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WEBINAR

DIGITALIZATION AND DIGITAL SKILLS GAPS IN AFRICA

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WELCOMING REMARKS:

HAROON BHORAT
Nonresident Senior Fellow, Africa Growth Initiative, Brookings

OPENING REMARKS:

LANDRY SIGNÉ
Senior Fellow, Africa Growth Initiative, Brookings
Professor and Executive Director, Thunderbird School of Global Management, Arizona State University
Distinguished Fellow, Stanford University

INTRODUCTION:

ALOYSIUS UCHE ORDU
Senior Fellow and Director, Africa Growth Initiative, Brookings

SESSION 1: MEASURING AFRICA'S DIGITAL SKILLS GAP:

LANDRY SIGNÉ
Senior Fellow, Africa Growth Initiative, Brookings
Professor and Executive Director, Thunderbird School of Global Management, Arizona State University
Distinguished Fellow, Stanford University

ZAAKHIR ASMAL
Research Officer, Development Policy Research Unit, University of Cape Town

JABULILE MONNAKGOTLA
Junior Research Fellow, Development Research Policy Research Unit, University of Cape Town

CHRISTOPHER ROONEY
Junior Researcher, Development Policy Research Unit, University of Cape Town

SESSION 2: BRIDGING AFRICA'S DIGITAL SKILLS GAP:

HAROON BHORAT
Nonresident Senior Fellow, Africa Growth Initiative, Brookings

LESLY GOH
Senior Technology Advisor, World Bank

CECILIA VÄRENDH MÅNSSON
Founder and CEO, TalentUp Africa
PostDoc, The Wharton School

LANDRY SIGNÉ

Senior Fellow, Africa Growth Initiative, Brookings
Professor and Executive Director, Thunderbird School of Global Management, Arizona State University
Distinguished Fellow, Stanford University

ALISON GILLWALD

Executive Director, Research ICT Africa

CLOSING REMARKS:

HAROON BHORAT

Nonresident Senior Fellow, Africa Growth Initiative, Brookings

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HAROON BHORAT: Well, good morning, good afternoon or good evening, depending on where in the world you are joining us. I would like to welcome you all to this Brookings-hosted event formally titled “Digitalization and Digital Skills Gaps in Africa,” which serves as the anchor for the formal launch of the Brookings-Development Policy Research Unit’s joint working paper with the same title. My name is Haroon Borhat. I’m professor of economics at what I call the most envious view you’re likely to see behind me of the University of Cape Town in South Africa, and also director of the Development Policy Research Unit. We are, with a group of my researchers, very pleased and honored to have worked together with Brookings to come together and produce a report which I hope you will enjoy reading or going through and listening to today with respect to understanding just the digital skills gaps in Africa.

If I could if I could just proceed perhaps with a few introductory remarks before handing over to colleagues. For me, I think a lot of the debates, a lot of the policy thinking, I dare say even some of the media discussions perhaps need to move in a slightly more nuanced direction in four areas, which I’m hoping that the report has partly taken us towards. And those four areas are: firstly to think about digitalization or the digital skills gap or the digital divide in a far more nuanced way. By that I mean it is not sufficient to simply focus on the digital divide as if it’s a homogenous concept. The report you’ll hear now will reflect partly on that. We’ll talk about drivers of the digital divide or the new digital economy or the role of technology at various different levels. So in other words, we’ll look at digital infrastructure, digital finance, digital participation, digital skills. All of that will come together in a far more heterogeneous assessment of digitalization. So for me, that’s the first key thing, which is far more heterogeneity in the discussion. And in fact, what that leads to, I’m still on my first point, is that if you’re talking about digital skills, that’s a completely separate discussion from digital infrastructure. And one needs to be sure that that’s the component or the area of digitalization that you’re talking about before policy proclamations can ensue.

The second is what I call, across a range of indicators and let’s call it discussions around different development agendas, is the preference or the importance of second order versus first order indicators. What do I mean by that? Let me take the simple one. We hear time and time again that primary school enrollment and secondary school enrollment in sub-Saharan Africa have gone up. What we don’t -- that’s a first order indicator. What we don’t talk about is the second order indicator, which is how many STEM graduates are there in sub-Saharan Africa. And in fact, that’s a number that’s far more important. It’s a far more second order indicator. And other second order indicator is access to the internet in sub-Saharan Africa has increased dramatically, but the internet usage gap is still significantly large. That’s a second order indicator. Broadband access has grown dramatically in sub-Saharan Africa, but the price of broadband is incredibly high in some countries. That’s the second order indicator. So the extent to which we focus much more on second order indicators that’ll again guide policy is really important.

The third area is around regulation. And I’d like to, looking ahead to the panel that we will have, almost a sort of teaser for our panelists, is to what extent can we think about the state, perhaps if I could put it in a devil’s

advocate sense, seeing a large part of the digital infrastructure here – I'm principally thinking of telecommunications – as a new revenue source, the new sort of license based industries that the state can rely on revenues and then actually abuse or use not for good, but in fact used for an irrelevant expenditure that doesn't fulfill development need. So to what extent are we thinking about regulation in the digital world in the same way that licensing has occurred in mining and the abuse, if you like, of licensing revenues is really important. And the final point about digitalization, a digital divide that we don't think enough about is the role of firms, and the extent to which firms and the supply side of the economy in sub-Saharan Africa are both able to upgrade technologies to pursue growth, or to what extent do existing constraints, whether it's the price of of of the internet or digital services skills, right or available infrastructure that serve as a constraint on firms productivity. That, for me, is a really key area of economic growth that we need to think about relative to other regions, developing country regions such as Southeast Asia. But with that, let me stop and I'm going to hand over to continue introductory remarks to Landry Signé, who I won't introduce, and he'll introduce himself over to you, Landry.

LANDRY SIGNÉ: Thank you very much, Haroon, for a wonderful, welcoming remarks and introduction. Hello, everyone. I am Landry Signé, and I'm a senior fellow at the Brookings Institution Global Economy and Development program and Africa Growth Initiative. And I'm very pleased and very excited to be with you today to share some of the findings of our broader research program on digitalization and digital skill gaps in Africa.

So let me start by acknowledging the contribution of our colleagues at UCT, at Brookings, the external reviewer for the incredibly wonderful work which has allowed us to be with you today. And I have a statistics, a number. Between 2015 and 2035, about 450 million young Africans will reach the working age, will be able to enter the job market. So that's extremely important. Out of those young people, about 5% will have top quality work and could sustain a great livelihood. About 20% additional people will have an average quality job, and the continent will remain with about 75% of young people who'll be either self employed or are likely to be in quite vulnerable, informal works, having those type of jobs, the amount order.

Even the digital transformation, the fourth industrial revolution, the velocity, the incredible speed to which we see tech adoption, it is extremely important to think about the future of work and to think also about the strategies that we can use to bridge the skills gap in order to provide to those young people a better livelihood. Broadly speaking, so the spread of digital, our emerging technology is changing the nature of work, not just in Africa, around the world, generally with disruptive effects on economy, on the effectiveness and on development. So if I just look at some broader statistics, global export of ICG services increased at an average annual rate of 8% between 2005 and 2016, And it is clear that e-commerce alone represented revenue of about 25.6 trillion US dollar in 2018. So African economies really have a very limited thus far at least digital, let's say, footprint in terms of global trade. If you compare, for example, on a hedge comparing 55 countries on one hand with a country like China, but China alone make up about 23% of total e-commerce trade, while the top ten advanced economies made up about 75%. So, it is extremely important, therefore, to assess, and as Haroon mentioned, we have numerous dimensions. We have the it originated, but you also have the role that firms can play, which is really important, especially as less than about a third of Africans have access to internet connections. And in most countries less than 10% have access to digital or bank payment system. This has being increasingly addressed with mobile payment amount order.

Shifting, we really think that with the emerging technologies associated with the fourth industrial revolution, with digital transformation, high speed broadband, big data, the internet of things, artificial intelligence, cloud computing, Imagine over this an opportunity if policymaker addressed key challenges to make substantial improvement. So the prospect could be quite positive. And these are for many reasons, first digitalized market and platform have the potential to reduce a matching and coordinating problems, for example, allowing small and medium African enterprises to sell their products wider within the continent or abroad. Another point, second one, which is critical also is the non riverine nature of digital information with significantly reduced margin. Now the cost of extending education, thus democratizing, if you can use the word, access to knowledge, to data and potentially potentially enabling inclusive growth. Third, digital technology also will strengthen economic integration by bridging structural gaps across sectors and geographies, including between urban and rural economies. And finally, digital technology that are also fueled by big data could guide and could be guided by smart algorithm and improve Russell's efficiencies while reducing pollution drastically. As you can imagine, I am incredibly excited to discuss the equations with digital transformation Default

changes to our evolution on which my book will be released next month at the August 4th Annual Revolution. But for now, I want to pause to give the floor to look. Dr. Aloysius Ordu. The senior fellow and director of the Africa Growth Initiative here at Brookings Institution at the Brookings Institution. Thank you very much again and looking forward to continue the conversation with all of you.

ALOYSIUS UCHE ORDU: Thank you very much for that Landry and Haroon. It's great to be launching this report after the work that DPIU has done jointly with South Africa Growth Initiative at the Brookings Institution. My name is Aloysius Ordu, as he just said. I'm the director of the African Growth Initiative at Brookings. A word or two about the Africa Growth Initiative itself. Our goal is really to inform policy for better development outcomes in Africa. And this report is designed to do just that in terms of achieving our goal. How do we achieve those goals through rigorous economic research of this kind? A discussion today through convening African voices and with high impact events here in Washington, across the world and across the African continent, but also helping to strengthen the capacities of think tank partners as we speak. We now have about 25 think tank partners that work with us across the African continent, of which DPR is one of them. The digital economy work is at the very heart of AGI's strategy. Other areas of our strategy include development financing, climate change, jobs, trade, and economic integration. Today's report is typical of the close working relationships that we have in AGI with the DPRU headed by Haroon in Cape Town, South Africa.

