JFAC S4 EP 2: What does peecycling have to do with agriculture?

Dr. Caitlin Courtney: [00:00:00] We collect urine from waterless urinals. The urine contains nitrogen, phosphorus, and potassium, which are the key components in fertilisers. We use reverse osmosis, um, like seawater desalination to concentrate the nutrients in the urine and make a concentrated liquid fertiliser.

Ntombini Marrengane: Did you know every time you urinate, you create the potential to boost agricultural production?

What we casually refer to as waste, something flushed without a second thought. is in fact exactly the opposite. Not only can water and valuable nutrients be extracted from urine, something playfully called pea cycling, for plant fertiliser and building materials, but precious H2O can be saved too. If we use new tech that's still being researched and tested, Instead of pulling the handle on the cistern and sending at least 12 litres of good drinking water literally down the toilet.

This goes beyond [00:01:00] saving the planet. It's about health and sanitation for its people too.

Bill Gates clip: I want to talk to you today about toilets.

In rich countries, you just take the toilet for granted. It's magical that there's a sewer system bringing water in, taking away the waste, and it all gets

cleaned up in a processing plant. However, for the poorest 2. 5 billion in the world, they don't have this. So how do we solve this? Well, some scientists that I work with said that we should challenge the world to come up with a way of taking the waste and processing it locally.

We call this the program to reinvent the toilet. Several reinvented toilets are being tested right now in Durban, South Africa. Durban's a [00:02:00] good place to run these tests because the city is growing fast and many people there don't have modern sanitation, which means that even if they have access to a toilet, the waste can get into the environment and make people sick.

A typical toilet needs water, but many of the new approaches don't require any water at all. Some of them don't need electricity either. Others run on solar power. All of them remove the pathogens from the waste, and most importantly, they don't have to be connected to the city's sewer system. I'm optimistic that eventually we'll find approaches that make great sanitation available to everyone.

Ntombini Marrengane: That was Bill Gates speaking about one of his projects to reinvent the toilet. Durban is just one of the places where scientists and researchers are finding ways for advanced sanitation technology to make the most of arguably the most valuable natural resource of them all. Capturing nutrients from our urine and using them to help grow our food is [00:03:00] something the Rich Earth Institute in Michigan, USA has been doing for over a decade now.

At the University of Cape Town, Dr. Dylan Randall in the Civil Engineering Department has been making urine into fertiliser and even bioglue to make ecobricks. He explains more.

Dr Dylan Randall clip: A lot of the nutrients found in urine. So for example, the phosphorus, the nitrogen, if we allow that to enter the environment, we get eutrophication.

So we get the algae blooms that typically form in dams. But if you were to recover those nutrients, you could produce a fertilizer. And we're actually running out of natural phosphorus, for example. So if we recover this phosphorus from our urine, we can produce the fertiliser in a more sustainable way.

Ntombini Marrengane: Welcome to season four of the Just for a Change podcast, powered by the Bertha Center for Social Innovation and Entrepreneurship. I'm your host, Ntombini this season, we're looking at unexpected connections, [00:04:00] surprising overlaps, and unusual alignments in the work being done locally and globally that are contributing to more sustainable ways of living.

And just a reminder that the view shared by our guest may not necessarily reflect the views of the Bertha Center. In this episode, I speak to Arian Herman, an award winning social and climate innovator who has gained a

lot of attention and funding for problem solving in the sanitation space. He will tell us more about his venture Liquid Gold Africa.

But before we get into that, Let's find out more about P Cycling from the winner of the 2023 Bertha Center Youth Innovation Essay Prize, Caitlin Courtney.

Dr. Caitlin Courtney: My name is Dr. Caitlin Courtney. I'm a lecturer and researcher at the University of Cape Town, and my research focuses on circular economies, specifically resource recovery from urine and non sewage sanitation systems.

Ntombini Marrengane: Kaitlin graduated with a PhD in civil engineering and is now a [00:05:00] lecturer in chemical engineering at the University of Cape Town. We chatted to Kaitlin about her groundbreaking research into non sewage sanitation systems. First, I asked Kaitlin to explain what non sewage sanitation systems are and how we can use them to harness value from waste.

