoid Robots at Work, May 2026.