About the report itself. You already heard from Landry and from Haroon as well. Africa. Our continent. Across the continent, the information technology revolution is gaining momentum. That's what we're at. Even in remote villages, individuals now have access to cell phones. In fact, today, cell phones are as common in South Africa and Nigeria as they are here in the United States. The technology revolution is impacting the way we work, the way we study, and indeed the way we interact with urban folks and folks around the world. Yet. Within African countries. The technology revolution has not spread as far and as wired as we would all like to see. There are digital divides across gender, geography, age and income. In Africa, we run the risk that a technology revolution is leaving some people behind. This is a key lesson from today's report that South Africa, the most advanced country on the African continent, has a huge digital gap. These are the countries in the OECD.

This finding raises the question what to do to bridge the digital divide for Africa's policymakers? Here are some things to do. It means that investments in infrastructure, particularly inner city broadband, remains a priority. The African Development Bank estimated that Africa needs to spend about \$130 billion a year to close the infrastructure gap. You see, without electricity power, you cannot charge your phones and you certainly cannot connect to the internet for jobs. This also means that investments in education, in health are vital to skills development and job creation on the continent. Because digital technology enables businesses to be more productive. It enables people to find jobs and better opportunities. It enables better service delivery by our governments and by firms. Another lesson from this report, which Haroon mentioned briefly, is the whole notion of the importance of data. Data on the level of digitization within countries and between countries in Africa. Data on the demand and supply of digital skills and soft skills data on African countries vis a vis other countries of the world. And data governance to assure the security of people's online activities. So for us in Nigeria, this report is timely and it's a great deal. It means a great deal to us, first of all. The study confirms the robustness of the exam framework, which was developed specifically to be tested in South Africa, which you hear more of today. Second is that it raises some important challenges and opportunities. Funding permitting, we would like to apply the digital skills framework to other African countries Kenya, Rwanda, Nigeria, Ghana, Senegal, Morocco. And not to forget the heterogeneity on our continent, we need to apply this framework to low income countries and indeed fragile states across the continent. So we plan to disseminate the findings of this report very broadly.

For now, I'm delighted that we have assembled an impressive array of scholars and practitioners for today's events. My special thanks to Haroon and Landry and our teams in AGI and DPIU for the hard work in bringing us here today. And I also want to make a special thanks to our audience, online audience, including our funders and supporters, for making time to be with us today. I'm looking forward to a very rich conversation. Now, here's what we're going to do in the rest of the time. We have viewers who have questions for our panelists will be introduced shortly and submit those questions by email in events@brookings.edu. All those on Twitter could use Twitter at Brooklyn's Global using the hashtag #DigitalSkillsAfrica. Let me now pass on the baton again once again to Haroon for the first part of this, which is measuring Africa's digital divide, that digital

skills gap. And then thereafter, we'll move to a second segment where we'll be talking about the digital bridging Africa's digital skills gap. Landry, over to you.

LANDRY SIGNÉ: Thank you. Thank you very much, Mr. Chair, for giving me the floor. So for this section of the work, we are very excited to bring some of the brightest young African brain who have made a phenomenal contribution to do this work, leading many of the key aspects of their work to share the findings. So let me introduce them. So we have with us today Zaakhir Asmal, who is a research officer at the Development Policy Research Unit at the University of Cape Town and has previously worked also as a researcher for the Human Sciences Research Sponsors, Economic Performance and Development Program. So we also have Jabulile Monnakgotla, who is also a research engineer research fellow at the Development Policy Research Unit, still at UCD. And of course she has intern before becoming a junior analyst and a junior research fellow. So she has an extensive experience there and Wright has written numerous reports for the South African Department of Small Business Development, the Department of Higher Education Imam orders. And we finally have Chris Rooney, who is also a junior researcher and has obtained his business, science and economics and master in economics from the University of Cape Town. Has done extensive work with the Department of Labor. You are bound UNDP among order contributing to a gear reports which has helped setting the national minimum wage in South Africa. So I took a little bit of time to introduce them a little bit more simply because I think it is important to show the rest of the world that we have incredibly bright minds, career thinkers on the continent and without thinking longer, let me give the floor to Zaakhir.

ZAAKHIR ASMAL: Okay. Thank you, Landry, for the introduction. Just shared my screen. Yes. So this is the report. It's called Digitalization and Digital Skills Gaps in Africa. An empirical profile. I'm going to first run through an outline of what it will be going through today, and then we'll proceed with highlighting some key findings of our report. So I'll be starting off with an introduction. Then I'll pass over to Peter to take us through the methodology and results of the Digitalization Gap index developed by Africa. We will pass over to Christopher, who will give us some insights into how we can measure digital skills supply and digital skills demand using labor force survey data and highlight some issues with the data availability in that regard. I will then go on to speak about about policy, to set up the themes and highlight some themes that will be discussed later on in the session today. Then I'll just end with some concluding remarks.

ZAAKHIR ASMAL: At the start of what? Why is this an important study? So increased digitalization has resulted in shifts in the nature of the functioning of labor markets on both the demand and supply sides. And this is something that's been looked at around the world. But much of the focus on this relationship has been on the developed world. So research on measuring and understanding the nature of this relationship and the nature of the gaps that exist have been particularly limited for Africa and other developing economies. And this is important also because we can't just take the results of the studies that are being done for other regions in the world. We need to understand the particular context that exists in specific countries and specifically in Africa, which is the focus of this report. And some of those unique characteristics are the high rates of self-employment and informal employment. So that presents a unique labor market to consider how digitalization and its impacts will be felt in such an environment. Another important piece about why this is important for Africa particularly is the demographic changes that are happening around the world and the fact that Africa will make up one fifth of the total workforce and around one third of the total youth workforce in the world by 2030. So this is a substantial increase in the youth population engaged in the workforce. And with the advances in technology and digitalization, it's important that they are plugged into digitalization and obtaining the correct skills to thrive in such will. And we've got increasing mobile phone subscriptions into internet of abilities. There are innovations in mobile banking are increasing within the region and in the future, digitalization will only play a bigger role in how labor markets and ultimately economies function within the region and globally. So within this context, what does this paper set out to do? And there are three key questions that we at least try to consider as a starting point. We know there's a lot of work to be done and a lot more to consider. But as a starting point, we look at what how can we understand the level of digitalization in Africa? To what extent the level of digitalization in Africa ahead or behind that of regions? And then how do we measure digital skills, demand and supply and the skills gap? And how do we do that in the context of low data availability? And so Jabulile will next take us through the index, which will look at the first of these questions, which will consider how do we consider the level of digitalization in Africa, and to what extent is digitalization in Africa behind other regions first or then later on, consider how we use labor force survey data. The case study about South Africa to measure the demand for digital skills and the supply of digital skills and what that can tell us about a skills

gap in Africa. So I'm going to cross over and open now to Jeopardy there to take us through the results of our digitalization index. Thanks. [Inaudible].

LANDRY SIGNÉ: Jabulile, can you unmute please?

JABULILE MONNAKGOTLA: Oh, thank you. Thank you Zaakhir. And through the World Bank's foundational pillars of the Digital Economy for Africa Initiative, they proposed a series of five dimensions of digitalization. So we followed the same analogy to inform our digitalization major. Firstly, digital infrastructure, which is important for individuals to engage in digital services through access to high quality broadband infrastructure. So this dimension is made up of fixed telephone subscription, mobile cellular subscriptions, secure internet service and individuals using the internet. And secondly, digital into partnership, which measures the ability of entrepreneurs to easily explore new products and opportunities in the digital space. This dimension is made up of venture capital availability, ease of access to loans and service exports. And thirdly, digital finance captures the availability to use financial services by individuals and households, allowing them the opportunity to pay, even borrow. So this dimension is made up of account ownership and a financial institution or mobile money service provider. Use the internet to pay bills or to buy something online in the past year and made or received digital payments in the past year. Firstly, digital public participation reflects the use of digital technologies to facilitate government's digital engagement with citizens. This dimension is made up of online services index and E-participation index value. And lastly, digital skills dimension, which measures the skills and education required to actively participate in the digital ecosystem. This reflects availability of a skilled workforce to support the development and use of digital technologies. So this dimension is made up of secondary gross enrollment ratio, tertiary gross enrollment ratio. Many years of schooling and internet access in schools. Next slide. Next slide, please.

JABULILE MONNAKGOTLA: Okay. So the study proposes the digitalization gap index using the kind of first time effort which is which is widely used in poverty studies. So we look at 21 African countries relative to G20 countries between 2011 and 2017. The study primarily uses data from World Bank database and United Nations. So the Digitalization Gap index is constructed based on the five dimension and is made up of 16 individual indicators. And this can be represented by this function. So we can calculate the mean values for each dimension for African inferiority. Then we take the material used to calculate the normalized gap, which is the deviation from the digital vulnerability line. This is represented with the funding formula, which is the mean for G20 countries minus mean for African countries. Divided by G20 mean in. So the Matrix is the instance that by replacing all negative elements with a zero. And negative elements are an indication that a country is not vulnerable in that dimension. Then finally, we calculate the average of the dimensions to get our digitalization index. Okay, So next we provide a snapshot of the five dimensions for Africa relative to G20 countries between 2011 and 2017. So in terms of digital infrastructure, there's heightened in terms of digital infrastructure for Africa, for mobile subscriptions and individual internet usage relative to things like infrastructure. And in terms of digital partnership, there has been steady progress towards promoting enhanced access to the entrepreneurs and firms in terms of venture capital financing and access to credit in the African market. So access to venture capital is surprisingly close to its closing ranking at 2.5 to that of the G20 countries. 3.5 access to loans has also improved significantly in the region from a rank of 2.5 to 3.3 over the period. So this is still below the 4.3 rank school for the G20. So in terms of digital finance, there has been a growth in user trades in Africa indicating some progress towards enhanced digitalization in the region. So 45% of all individuals had a financial services account which lags behind the G20, which is 82% reporting to have an account. So using the internet for online transaction in Africa with 80% of individuals report using the internet for those purposes, while over half of the G20 population reported making online transactions. And in terms of the digital public participation, African governments lag behind G20 governments for both the online service index and participation index, and it has been increasing over time, which shows some improvement in governments engagement with their citizens in Africa using digital technologies. And the final component of the ecosystem is the availability of skills that are required to make use of digital infrastructure and digital public participation. So the mean years of schooling in G20 countries reach an average of 10.6 years, which far exceeds that in Africa, which is like six years. So if so, a significant number of African students do not progress beyond primary education. Hence, tertiary gross enrollment ratio for Africa stood at 15.3% in 2017, compared to 65% in the G20. So the share of schools with internet access is surprisingly low for both Africa and the G20, but this could be a data coverage issue. Next slide, please.