Dr. Caitlin Courtney: Let's start with what a sewage sanitation system is. So this would be something like a toilet or urinal that's connected to a sewer line. Urine and faeces, uh, which are often referred to as yellow and black water, are typically mixed with all our other domestic grey water. So this would be your shower water, your kitchen sink water, etc.

And then this mixture would be transported via a sewer line to a wastewater treatment plant. There are two challenges with this setup. Firstly, is that, Wastewater treatment plants weren't designed to recover the nutrients in the wastewater. And secondly, those nutrients are very dilute. For example, um, urine contributes the majority of the nutrients, but [00:06:00] only 1 percent of the total volume.

A non sewered sanitation system would be any sanitation system that's just not connected to a sewer. Sanitation systems can also be source separating. So this means that the urine and the faeces occur separately from each other. This also allows for us to treat them differently and then we can maximise, uh, the value that we recover from them.

So, for example, at UCT, we collect urine from waterless urinals. The urine contains nitrogen, phosphorus, and potassium, which are the key components in fertilizers. We use reverse osmosis, um, like seawater desalination to concentrate the nutrients in the urine and make a concentrated liquid fertiliser. For the faeces, for example, there's a company called Sanergy in Kenya and they use black soldier fly larvae to decompose the faeces and produce another type of fertiliser.

Ntombini Marrengane: That's really quite amazing. [00:07:00] Because we're dealing with human waste, hygiene might still be a concern. So I asked Caitlin, how can we ensure the technology remains safe, especially for those who are more vulnerable?

Dr. Caitlin Courtney: The interfaces that non sewage sanitation systems use are often identical to those that we currently use.

So like a toilet or a urinal. So it's completely safe for the user slash donator. Um, Um, but in terms of the products that we produce from urine, we mix the urine we collect with calcium hydroxide, commonly known as lime. And this raises the pH of the urine, which then inactivates any pathogens, um, that might be present.

So this means that the fertiliser we produce is also safe. The high pH has another advantage. It stops the urea present in urine from breaking down into ammonia. And it's ammonia which, uh, gives toilets that horrible smell when you don't flush them for, for long enough.

Ntombini Marrengane: It sounds like this could be a game changer for those [00:08:00] who don't have access to water and sewage systems.

But I was curious to know, what are the biggest challenges that we face in having technology like this used more widely?

Dr. Caitlin Courtney: I think it's just a lack of awareness, and I'm sure there's also a bit of an ick factor. I think most people don't even know that they could use their urine as a fertiliser.

Collecting your own urine at home is really simple. It's as simple as attaching a big funnel to a jerry can and then peeing into that. In our lab, we

use calcium hydroxide to raise the pH and prevent the odour, which is probably inaccessible to most, but you can also use ash from a fire or your brine and it will also raise the pH.

But in terms of a biggest scale, I'm talking citywide adoption. The biggest challenge is that the treatment technology we're developing to produce fertiliser from urine is still in its infancy. We're only just at the stage of testing it at a pilot plant level. And until we're [00:09:00] able to produce a product on a large scale, there isn't really an incentive to collect urine on a large scale.

It's all connected.

Ntombini Marrengane: Caitlin is not alone in seeing the potential in the precious resource of urine. Caitlin. And in saving water too. Access to water and sanitation is one of the United Nations Sustainable Development Goals for 2030. According to the UN, half the world's population is already experiencing severe water scarcity at least one month a year, and this is projected to rise along with global temperatures as a result of climate change.

Just a reminder to subscribe to this podcast so you don't miss other episodes, and be sure to spread the word about this important series. Joining me today is Orion Herman, chairman of Liquid Gold Africa. Orion's company is working on developing dry sanitation solutions to conscientiously use our planet's resources.

Manage costs for the end user and identify the potential for new products in a simple and cost [00:10:00] effective way Thank you so much for joining me today. Ariane. It's exciting to have you with us.