JABULILE MONNAKGOTLA: So next, we apply the Multidimensional Poverty Index methodology by combining these dimensions into a single measure of digitalization in the country level. So the table provides the head count index for Africa relative to G20 countries, well over well over 90% of all African countries in the sample fall below the G20 meeting for all the dimensions. So, for example, the data shows that hundred percent of all African country or African economies in 2017 fell below their mean of digital skills achievement for the G20 countries. So now looking at the relative vulnerability index, we can observe a decline in relative digital vulnerability in all dimensions except that of digital entrepreneurship. His average score for the Aggregate Digitalization Index has improved, despite below, despite being below the G20 mean almost all African countries in the sample lagged behind the average G20. Country across all dimensions of the index and digital skills in particular is the one dimension in which no country in the sample reached the G20 threshold mean for both 2011 and 2017. So this begs for policy intervention to prioritize this area in Africa. Our next slide, please. So what is the percentage contribution for each dimension to the overall digitalization gap index score? So a digital infrastructure is the key contributor and driver of the aggregate digitalization gap, contributing 26% of the Digital Gap index. Digital and entrepreneurship have contributed less over time to the digital vulnerability, and we also observe that the contribution of digital skills have has increased over time from 17% to 19%. Next slide, please. We will now turn to examine digital skills by country to see each country how each country compares with the G20 countries. So these scores are deviations from the new score for the G20, meaning higher scores indicate poorer performance. So upper middle income countries are doing better than lower on low and middle income countries. So the countries with the poorest overall digitalization complaints are Niger, Malawi and Madagascar. Why Mauritius on Africa in Tunisia had the lowest digitalization gaps relative to G-20 meeting. So to provide. Nick's likely to provide more specific information about the indicators that can explain the overall digitalization score we presented is the digital GEP scores for each country. So indicators which have been away from the vehicle and reflects vulnerability and those on the line are not vulnerable. So the data gap score is the largest for the digital infrastructure and digital findings dimensions for the most vulnerable countries such as Benin, Malawi and Niger, and most African economies perform relatively well in terms of digital interpreting, with the exceptions for with the exception for Zimbabwe. And lastly, and slightly so lastly, we present a comprehensive breakdown of the digital skills dimension. So we see that almost all African countries in our sample lagged behind G20 countries in terms of all the digital skills indicators and their tertiary cross and Drummond ratio is finished away from the vertical line for most countries compared to other indicators. So it would provide us with a better perspective of how we can measure the demand and supply of these skills in specific countries. I now hand over to Christopher to present a South African case study.

CHRISTOPHER ROONEY: Thank you.

LANDRY SIGNÉ: I'm just to the audience apologies. Chris will present without showing the video. So that's in today's edition of the Digital Challenges that some of the challenges that you are facing on the continent with the bandwidth. But yes, Chris, you have the floor.

CHRISTOPHER ROONEY: Thank you, Landry. And so I see what you're looking at skill gaps. We look on one side, the demand for skills and the other side the supply for skills. With regards to the demand side, we will based on the methodology of the Muro et al a calculated digital school for each unit occupation and they identify to only cost variables, knowledge, computer and electronics and work activity interacting with computers. Now for each old variable, the level and importance are provided, and the lower the level refers to the complexity of the skill in the occupation occupations daily course of events. While importance is how critical the skill is to complete day to day tasks now because the level unimportant to use different scales, we standardize the scores and once we expand our schools, we derive a digital school in the following way, which follows Muro. Muro et al. Our next slide, please. So to give you an example of how we calculate the scale, we use a computer systems analyst and people, we have the knowledge level knowledge importance with activity level and work activity, important scores. And I've done some work here, which is standardization. And because of the overall digital score, which is 78.4. So what do all these digital scores mean? Can you fix this stuff? They use you in real estate. We look, we consider all occupations 60 and above at the high school level, 64 to 60, immediate skill level and 33 and below have a low digital skill level. And I've given some representative occupations to think about which ones want to indicate each level. And in the high category of computer programmers, electrical engineers, geologists and physicists, media operators, hotel receptionists and financial analysts and plumbers at the top, fitters, building construction laborers, shoemakers and related

workers once cultivated all the digital skills for each occupations is based on U.S. occupational code. And this is the to perform.

LANDRY SIGNÉ: Chris? Chris? Will you mind if you when I don't know sometimes we have some small difficulties listening if you can just speak perhaps in the same position closer to the mic please.

CHRISTOPHER ROONEY: Oh okay. Can you hear me now?

LANDRY SIGNÉ: Perfect. Thank you.

CHRISTOPHER ROONEY: Okay, great. So once digital skills are calculated for each occupation, it is necessary to perform a crosswalk between the only occupational codes, which are US occupational codes and the South African labor force data. Next slide, please. So yeah, we showed employment changed by digital skills intensity in South Africa. And the overall message is that digital skills intensity has increased over the decades. The prominence of those and similarly digital skills decreased from 47.6% to 41.6%. In contrast, patients requiring a medium or high level digital skills increase by 1.1 and 6.9 percentage points respectively. Now, there are two potential explanations. Most of these approach occupations require more digital skills. Occupational distribution is shifting towards jobs, applying a medium level of digital skills normal in rural life on this effect, a substantially larger mistake. And this is likely to be the case in South Africa as well, which has a far less developed labor market. Then the best of are opportunities for proposals to become dominant. Next slide, please. And this looks at the mean digital skills intensity schools in each country. Well, they will increase by 2.2 percentage points. But then the mean schools for the medium and high digital skills does decrease from a 1.6.2 percentage points respectively. Small business. This set the industry main digital intensity goals for various industries. As you can see, that means as a school increased from 76.7 percentage points to 42.1, and that's an increase of 5.4 percentage points. All industries in South Africa experienced an increase in their digital school with manufacturing, transport services and construction experiencing the largest absolute increases, and while the smallest increases in agriculture, financial services and community social and personal services. Can you go? Next slide, please.

CHRISTOPHER ROONEY: I looked at them all. And now we look at supply. And this is a very challenging issue because generally there's a lack of data in Africa and we do and it does exist. It is usually based on self-reporting measures or proxies such as the possession of certain devices like a computer or tablet. And an alternative to using a self-reported surveys is to use a live education as a proxy for digital skills. And the key assumption here is that the higher level of educational attainment is at least a high level of digital skills acquired. And the one caveat here, which I must mention is when we measure the supply of skills, we are including the entire population and not just those who are employed, as was the previous case with demand. Now, here we use a taxonomy Bashir and Mayamoto, they all they did the first two columns and we used the South African equivalent there for the different South African South African educational categories. Next slide please. So with regard to the level of the difference, efficiency, the supply is different. Some of the population have the only foundational digital skills as a percent of 10 to 46.2 percentage points in 2015 and subsequently 46 percentage points in 2020 is an overall decrease of 20.2%. Intermediate digital skills increase 45.6% in 2010 to 55.6% in 2020, an overall increase of 21.9%. Although there is a big increase in those at [inaudible]. It's also very low base. Next slide, please. This just goes by employment status. So mostly between the unemployed. Unemployed have foundational intermediate digital skills. There has been a decline in foundational digital skills amongst both unemployed and employed, and most of this increase has been accounted for by proportionate increases of those with intermediate digital skills. The proportion of those with advanced digital skills increased by 2.1 percentage points compared to the marginally increase of 1.6 percentage points for the unemployed. Next slide. Please.

ZAAKHIR ASMAL: Okay. Okay. Thank you, Chris and Jabu, for going through those results with us. I'm just going to close all our session by thinking a bit about some of the policy implications, but I won't go into too much detail because that will be the basis of our discussion later. So I'm just going to highlight a few themes and some key results that need to be considered in terms of considering policy. The first thing is that it's very clear that the index suggests that many African economies actually, if not all, are lagging in terms of digital development. And importantly, we should develop all components of that ecosystem, those five dimensions that we have considered. But in our policy discussion, yeah, we do focus on the top three contributors and

those are digital infrastructure, digital skills and digital financial inclusion. So in terms of digital infrastructure, the index has confirmed that African countries lag trinity countries on indicators related to this. And this is a major problem because if you think digitalization if you think about the ecosystem, the foundation on which all of that is built is the infrastructure. So with inadequate digital infrastructure, it will not be possible for African countries to reap the full benefits of digital transformation. And I mean, they won't be able to use the skills. There's no because these things go hand in hand together. You need to develop the infrastructure and then start thinking about how you benefit from the ecosystem that is built on that infrastructure. At a high level, we can say that the key things to do are to address the affordability of broadband and then to ensure access to all groups in terms of increasing affordability. We know that African countries are stronger in terms of mobile subscriptions compared to fixed line infrastructure, and that's encouraging. It means more people are getting access to the internet and being online. But fixed broadband should be a priority stall to ensure that high speed internet and affordable internet becomes accessible and that firms are able to digitize. Important also to have reliable, cost effective electricity and broadband as well. But we also do acknowledge there's constrained public budgets and that, you know, we'll have to think about how to do this. And partnerships with the private sector may be critical as well. Terms of increasing access to digital infrastructure. It's important to ensure that no one gets left behind, whether geographically vulnerable groups. There are few things that governments can do to prioritize underserved communities, which may involve, for example, subsidizing a source of revenue for city companies, which might be raised by ensuring access to marginalized or poor communities. Also to ensure that strategies are put in place to prevent isolated companies from operating as an oligopoly and in a way that excludes lower income users. And then it's also important that universal access should be prioritized to ensure that Africans can benefit and that any drive to improve digital infrastructure and connectivity does not leave anyone behind. Then the next key component that we want to discuss is digital skills. And we know that Jabu has indicated to us how important it is in the index and what has been found in terms of the lag in that regard. But importantly, we want to emphasize that different countries have different needs, have different constraints and different operating environments. So appropriate country specific interventions will be important to target development of specific skills in different countries. And any actions on the supply side must be coordinated and balanced with that access to infrastructure, the digital platform, and as well as the stimulation measures to stimulate demand and participate in the global digital economy. Apart from a few more advanced countries in the sample as well. Primary schools unlikely to have the minimum interest infrastructure required to train effectively within the space of digital skills. So that's again is emphasizing the need for the skills to go along with the infrastructure development. And then again, we want to introduce the idea of the tension between trade offs, between different types of skills and education, given limited resources. I mean, there's a digital skills that need to be developed at a basic cognitive level. And then there's also the higher level skills that are typically associated with STEM and post-secondary education and in specific fields. I won't go into too much to taking account of the time, but we will get into the discussion about this later as well. The last thing that I want to talk about here is the digital finance dimension. And we've noted that this has the highest quality second highest contribution index and we have seen progress in the use of and ownership of a financial service account. But it's likely fueled by the increase in mobile phone use and it still remains a gap even though there's been this increase in trend over time. But what is interesting about that and what should be considered is how the rise in mobile banking can be used to further formalize informal sectors through formal credit access and assessment using tools like a blockchain and record keeping. And then this is where we also get into the issue of regulation and how governments should enable financial sector deepening by promoting regulation that addresses barriers. And just to highlight some of these barriers, so governments can do this by promoting use of blockchain financial tracking transactions and establish a single identity for residents which currently does not exist for about half of African countries. Governments should also address threats of fraud, cybersecurity and high transaction costs. It's very important that consumers have trust in digital system and feel that they are able to take advantage of digital inclusion and digital participation. And then I'm just going to end with some concluding remarks which are related to the results that we have shared between now. So again, I'm just to highlight that the index suggests that many African economies are lagging in terms of digital development.

ZAAKHIR ASMAL: Some indicators, such as mobile phone subscriptions and bank accounts, have shown steady progress. There have also been progress in digital public participation and digital finance dimensions. However, over 90% of the countries in the sample remain below the G20 mean in aggregate, and its African economies are at risk at falling even further behind due to significant gaps in infrastructure, technology and skills. Again, I would like to emphasize the need to tailor policies to local political and economic context, while also emphasizing the need for comprehensive strategies across nations, regions and the continent. And again,

to emphasize that while we focused on the three key contributors, this must be thought of as an ecosystem in which all five of these dimensions interact, support each other and produce returns and in line with how they interact with each other. So it's important to improve all components across the digital ecosystem, but obviously they will be priorities and to identify the potential synergies and this potential barriers between these competing priorities. Leadership should develop and continuously update a comprehensive strategy that aligns these priorities, and it's important to involve multiple stakeholders and that this is a strongly coordinated approach. The successful outcomes of improved digitalization and reaping the benefits of digitalization in individual countries will be reliant on strategic prioritization, which focuses on local contexts and local constraints, and takes into account appropriate measures to take account of those constraints. And then just one last thing I would like to highlight is that while we believe this index can help guide these priorities and point out specific vulnerabilities and strengths of particular countries, the lack of is a concern. As you may have noticed, our index is looks at the year 2011 and 2017 and it's now 2023. So it is a bit of a concern that we do not have access to timeliness and regularly updated data in respect of these dimensions and indicators. And so that is something to really take on board. Think about how do we emphasize and make sure we collect the type of data that we need to do the analysis and. Perform the insights and inform the policy that needs to be taken in line with those insights. I don't know if I'm going to pass over to Landry now, but I think we are.

LANDRY SIGNÉ: All the way to concrete the first session Zaakhir. So I just want to let the member of the audience know that you'll be starting in about trimming it this second session. So if you want to take those three minutes it's to have a coffee, a small coffee break or some water. And please join us exactly at the hour to continue in the next session, which will be chaired by Haroon. And after the next session, you will have a broader Q&A session where you can also engage with our present presenter of this panel. So see you in about three minutes.

LANDRY SIGNÉ: We are back now, so I will give the floor to the chair of the session, Haroon Borat.

HAROON BHORAT: Excellent. Thank you very much, Landry. Welcome back, everybody. Perhaps to see you have a road map of where we going? I will open up a panel of esteemed guests who I'll introduce in a minute. And then once they've provided introductory remarks, we'll. I will try and do a sort of as the phrases or redirect back to them individually with some perhaps elaborations on inputs they've made. And then we will go to you, the audience. So we have some questions that have come in already via Twitter, but they're also live questions that are coming in. And then I will try and sift through those lists of questions and handed back to our panelists, but also to Zaakhir, who presented the the sort of the the core of the report today. Okay. So let's proceed. Let me let me do the following, if you don't mind. So we don't interrupt the flow. I'm going to introduce our panelists all at once and then hand over to them sequentially so they will know the order they are going to speak, because that's the world I'll introduce them in. Our first panelist is Lesly Goh. She's the senior technology advisor at the World Bank, and she was former World Bank chief technology officer. So strong link to to the World Bank. She's a fellow at Cambridge Center for Alternative Finance and at Cambridge University's Judge Business School. She is a senior fellow at the National University of Singapore at the at the Lee Kuan Yew School of Public Policy. She's also a professor of practice at Xinjiang International Business School and serves on the advisory board for Harvard College Project for Asian International Relations. Lesly principally serves at the nexus of technology and policy and brings, as you can hear, extensive international experience. And she's worked in areas around AI, blockchain, the internet of things, 5G and so on. So please keep your questions ready for for Lesley. She'll be followed by Cecilia Värendh Månsson, who is the CEO and founder of Talent Up Africa, which is an enterprise with operations in the US and Africa with the goal of helping solve the global tech talent crisis and the laudable aim of unleashing opportunities for African talent. Dr. Marson is a postdoc at the Wharton School at UPenn and a fellow at the World Economic Forum, and she's previously worked as an associate at Morgan Stanley Wealth Management in New York. And our third panelist is Landry, who we know very well. He's a senior fellow with Brookings at the Africa Growth Initiative and a co-director of Globalization 4.0 and the Fourth Industrial Revolution Initiative at the Thunderbird School of Global Management and is also a distinguished fellow at Stanford's Center for African Studies. Landry served as a visiting scholar, a scholar, and has lectured at Oxford, Stanford, Georgetown and others. As we know, he's strong on social media, so we've seen him in very a fair number of sort of public global fora. A final panelist is Alison Gillwald, who's executive director of research at ICT Africa. We're very lucky to have Alison. I know she's squeezed us in between many events and she's an African digital policy and regulatory think tank is the is the ICG Africa based in South Africa. She's an adjunct professor at the University of Cape Town's Nelson Mandela School of Public

Governance, where she supervises doctoral students undertaking transdisciplinary research. Obviously on the digital economy and society in Africa. Alison leads the research ICG Africa team that provides technical assistance to the African Union data policy framework and implementation and capacity building plan of that institution. She was recently commissioned by UN Women to produce a background paper for KSW on his work on intersection of digital inequality and data injustice. Alison has advised the South African Presidency, the National Planning Commission, the Competition Commission and the Independent Communications Authority of South Africa, and of course, is involved in a wide variety of multilateral African agencies, and she's published widely in the area. So I think you'll agree with me that we have a wonderful panel to take us through some of the sort of policy burning policy questions around digitalization and digital skills and the digital divide in sub-Saharan Africa. So with that, I've given the organizers of. 3 minutes. And as a speaker, I think that is criminal. So I'm going to give you between three and 5 minutes. And if you take a little bit more, but you're saying interesting things, please go for it. So I'm going to hand over first to Lesly. Thanks.

LESLEY GOH: Thank you so much, Haroon. What an honor to be among this esteemed colleagues, the speakers from different parts of the world. I'm honored to be here. Last year was here as part of the Aggie launch of the report. And I remember with fun insights on all the great things that we went that was put into the report and congratulate you this year on another excellent report on a topic that's very close and dear to my heart around digitalization and also around this whole topic on skills gaps for the future in Africa. So a lot of my work has is about advising governments and policymakers and regulators to leverage digital technology in order to address sustainable development goals in many of the developing countries at the intersection of tech and policy framework. So I'm currently in Asia. I moved here a year ago in Indonesia, and I've learned and I witnessed a lot of the digital transformation in government and private sector here in Asia and more specifically in Indonesia, and lots of learnings from years of hard work over time that could be quite applicable in Africa. So a lot of the learnings also happens in Africa, such as Kenya, where some of the sectoral working around agriculture that we've spent quite many years since 2018 to really build the digital infrastructure in Kenya to support that digital transformation of agriculture. And I'm glad to share some of the reports that my colleagues publish at the World Bank around scaling up digital innovation in agriculture in Kenya and the region to support the effort on agriculture transformation. And what that essentially boils down to some of the key elements that our colleagues have highlighted earlier. But I will double click on the areas around institutionalizing innovation and digital at the core in government. By that I meant investment from the government on the to cultivate and the innovation ecosystem. Kenya, for example, set up the Digital Transformation Office for Agriculture, and that happens at a very critical junction to really catalyze innovation and bring in more innovators and agtech and fintech innovators to come together. And since 2018, until now, there's 26 of them, and they have really grown over time. And with the effort of government and private sector support is one evidence of the great partnership between government and private sector coming together. And the other aspect is bringing these kind of private sector investment from Silicon Valley. As an example, Ghana is a great example where MEST, the Meltwater Entrepreneur School of Technology, has really been a great asset, shining examples founded by Bjorn, who came from Silicon Valley and brought in not just a financial investment, but also the digital skills and capabilities and inspire the young people and the innovators who really step up and try to address some of the challenges in society. In my recent mission in Ghana in April, I had the honor of meeting the founder, as well as some of the innovators in this school. The last point I want to mention, since I want to keep it short, is around the government to government dialogs and capacity building. So I sit on the Singapore Govtech board for the last five years and Singapore journey for digital transformation has been one that many countries are trying to clone, but yet trying to figure out it's not just a cut and paste. It's about truly raising the digital quotient in public service leadership as well as the community at large and the young people in order to give them the high aspiration of what digital skills really mean to create greater jobs and opportunity for the young people. So I think it's a lot about how do we raise the aspiration in Africa and learn from other countries, perhaps in Asia, in Singapore, in Vietnam, in Indonesia. I have few countries. I work very closely with the government. And the private sector to bridge the digital divide and help create a greater opportunity for for all in the country. So I'll stop here to give time for my other esteemed colleagues to provide their insights as well. Thank you so much.