Orion Herman: Thank you Ntombini so much for having me on the show.

Ntombini Marrengane: Tell me a little bit more about how you ended up working in this sector Were you always interested in the sanitation space?

Orion Herman: So in terms of working in the sector, um, always been interested in water specifically, because, uh, I mean, this is the most precious resources we have on this planet and the way we consume it has been, you know, uh, not sustainable. So I knew I had to sort of make a difference within the space. So, and that's led me down to this journey.

Ntombini Marrengane: So how did you first discover this particular gap in the market that you could potentially use to bring about huge social benefits?

Orion Herman: Prior to me getting married or just on the cusp of me getting married, you know, I knew I needed to leave an impact on the world. I felt like there's an urge of doing something great socially as well as environmentally.

If you look at the data or the content, a lot of people were talking about climate change, um, and South Africa as a whole, uh, and [00:11:00] Scotland is focusing a lot on energy, but fundamentally the real problem was actually water. Um, you know, so without water, I mean, Basically can't survive. Uh, everything, all industries pretty much collapsed.

And this is the real giant. And this is where I knew that I wanted to make a contribution or add value too. Um, and that's what started the journey and that's what created the vision. Um, and that's what wakes me up every single morning.

Ntombini Marrengane: What has been the most challenging part of your entrepreneurial journey so far?

Orion Herman: So in terms of our biggest challenges so far as an entrepreneur is definitely the entry into market. Uh, we're not literally updating or improving on a new technology. We are creating a whole new value chain around sanitation and using toilet resources as a byproduct for agriculture. Uh, that has been our biggest headache and our biggest challenge because it's all completely new.

Um, to industry, whether it's from the private sector, government, as well as culturally, in terms of how you look at waste. And that fundamentally has been our biggest challenge.

Ntombini Marrengane: What are some of the common [00:12:00] misconceptions that people might have about your work?

Orion Herman: Yeah, so, and that's a good question. So culturally, like people perceive human waste to be a negative element.

There's obviously the health challenges around it. There's the element of managing waste. I mean, you don't go through school wanting to be a sanitation entrepreneur, you know, uh, it's not, it's not highlighted, uh, as a glorified job, but it's, it's a massive challenge. So you have to sort of deal with all the challenges associated to the cultural norm.

Uh, people perceive human waste to be just, you know, push the bucket down the line and that's that. And somebody else will deal with it. Uh, adding a circular lens to it changes the narrative. Because policies and regulations that adds complexities around it. So that for us has also been a bit of a challenge as well.

Ntombini Marrengane: I'm really curious. So tell me about the first time you pitched this idea.

Orion Herman: Um, yeah, as you can imagine, quite interesting. A lot of, uh, raised eyebrows, but I think our, my, our very first pitch was [00:13:00] to, uh, professors from university of Johannesburg. Fortunately, the the research and the scientists understood what, what we, what we mean, but to see an actual product from it.

Was was incredible. And I'll never forget the one of the professors saying that we actually going to make money off people's urine, and we had a good laugh at it. But it was it was a key milestone in the validation that that is possible because the human body is so incredible that we produce a natural phosphate that we mind from the ground, and it's so energy and chemical intensive.

But now the human body produces it naturally, and we've just found a way to, to harness the nutrients from the body. And so a lot of good, I think using that approach by pitching to sort of university research professors was easier than pitching to, you know, a business sector because they got it. And I suppose that gave us confidence to take on the next steps.

Ntombini Marrengane: And what was the reaction when you pitched it to the business community?

Orion Herman: So by that time, when we did pitch to the business community and [00:14:00] to, uh, potential clients, so there was a bit of giggles, uh, in the beginning, it was, are you going to do what? But it was great because now there's, there's an opportunity.

Once we were able to explain why the problem was there. Because human waste creates so much downstream damage. Uh, they got it and been able to say, we have a solution to convert the waste to fertiliser. They got it, which was nice. And I mean, I'll never forget that. The same is always, every

time you visit the bathroom, you produce enough fertiliser to grow one loaf of bread automatically.