HAROON BHORAT: Wonderful. Thank you, Lesley. Over to you, Cecilia. You with us, Cecilia?

CECILIA VÄRENDH MÅNSSON: Yes, I do apologize. For some reason, I was pushed out.

HAROON BHORAT: Okay, but you are back in.

CECILIA VÄRENDH MÅNSSON: I am.

HAROON BHORAT: Wonderful. Over to you.

CECILIA VÄRENDH MÅNSSON: Perfect. Thank you. I apologize again. So, first and foremost, I wanted to say thank you for being invited to this panel. Indeed, it's a great honor to be part of this discussion on a topic so dear, dear to my heart and so important for the continent. And secondly, I want to congratulate the authors for both a great report and a good presentation. So first and foremost, Secondly, can you see the screen? Can you see what I'm sharing? Perfect. Got it. So let me start with a few personal experience from my work on the continent. So if we start with the start up, I'm the founder and CEO since a few years ago of something called Time about Africa. We work, as Professor Barnard specifically said from the beginning, to help top talent from the continent get good remote work positions in the US. Doing finding top talent on the continent is very hard. It's harder to find the top talent on the continent than finding big companies in the US willing to hire those. Those that's talent can leave. A report by Google and Accenture in the end of last year acknowledged that there's about almost 1 million within tech. Only 20% of them are good, competent tech people. That's not enough. So clearly a problem with the digital skill here. I want to also note a few things from my research. So my research focused on how fintech solutions and mobile technology impacts microfinance in Africa. So think microfinance is social enterprises with two goals. They want to do well, increased financial inclusion, and they do want to make money. What happens to this balance when we have have fintechs and when we have digital innovative solutions? Will the social enterprises, the microfinance organizations, be able to optimize both? Sadly, what we see, that's not what's happening. It become tensions between the two and we see that microfinance will increase focus on finance. Part of the reason different initial goal over the social goal. Part of the reason is really going down to to infrastructure problems in the most rural areas, but it's also getting down to literacy, then going right into the the point of this this this panel problems with digital and financial skills. To cite a few other statistics, the report clearly did did did better in pointing out a few things few of the statistics specifically I would say that figure one and figure five were, I think, specifically telling. But we do know that 2030, about one third of the world's population under 25 will be from Africa. And by 2035 it's forecasted that and the number of people joining the workforce will and in the world will will be minority from from Africa. So if we don't deal with the skills gaps, skills challenges that we do know and been pointed out from from the report and also from SPEA, it's clearly, clearly crucial. And where I think it's very important is where the government should really be an enabler to to incentivize private initiatives such as our own initiative when it comes to to finding good people, investing in people, outsourcing them. I also think it's important. Lastly, also noted that before that, African countries learn from each other within the continent, but also look abroad. Look at India, for example. Look at I just came back from the Baltics on on looking at the governments with with that group of Wharton students looking at what can be taught from from the Baltics on those small countries in in African and African countries. Lesley mentioned a few examples from from Kenya. And then I should probably leave it to the next panel. But but also looking what they did last year was looking at India who very early on implemented mandatory coding schools in high schools. Kenya has done the same. Now clearly an important initiative to to increase them to to increase the digital knowledge from from the very young age up, which clearly will become very, very important. Just the final thing, which was also mentioned earlier on, very important. Also think about the the infrastructure, because we can we can do a lot of digital training and try to to use a digital computer to to to facilitate training, but without the relevant infrastructure. When it comes to why find internet? It doesn't really make sense. So I will end here in interest of time.

HAROON BHORAT: Thank you very much. Cecilia Excellent. Thanks. Landry, over to you.

LANDRY SIGNÉ: Yes, thank you so much, Haroon. I thank you also to the panelists for the brilliant intervention, so I will not take a long time because I share some preliminary remark earlier. But a few things that I want to highlight is that agility, Agile governance will be extremely important in aligning the advisory dimension that we are discussing and that agility in particular by African governments, because in order to align what we call the physical capital infrastructure, the digital and technology capital, so to what extent government will be ready to adopt the technology? To what extent will they be able to build or help or support the environment to build infrastructure? To what extent the human capital related to primary, secondary, tertiary education? Will it be possible also to align academic curricula to make sure that the skill which I develop are aligned with the virtue of work and is not a dimension? The perception all of this will not have the same impact.

Everything that we are discussing will not have the same impact if it is not our soil work which is done or which is made in in improving, adjusting the perception, especially of the one. We are very skeptical about technology, about the prospect for jobs and for job creation. Amount order. So. Comparing last week to some of the work that I have done with my forthcoming book, Africa's Fourth Industrial Revolution, but also with another paper I co-published with the Rose Fox on how the fourth Industrial Revolution can whether the fourth generation will bring good jobs in Africa. So it will be important for government to do a deep dives in the area with the highest potential. Not all the sectors are equal. So we found, for example, that in the service sector for e-commerce or expanded tourism, we have the greatest potential of having an impact on jobs, not just job creation, but also the quality of job in terms of improving formal wage employment. As long, of course, as infrastructure I city energy will be available. And it is also true that most of this sector will relatively remain in low and middle income countries, relatively small. So again, I can expand. I have so much to say here to be said here, but I will pause here to give you a brought to my colleague.

HAROON BHORAT: Excellent. Thanks, Landry. And I'll hand over to Alison, who rivals me with the wonderful background of Cape Town. Oh.

ALISON GILLWALD: I was a little bit more stylized. And do I share my screen, or is it going to be shared?

HAROON BHORAT: Uh. Let's see if you can. If you. If it says you can't, and the Brookings team will give you permissions. There we go.

ALISON GILLWALD: Great. Let me just. [Inaudible].

HAROON BHORAT: Yeah.

ALISON GILLWALD: Thank you. So here I. I'm really torn between sharing this data with you and responding to some of the policy proposals in the in the paper and using my 4 minutes for those. But let me try let me share this with you, and I'll try and pick on some of those as we go as we go along this. So I suppose you know what? Some of the things I just wanted to emphasize were really around the importance of the entire ecosystem and understanding the digital skills needed or the skills needed in order to see the benefits of digitization across the economy and society, not just being, you know, kind of digital literacy and these kinds of things that have tended to be focused on in policy. So really, I think you basically are concerned, and I want to just really emphasize what Zaakhir said is around the problems we have with this really very, very patchy data, making it very difficult. I mean, even the data that you're using from the World Bank is based on the IQ data, which is extremely patchy from Africa and is actually extrapolated from our 14 countries, which are done at the biggest number, the biggest number of countries time, you know, ten years ago. And these are extrapolated to 50 very good, 54 very different economies. So all forecasted an assist for those economies. So very, very problematic this data. But I think the real outcomes is, you know, the negative policy outcomes you've seen is, you know, what we need to do about understand that is we need to develop an evidence based and it's very difficult to do it without that data. But what we do know is that despite the potential of mobile phones and the internet being spoken about to improve livelihoods and lives and indeed life opportunities, I think increasingly important to point out this is that we have this very patchy data that particularly with students, we try to look at sort of disaggregated data and the problems with using the disaggregated data that is available is that, you know, if it's not kind of modeled and understood properly, it often produces these homogenized segregation that really doesn't speak to inequalities and differences in the different urban or rural women or male. So I think we've been part of a group, it's part of our men and women work that we've been doing. It's part of the community with. The idea is to really look into the idea of getting data accepted as a public good and funded as this and, you know, really developing decent public statistics as we move increasingly into these digital and data economies. And I think, you know, the pandemic really highlighted the compounding effects of digital inequality on structural inequality, of course, that structural inequality creates a digital inequality, But the compounding effects was the inability of most Africans to digitally substitute to mitigate the devastating effects of the pandemic and, of course, the limitations now for economic reconstruction and economic development. And as has been mentioned and as the background of education shows, is that, you know, it's very difficult to assess the progress we're making towards these other than we know we're very far off. And I think when you look at that data and you see these kind of mention that the improvements and the governments are kind of

getting right by that, better understand. But if you actually look at some of those figures and I'm really not a statistician, but, you know, these are very marginal improvements over very long periods of time in Africa.

ALISON GILLWALD: So, you know, these lags really are getting worse. We just, you know, we can't carry on doing the same things and hoping for different results. We've got to do things differently. And I think that really requires us looking at this entire ecosystem. And also really, this is not a central policy anymore. This is not a proper transversal policy. This cuts across the economy in society. We need coordination between the public and private sector. We've seen the devastating effects of, you know, private sector led public delivery of public goods without effective regulation. What we need is we need the public and private investments in these public infrastructures, but they need to be more effectively regulated than they have been in the past. And this really requires you know, you'll see from the data, it's not really digital skills are kind of one of the outputs of education. The main factor driving internet take up and more equitable use is actually education. And so the development of skills and training is not only in the citizens and consumers that we need in order to grow these economies that we've got, you know, kind of digital consumers in it. But of course, in the in the companies and the high level skills that are being spoken about in this report, But it's really important to understand the importance of education and training and skills development of this entire ecosystem. So we really need to develop, you know, policy and regulatory understanding of this very new area that, you know, people are struggling with all over the globe. But we have these institute. Capacity and legacies that we have to address. So really important just to to address the whole thing was my forward error because I have not been fighting. So I just wanted to say this is just actually an infographic that we developed for the African data policy framework. And it don't look at all the guidelines because it gives all this very high level principles. But if you look at this enabling environment and you'll see that the unlike the data policy frameworks is the first thing that says we need this foundational infrastructure. And that foundational infrastructure, as I said, is not just broadband, which is often implied and might be even implied in this report. We now really talking about digital IDs. We're talking about data infrastructures for data warehouses and those kinds of things. Those are the what are going to be necessary to drive the next level of digitization. So and then we you know, we speak about public data and value creation was a public value. And we have to look at coordinating trade policy and competition policy. You know, the regulators in all these sectors, new information sector regulators. So this capacity development is really across an enormous set of skills, which I've only just sort of really just highlighted. I'm just saying this is, you know, this is the new this is the new what the digital ecosystem is, you know, the current digital economy and societies, the economy and society. And yet we still dealing with this fundamental wicked problem that we faced for so long. The digital inequality paradox that the U.N. secretary general has described as one of the, you know, seismic shifts together with climate change that will determine levels of quality and inequality, reduction over the next and, you know, future. And really, so I think the important thing about this is that we've often reduced this to a digital divide. And, you know, with that worked for a kind of telecom environment. And of course, connectivity is a precondition of digital inclusion. But to connect it to connectivity, it really doesn't address digital inequality. What does is education, skills, development, eccentrics, and just that that's really where we need to focus out of the policy attention. But the paradox is in the fact that as you as we connect more people, digital inequality is increasing. And I think there's a lot of evidence of that. But importantly, as we move into this data fixation, the data data area look digitally. It's not only between those who are online and offline, which we knew was the case in basic voice and text environments. But it's also between those who've got the technical and financial resources to use the internet productively and even prosper, you know, at a national level. And those who are barely online eking out an existence, unable to don't have the skills to transact effectively or to fill their rights or create businesses. So shifting these policy outcomes really requires not only supply side interventions, but very much demand side interventions. And this is not just digital literacy and development, as you'll see. Just very quickly on your own, the policy points. So, you know, as I said, we need to speak about digital infrastructure much more broadly than we've spoken about it before. You know, it's not just broadband, it's also these other data cities, all sort of other things.

ALISON GILLWALD: But just speaking about broadband connectivity, you know, many, many countries in Africa have 90%, 95% broadband penetration. So your point about maybe there's not coverage actually doesn't apply to many places. It might apply to a rural school. That rural school will have coverage, but it doesn't actually have the affordability of these kinds of things to connect. So the to Rwanda, etc., you know, 95% internet connectivity, the city only 25% internet penetration, Rwanda, less than 15% internet penetration. So these are really demand side constraints that we're seeing and that need to be addressed from a policy point of

view. And just to show the kind of impacts of this, during COVID, we did horrible from the app. I never have to do them again for a phone service in Nigeria and South Africa because we couldn't do a face to face service. And in fact, you know, the pandemic actually widened inequality. So despite the sort of broader discourse on the expansion of of e-commerce and all of these kinds of things during COVID, in fact, in these two countries that we looked at more closely, But we now are doing a full after access survey. And it's becoming clear from the after access surveys as well, is that, you know, people actually were unable to digitally substitute. We've broken it down in terms of accessing God and doing all sorts of other things. But the benefits were really for those who were online. So we got in South Africa, we got more bandwidth. We were able to do that, but we were unable to bring more people online during the pandemic, despite various government interventions, which because they weren't actually dealing with that they were dealing with. And, you know, even if they were trying to deal with the lifeline subsidies, those that don't really work, where you don't have people already connected. Sorry, I'm just struggling to find my arrows. And so so just very quickly, from the AFT after the surveys that we're doing this year, again in. Unfortunately not across the global South without funding any longer. But across African countries funded by the Gates Foundation and Informal Sector Microenterprise Survey, that's run on top of that done with the World Bank. And I'll show you quickly some of the data. But basically, these surveys have been out run for nearly two or three years, for nearly two decades now. And there's just a very strong evidence it wasn't there earlier on just because we didn't have this kind of demand side data to support the notion that education is the key determinants of Internet access. And and did you know initially some of these indexes and these measures, UNDP and other measures were really looking at, you know, primary schools reporting those kinds of things. And I think what your data is absolutely correct is that we really only get the necessary level of skilled digital skill at the tertiary level. But even in a country like South Africa, where we have over 55% penetration now and 60% penetration, those who are not online, those are 40% or really the people who are, you know, look very much like people elsewhere in Africa. And I think my time is up. I'm going to quickly just just say that, you know, we're seeing shifts now as more people are coming online. Many countries, as I said before, below the kind of 20% critical mass associated with network effects and economic growth and development. But in many countries now where more people are coming online, the affordability of the smartphone, which was previously the main factor and still one of the main factors of not getting onto the internet, having access is the cost of the mobile phone. Once one is online, the cost of the data becomes an important determinant of use. But access is actually the price of of the phone. And this has implications because the taxes on them and all sorts of other policy implications. But what are we seeing now is as as a kind of tailwind.

HAROON BHORAT: Can I give you 15 more seconds?

ALISON GILLWALD: Yes, I'll just finish off this this this one, and then I'll leave it for you. And you can look at the slide set because there is some interesting data there is that it's becoming an issue of awareness now. So we really getting to rural areas, people are very poorly educated and actually not even awareness of the internet. And I'll just I'll just put this up here for you to go and look at. But the After Access survey is able to measure digital literacy in these kind of broad buckets and which is, you know, the ability to search security awareness, knowledge of password, uncertainty, familiarity with networks and apps and software and and it's easy to use. And that you know definitely there's an association.

HAROON BHORAT: Can I ask that you hold, you can hold some of the slides which are super interesting to and the Brookings team will distribute but we can also come back to them in the Q&A. That's all right. I have.

ALISON GILLWALD: Absolutely, I believe this is the last one.

HAROON BHORAT: [Inaudible].

HAROON BHORAT: Yes, I know there are many more interesting slides to come, but maybe if I could just turn back to the panel. And go individually actually to each of the panel's panel members with a question based on their really interesting inputs. And if I could start with you, Lesly. I mean, you know, you made a really enticing comment about agriculture and technology, right? And and I was wondering and you saying you said that actually some innovative experiments and innovative solutions that have been found in agriculture in the countries you worked in, I think you mentioned Kenya. It may or may not be. Could you give us an example of where those solutions have been brought to bear in the agriculture agriculture context?

LESLEY GOH: Well, I will actually share with you the actual report that my colleague had published in 2018 for the sake of the audience. But I'll highlight a few things. In fact, last year, in actually two years ago and Brookings, I had a publication on the Digital agriculture as an example of the breakthrough book. And my contribution was about a study of several different countries, one for Indonesia, another on China, and the third is Kenya. And it triggers one of the examples I highlighted as a case study from Kenya. But they are not the only one. I mean, there's about 26 of the Agtech startups that the World Bank, through the interventions since 2018, have been providing the ecosystem to nurture them over time. And these startups are ranges from e-commerce in agriculture, in remote sensing, in the areas around precision agriculture. So there are a whole slew of them, and then some of them are more intersectional agtech and fintech. So the report kind of illuminates a lot of these examples. Now, another country I just want to highlight is Indonesia. Now, having spent a year here physically on site, but I supported Indonesia from Washington, D.C. for a couple of years throughout the pandemic and designed the data hackathon for agriculture here. It is a huge, vibrant ecosystem. And why is that? So it rides on the wave of the fintech revolution here in Indonesia and then followed by some on the demand side on agriculture transformation, such as e-commerce. We feature quite a few interesting ones in my our report. The talk about the business model, the five business model in agriculture, where technology has a significant impact in terms of drawing out the innovators to contribute to solving the problems in agriculture and how governments can play a significant role is to invest in digital infrastructure, such as our colleagues have mentioned, about digital identity, in some cases about farmer registry and in other cases about the digital wallets and platform to facilitate government to people on subsidies and transfers of funds during COVID. I mean, there are many examples that I could go on and on, but I wanted to kind of give you a flavor, but not just continue.

HAROON BHORAT: So in in agriculture sorry, just a quick rejoinder. In agriculture, do you think there is the equivalent of that technology gap that effectively suppresses productivity in agriculture in Africa? I mean, no one thinks of what you meant. Remote sensors, drone technology, all of that that's now embedded in agriculture. Do you think there's a catch up for sub-Saharan Africa that could increase productivity in agriculture?

LESLEY GOH: So there are so I would say in and I wouldn't comment on every country's. There are some countries that I spend more time in now, Ghana as an example, and Togo. I think there are opportunities that we can uncover in terms of use cases where data and digital innovation can really help address some of the challenges in agriculture. And that's when you really get into the nitty gritty on what's the role of the government, what can they play in terms of providing these kind of digital public good? And then what's the role that they can do to catalyze innovation, to bring private sector along and then creating these platform an ecosystem? So I would say instead of just talking broadly about the entire Africa region, I want I wanted to mention that just a few countries that I spend some time looking into the ecosystem and the gaps, I find that the potential is there, but it takes time to build the foundational layers and also investing in these digital public good.