They got it. Oh, that's potential. You know, uh, to produce something new. So the willingness to help was great, but what we found was we were nice to have, not a must have. Uh, and that's what also, um, you know, made us sure that we go through the cycle of being able to, okay, where do we start now? Which partners do we use?

But I think well received, a lot of jokes are on table, as you can imagine, but the guys saw the potential, which was great.

Ntombini Marrengane: I think what you've just shared is, is really important point. Because as [00:15:00] human beings, we tend not to think about, um, we tend not to think about things that are sort of like not a burning fire in our face.

Um, and if waste has been part of the human journey, um, since the very beginning, and it's always been there, trying to now problematize it. And demonstrate a solution, um, can seem quite, as you said, a nice to have because it's going to go away anyway, theoretically at least.

Orion Herman: No, absolutely. It's so key because the way we built infrastructure and systems is we just shift the bucket, right?

And let somebody else manage it. As long as it's not within my, uh, not within my sphere, it must just move along because that's the way we've designed it and built it. Um, however, that's caused downstream impact and environmental impact because of population growth. That's put pressure on our infrastructure.

Um, It's still, I mean, 2. 4 billion people on our planet still don't have access to safe sanitation, but [00:16:00] yet, uh, there's, there's more phones in Africa than there are people. And yet 50 percent of our population don't have proper access to sanitation, which is a fundamental building block for improved life.

So we have to look at alternative designs. We have to look at the areas that we live in and how we come up with solutions to, you know, uh, to adapt in that environment. I mean, we took our design from the European markets in terms of how we do infrastructure, but they water flush. We not. So something we have to consider when, you know, civil designs, architecture designs, and forward thinking in terms of the way we look and manage waste, which is key.

Ntombini Marrengane: I think you've set yourself quite a challenge there, not just to change the way that people think about waste, but more critically, challenging people to find their role in the sustainability journey, finding their role in creating ecologically sound and sustainable solutions. Sustainable communities. Um, that's that's that's not a small job.

Can I ask you? How do you see South Africa moving [00:17:00] more towards this technology?

Orion Herman: What's nice about South Africa is that we are sort of leaders within the African space, and we are willing to test out innovations. So I think people are at a cusp where enough is enough, uh, things need to change. We cannot still be walking with a bucket full of our waste down to a river and emptying that out.

So fundamentally, you can see there's a shift within society that people are, they need change, right? Um, dignity has been stripped. So, Fundamentally, I think people are being more conscious now with regards to the environmental waste and how we handle waste. So South Africa as a whole, I think it's great landscape to test and pivot and trial out new innovations on this.

I mean, we get a lot of support from the local government in terms of looking for alternative sanitation solutions, which is great. Because that comes from the pressure of society and that comes from the pressure of the communities that we serve. Is that we're not, we don't want a chemical toilet anymore.

We want alternatives because it's not, it's not dealing with the problem. So I think mind shifts are [00:18:00] changing. Uh, not as rapid as we would like it to be, but things are changing, which is positive for us.

Ntombini Marrengane: And in terms of accessibility, is your technology something the average household could make use of, or does it have to rather be addressed at a systemic level by government?

Orion Herman: You know, so when we designed our technology, we sort of looked at, there's this balance between making sure that we're commercially viable and sustainable so that we can grow and impact. And then there's a social need, right? So what we need to find, what is the core? What are we really trying to solve?

And that was to serve the underserved, right? But we knew that the commercial model would take a bit longer. Um, so we designed our technology to serve the underserved markets because that has a whole ripple effect within this. So yes, we can plug in to a household level, um, for the, for the formal markets, but our design right now, and there's As organisation right now is to serve on the markets because if we can create a citywide, uh, sustainable sanitation chain that creates jobs, creates byproducts, um, surely as we evolve, we'll, [00:19:00] we'll meet the needs for all markets.

But right now, as an organisation is dealing with the biggest challenges is the very urban and informal markets. So we've designed it to be awkward to create jobs and to feed into the local supply chain.