HAROON BHORAT: Right. Excellent. And Cecilia, so, you know, what struck me was the immediate question about, I mean, the excellent work you're trying to do in getting sort of African skills sold on international markets. If I could simplify it. Right. So my question. But you said it's difficult, right? So my question is really, to what extent in your experience, do you think it's a function of, let's say, a true skills gap in the way Zaakhir and other and Jabu presented? So the risk, the prevalence of a skills gap. So in other words, we can't really find enough Python programmers in sub-Saharan Africa. And to what extent is it also or rather a sort of information asymmetry, as economists would call it. So the fact that, you know, there's a Ghanaian coder, well, not simplified, but many of the corporates in the north wouldn't know where Ghana is on a map. Right. To what extent is it soft skills that may be missing rather than core skill? So just a reflection on that in your experience.

CECILIA VÄRENDH MÅNSSON: Thank you. And a very good question. We have been reflecting quite a lot in the in the board and with investors on what is actually going on. How can we lose companies that want to hire from Africa and we just don't find them? Is it because maybe it's too too much competition in West Africa and other countries such as Mozambique and Senegal, where we know that the developer population is increasing about 10% annually? Or is it really just the fact that there is just not enough people? I think it's it's one just it takes time to develop from the bottom up to to the point of being equally good as international standards.

Number two, I do think that there is competition and the bigger companies are coming down. The Googles, the Meta, the Microsofts, they are on the ground setting up campuses and really trying to to to write the benefit of good African talent. I do think also that the good people leave. So if you are a very experienced by Python or Angular or C++ and you have the possibility you will take the flight to Canada or to the Middle East or to the UK, and you will rather be there as a senior programmer than being on the continent. Maybe you go back, maybe you send back home help and maybe continue to train. But I think that that's part of the problem as well. So I think it's a mix of of not enough supply in the supply that exist leaves. It's a time difference here. Competition is coming down to the major markets, Kenya, Nigeria and Ghana. South Africa. One should look more in the other countries and but less so may be not enough information, because I do think Andela was, I guess, one of the bigger, bigger platforms that came down and said African put African talent on the map. So I think less asymmetry of information from international companies, but more relocation and time to develop.

HAROON BHORAT: Yes. So then. And the other. Thing you actually you sort of spoken on about, well, you know, we can only do so much as corporates trying to sort of create the match right between demand and supply. If you have a massive infrastructure gap. So tell us a little bit about that. I mean, so that's an interesting bridge to the report because that's what Zaak and Jabu have shown that, you know, as a weight in our vulnerable, what we call our digital vulnerability index, infrastructure's the big weight. And of course. It is. The necessary conditions are right for producing coders and so on. If you don't have the infrastructure, we don't have cell phone towers, you don't have ISP's that function, you don't have the bandwidth and you're in trouble. So tell us a little bit about that and to what extent that's been a challenge for you.

CECILIA VÄRENDH MÅNSSON: Yeah, the only problem that we have had is actually infrastructure. So the people that we're now sitting in Nigeria for U.S. companies, the only complaints we get, it's not about the skills, it's not about the level of proficiency, it's not about the teamwork. It's actually they don't show up because what if I didn't work or why all of a sudden the generator broke down or something? So that is a problem. And it is also a problem when it comes for us to actually finding the good people, because you have interviews and you can't reach the people. So that is a problem. And I do think that one one should do. And what I think one should do in partnership with with governments is really subsidizing wi fi usage, having hubs with with the relevant infrastructure where people can come and work. There are a few in Nigeria specifically, but they're all very crowded. So more initiatives like like that to really solve that problem. Because again, the problem we have with the talent is really the Wi-Fi connectivity is great.

HAROON BHORAT: So let me move on to you, Landry. I mean, you made an interesting and intriguing point for for me as sort of a structural transformation person. You mentioned the role of services, right, in growth. And I was just wondering whether. In terms of leveraging technology for growth, whether you think there's a role for and just based on what Lesly said, almost for technology to be embedded in all key sectors agriculture, manufacturing and of course services. And how do you think that can be enabled in Africa?

LANDRY SIGNÉ: Thank you. Thank you very much, Haroon. So, so perhaps before going there, I want to just highlight quickly in terms of agriculture, which was discussed, prejudice, need and the potential for for an emerging technology. Digital technologies to the agricultural sector is extremely important, especially in terms of earnings improvement of the earnings of the farmers, but also in terms of reduction of poverty, in terms of environmental benefits as well. And that connects to the question that you have just asked, Haroon. So when we should not be thinking about technology, about emerging technologies or about digital transformation as a specific sector. So I think that we should be thinking about it holistically, as you mentioned, from a structural transformation perspective. In fact, some of the characteristics, the scope, like virtually all the sector affected the well, in a way or in order. So of course, you have some areas or some sectors which are marketed as than others. I mentioned the service sector, for example, is the area where we have more transformation and Haroon, you have been extensively involving industries without smokestacks in the industry with smokestacks project and which were quite which are quite attractive because they have similar characteristics as traditional manufacturing. They are labor intensive, they absorb a high quantity of moderately skilled worker, the export ability to trade ability, and there are actually really high productivity. So service sector, yes, extremely important in part in job creation, in skills, in transformation of the sector or agriculture or Arcelor a lot, although may not have the same impact in terms of quantity of job created because agriculture is already but could improve the commodity revenue and we have in manufacturing. So it's also another key area where the dynamic will be slightly different. So I mentioned on one hand the the industry without smokestacks, but on the other hand

smaller scale production for domestic and regional market could also make a monumental difference in. Although I don't like too much using the word substituting. But lesser in producing locally and creating that those local those national those continental value chains. So those would be very important. And there are not too concerned about jobs because first, it's not even enough jobs in those areas, those sectors. Everything still need to be created. So so the question of substituting a capital for labor for this destroying job for me is a secondary question. And for this to happen, for all that transition to happen in the primary sector, in the secondary sector, in the tertiary sector, all government have to take responsibility and act with effectiveness. There's a lot that can say our stop here and more broadly about our conversation later.

LANDRY SIGNÉ: Great. Thanks. Thanks, Landry. That's excellent. I mean, in many ways it's the solo growth model, right, that sits in the residual, but now the residual seems to be embedded in every part of of an economy across all sectors. So, Alison, I had a little bit of a a sort of lump in my throat when you said you were worried about the data quality. So. So, I mean, you know, in many ways Zaak our report, we we relied on the World Bank's data. Right. Even the World Bank's own sort of technology and jobs report recently. Yes, they were firm surveys, but they relied on sort of aggregate country level data. To tell us a little bit about your concerns around the data quality. Is it about being updated or is the coverage poor or is the quality just poor is in some indicators relative to others? Yeah.

ALISON GILLWALD: Yes. So Haroon, I actually wasn't being that specific about your data. I was speaking about the problems with the digital data generally. And that data in Africa, generally macro data, the macro data, but also really the challenges around demand side data specifically because, you know, we can't get this information from administrative data anymore in the prepaid mobile markets and those kinds of things. So it was really about the data as a whole. And just to mention that specifically, the, you know, the digitalization and the digital indicators that the bank uses is actually the ITU data and the actual data that we work with the expert group all the time. I mean, it's it's they know the problems with these the data. And the problem, of course, then is also it's very often presented at the aggregate level. It really doesn't it's not very helpful. So so it wasn't specifically about about your data was the.

HAROON BHORAT: I understand that but tell us more like so yeah. So tell us a little bit more about the data quality issues. Is it it's presented to aggregate are the administrative so. Here's a question, right? Can we turn to key providers in the digital universe, whether it's telecommunications and legislate that they need to provide such data to country governments? I mean, is that a way around it? Yeah.

ALISON GILLWALD: Yeah. So I'm hearing there is some data you could get from them. And certainly, you know, in terms of big data for general policy planning, you know, mobility data for transport planning or something like that, we could do a lot better job. In fact, your proposal around the Universal service funds, which have, you know, disastrous stories to tell across the globe, with a few exceptions, but, you know, really not limited to rollout of services, etc., might well be better used to know in a data environment to get make the contribution, the public data, the data, the private operator data that's contributed to public data that can then be accessed by governments for planning or by startups, for creating apps or to all sorts of things that might be a better use of that. But just to just to speak a little bit about the data. So I mean, historically, the indicator data was collected from administrative data, which, you know, simply even the total number of subscribers has been enormously problematic because of the multiple SIM card ownership. So, you know, it's only through the demand side data that is really time consuming household and individual level, you know, nationally representative data that you can go back and model properly because it is representative that you can get the kind of disaggregated data that demonstrates, you know, the intersectional inequalities that we see. So if you're just to talk about a lot of this aggregated gender data does at the international level in it speaks about, you know, it speaks about women and it's kind of those groups. And so, you know, we need we need these interventions to address inequalities that women experience. But in fact, it's a very specific group of women experiencing those. And it's this women's intersection of being rural, of being, you know, unemployed or cetera, etc.. And in fact, you know, urban women, even urban black women in South Africa simply by being urban, you know, have better digital access than a rural African man, a black man. So these kinds of, you know, nuances that we really need for policy intervention because policy interventions that are, you know, really either scattergun, which is one of the problems, but also that kind of using this. In fact, you know, this descriptive data is actually kind of misinforming if it doesn't actually allow the kind of nuances and granularity that you need for policy interventions.

HAROON BHORAT: That's very, very useful. Thanks, Alison. I have a few rejoinders, but let me let me open the conversation to the audience. And we do have some written questions which what I'm going to do is I'm going to pick out some interesting ones and then open it to the floor and feel free to dive in if you if you think you're well-placed to to answer it. So the first question, which I thought was a very pointed one, is which we haven't really spoken about, but we've spoken broadly about education is around the role that elementary schools so primary schools can play in promoting. So the formal question is in embracing the digital world, But I guess it would be in providing the anchor for promotion of digital skills. So what role can primary schools play? Anybody want to take a go at that?

LANDRY SIGNÉ: Perhaps. I'll be happy to do to let one of our team member, Jabulile or Zaakhir, or unless you want me to jump in. So I'm happy to give you the floor.

HAROON BHORAT: Zaak, do you want to have a go at the human capital side?

ZAAKHIR ASMAL: Um, yeah. So I mean, I think in the report we speak about primary school and how it the foundation upon which the higher level skills must be. Form later on. So it's key that I mean, some of it is not even a skill specifically. It's about having proper cognitive skill development at the entry level, which provides the basis upon which to build up the skills that are required to participate effectively in the digital economy. And I think the other thing also that we've mentioned that's important is that it's important for digital infrastructure to really be incorporated in that environment, because we can talk about digital skills, we can put in a curriculum. But if those schools don't have access to the infrastructure and they can't actually it's not theoretical, right? They need to physically able to know how to engage digitally. And I think I'll leave it there. But I think that we can maybe expand on that a bit more and maybe a bit another perspective.

ZAAKHIR ASMAL: Okay. No, but that's useful. Landry, can I? You are close colleague and coauthor on the report Time. I feel free to cut in on you I'm going to ask the next question, which is actually a question for Cecilia, I think, because it's a really interesting one. It is. How can the African diaspora be helpful? And so I guess I would ask you that, Cecilia, whether you've found there's an African diaspora in the northern countries that that you found has been useful in connecting the continent to northern employers.

CECILIA VÄRENDH MÅNSSON: I mean, I think I mean, we're building the entire business model on trying to solve the global tech talent crisis with African talent. So in that regard is really what we're trying to do. Looking at Africa, we know that it's the youngest, fastest growing, flexible, hard working, highly interesting about international possibilities. Really finding them, nurturing them and solving the big problem that we're having, having in Western countries when it comes to not finding the right people quick enough to extensive salary rates, specifically on the West Coast here in the US, and really solving this big challenge with African people. So I think it's tremendous opportunity, but there are many things that needs to happen on the ground. As we have discussed, it's the infrastructure, it's the training. It takes time. I mean, if it's if Google said it's about or Google and Accenture in their report, we're saying 170,000 tech people on the continent. That's definitely not enough to solve the global tech telling problem.

HAROON BHORAT: Yeah, I mean, I often think just as an informal point that networks are so under emphasized, right. So if you had a a senior executive who was from Ghana at Amazon, suddenly that opens up a portal to sourcing skilled people in his or her home country. And there was another question which we haven't really touched on, which is around mobile money and whether it can play a role in facilitating financial inclusion for marginalized groups. And I'm not sure who would like to take it. Maybe Lesly or Alison.

CECILIA VÄRENDH MÅNSSON: That's part of my PhD research.

HAROON BHORAT: Okay, Go for it Cecilia.

HAROON BHORAT: And any of you can carry on afterwards.

CECILIA VÄRENDH MÅNSSON: I can just say very briefly, because of digital problems, because of lack of infrastructure in the most remote area, because it's important and it's capital intensive for microfinance or for

banks to actually go and invest in the digital skills modules that we teach on the literacy on the continent, on the countryside, on the continent, using mobile money for financial inclusion is it's believed to help, sadly, the PhD where we actually gathered for a year, the data on the ground. It points, sadly that it's not helping so well, not yet at least. Sorry, and I will stop it there.

HAROON BHORAT: That's fine. And then Alison?

LESLEY GOH: Maybe I'll chime in. Yeah. So I'll comment on what I experience in Indonesia with digital money and mobile wallets and all that stuff, because I moved from Washington, D.C. to Jakarta almost a year ago and there is such a vibrant fintech ecosystem. There's I have about 45 digital wallet now through different fintechs, you know, for different purposes. But my point to this is that is this one of the entry points for many of the basic pyramids, folks who do not have a bank account in the rural communities if they have access to this. Imagine a farmer, a smallholder farmer, having access to a digital wallet now and he's able or he or she is will be able to access inputs, suppliers, seeds, fertilizers, pesticides, etc. through that mobile account and transact in such a way that doesn't depend on cash anymore. And then over time, that data will accumulate to create even more useful, meaningful insights about the smallholder farmer, which the fintech and the banks can then use to really create a better profile on the risk profile of the smallholder farmer and hence create financial access to these people, to farmers. Now, this is one of the choking points of many of the informal sector workers where they do not own land, they do not have physical assets. But with this access to this data, this behavior information. Now you have more insights about the risk profile, the ability to pay back the money and the ability to use that money for productive use. So I find that the direct connection of mobile money or digital money to the base of the pyramid is a clear line of sight for opportunities to help them create more financial inclusion opportunity. So I think this is one area that could be a leverage point in Africa. Kenya did that well. Many other countries can really step forward and deliver.

HAROON BHORAT: Let me ask you this, Lesly, and then also to draw Alison in is to what extent, as a follow up, are we are we thinking? Insufficiently about prices. So in other words, we think about coverage. So let's provide mobile money. Let's make sure there's access to broadband, access to the internet. But actually, we're not thinking about relative prices. So if you think of interconnection fees for mobile money operators or if you think of the price of broadband. So there's some data which shows that internet poverty levels, internet access rates in India and Zambia are the same, but internet poverty levels. In other words, usage rates are much, much lower in Zambia relative to India, and it's to do with prices. The price of broadband is much, much higher in Zambia relative to India. So to what extent are we not thinking enough about these structures, about prices? So we provide all this coverage, but in fact, it's too expensive, in Alison's words, for, say, an African female in a rural area in South Africa to actually make use of it because it's just too expensive. So what do you think Lesly is about, just access? Or do we also have to think about fees and prices and so on? And then I'll hand over to Alison.

LESLEY GOH: Well, this is a topic that my husband that in his PhD. I'm fintech in financial inclusion, and he talks a great deal about access, affordability and looking and inclusion and active usage and so on and so forth. So I think I would defer to him for that matter. But from my perspective, I learned through osmosis in the years that he got his PhD, that these are key elements and you have to balance the forces to make sure it's affordable for the people who are at the base of the pyramid.

HAROON BHORAT: Okay, Alison.

ALISON GILLWALD: Yeah. So I think, you know, our data over a long period of time, well over the last decade of mobile money shows direct linkages between availability of mobile money and digital inclusion. And that's particularly where we can compare the just extraordinary take up of mobile money in East Africa compared to other countries that we survey. You know, when most Africa and even southern Africa where in fact, you know, financial regulatory constraints actually prevented the take off that had happened in a almost unregulated financial environment in Kenya. So there was an example of, you know, a very effective financial regulation actually constraining this take. But even in underbanked communities like Africa, like South Africa, with these like underbanked communities, there has been the use of mobile money, although it's far less than in other areas. I just wanted to also mention, you know, again, it goes back to the basic constraint around internet penetration and take up. So when we talk about mobile money and the take up of mobile money that we saw in

East Africa, we're really talking about, you know, very basic airtime. So these are not necessarily people with smartphones, etc.. So that really is an important entry point for the bottom of the pyramid. These are people who have no other alternatives and do not have bank access. They do not go they literally had to travel physically with money in their pockets to get to places, to markets, etc.. So in nor is it I think there's lots of papers, lots of research on the. This of course, is quite different from, you know, internet based wallets and things like that, which have a whole lot of much, much greater value add. And you can begin to build this data around people and get them safeguarded and profiles for credit and for micro-insurance and those sorts of things have enormous value adds there. But as I said, it goes back to the inability to have this paper in the slides that I could show you, actually show with a microenterprise survey that we do with the bank is that a large number of informal sector micro enterprises, micro-enterprises and informal sector people actually have a smartphone. It's surprising number to actually have a smartphone but actually don't use the internet. So again, it goes back to the demand side constraint, actually, although that seems like a supply side issue, it's actually a demand side constraint.

HAROON BHORAT: I think that's phenomenally useful.

CECILIA VÄRENDH MÅNSSON: Can I say.

HAROON BHORAT: Yes, please, please.

CECILIA VÄRENDH MÅNSSON: One very small point at this point. To the individual who wrote who asked the question. I published a blog exactly on this topic on the Brookings site. So just Google mobile financial services can increase the impact, but it's more complicated than what we think. The story is more complicated than what we think. It's on Brookings.

HAROON BHORAT: Wonderful, wonderful. That's that's a much better way to answer that question. Thank you. Thank you, Cecilia. And unfortunately, our time has run out, so we have many more interesting questions. There was one in corruption in technology, but we just didn't get a get the chance to go there. But I think it's a phenomenally interesting one, perhaps one for Brookings to follow up on as a part of a research agenda, the sort of technology opportunities that we have available. But from my side, if I could hand over to the director of AGI to to see us home, if that's all right. But this has been phenomenally useful. I think there are a couple of lessons about infrastructure, about education, about pricing. I keep on coming back to that, about regulation in the digital universe that we really do need to resolve and unlock for sub-Saharan Africa. And I think again, back to my introductory comment, if we don't talk to the level of detail. That's required, whether it's about what regulatory fixes we need it need, or whether it's about quality of coding schools. I think we are always going to be back in this environment talking about the grand challenges rather than the specific fixes. But let me stop there and thank you all for attending and hand over to Aloysius if he has some final words of thank you to say to the audience.

ALOYSIUS UCHE ORDU: Haroon, thank you. Thank you very much. The entire panel. It's really been a privilege to have you guys discuss what is clearly a very, very important topic for our continent. Alison, Cecilia, Jabu, Zaakhir, Lesly, of course, Landry and Christopher and you yourself, Haroon I would like to really, really on behalf of the Africa Growth Initiative at Brookings Institution, thank you all for making the time to join us today. Thanks to to the staff of DPRU, and staff of the AGI, and our Brookings colleague in Communications who have made this challenge of navigating so many continents and linking us all up to have this brilliant conversation. Of course, without our audience, we wouldn't be here. And our really, really sincere thanks and appreciation for the audience who stayed with us throughout this session. Thank you all.

HAROON BHORAT: Thanks, everybody.

CECILIA VÄRENDH MÅNSSON: Thank you.