Ntombini Marrengane: And fundamentally, you're trying to change human beings relationship with their environment. That's not a small job.

You've also come up with Africa's first urinal for all genders. Can you tell me more about that and how much water it can potentially save per day?

Orion Herman: Yes, so we've built Africa's first, uh, urinal, uh, for males and females designed for females by females. So we pretty much looked at how females, uh, females behavior, uh, within the public space.

So most women in South Africa are taught, in fact, Africa are taught not to sit. Or touch on the technology when they, especially when they go into a public area. So we said, Hey, why change the behaviour? Let's just change the design. Uh, and why do only males get an option to urinate as a second option?

Females don't [00:20:00] because four out of five times you visit the bathroom is to urinate student do number one, but females only have one option. And that's where the, uh, we stand was introduced into the market. So it is a gender neutral, but when they, when we say gender neutral means that, you know, women get their own and men get their own because privacy is still very important to a female.

Um, but women don't get it, uh, they don't touch it. There's no transfer of bacteria. It's got a one way valve, so there's no odours within the environment and you urinate safely within that. And that contributes towards sore separating, uh, which is a key factor in terms of how we process our waste and create new byproducts from the waste.

Ntombini Marrengane: And how much water can it potentially save per day?

Orion Herman: Good question. So per annum, it saves between 120 to 130, 000 liters of water per year, per year.

Ntombini Marrengane: Please, can you tell me more about how urine can be used as a valuable resource for our agricultural industry?

Orion Herman: Brilliant. Um, if you look at research papers, for years, scientists have have been saying we should take, um, you [00:21:00] know, the very waste we reproduce naturally to the farms that feed us, but we just didn't have a link or or technology or commercial element for this.

So to give you an example, every time you urinate, you produce enough fertilizer potential to grow one loaf of bread, right? So that means One, a human being, you and I, can literally take care of our food for the whole year from the waste we produce from our urine. With that information, I mean, with that agricultural space and knowing that, this is all wasted potential.

So urine is full of nitrogen and phosphorus, all the key nutrients for agriculture growth. Uh, but yet we flush it down the toilet, it lands up on our wastewater treatment plants, and eventually down to the beaches that causes E. coli. We've been able to build technology that's been able to source separate, pull out the valuable nutrients and phosphorus.

Ntombini Marrengane: How do you think harnessing urine can empower vulnerable communities, and women especially?

Orion Herman: By doing soil separation at the beginning of pipe, uh, is, is fundamental. It's key because that pretty much saves in terms of water usage, but it also allows us to create [00:22:00] jobs through waste management. By being able to recover nutrients at a community level, That means you're able to have access to important inputs for agriculture, especially for your emerging farmers that cannot participate at a large commercial scale because the inputs for agriculture is so expensive.

To give you, uh, to give you perspective, South Africa imports 95 percent of its fertiliser from the Middle East. Uh, and I've been able to have locally produced fertiliser from the human body allows your emerging farmers to participate more, to become more competitive in terms of pricing. Uh, it impacts women, um, specifically because now they don't have to, for example, be exposed to violence, uh, or open defecation or open urination, uh, and providing toilets at a household level.

And so separating allows them jobs to be created, allows more production to take place, allows women to have more time within the communities to do something more productive. And more importantly, it's that access to the fertiliser for the emerging farmers that allow people to become more commercially viable and to grow wealth and our legacy wealth.

Ntombini Marrengane: Is there a [00:23:00] particular agricultural sector that you've, that you've targeted Um, in marketing your product or where you find it's used more prevalently?

Orion Herman: Yeah. So we went about sort of like engaging with your large fertiliser companies, which, which is great. And they showed a lot of potential with regards to the uptakes of the fertiliser.

But our core is, uh, you know, focusing on. mandates that focus on, uh, merging farmers. So for example, organisations like for farmers, for example, that work specifically with, uh, merging farmers, we want to get into that supply chain and help grow that particular market. You know, as an organisation, as a business, we always look at what's going to be commercially viable and what's going to make us more sense as an organisation.

And that's why we always partner with. Uh, organisations that do support the merging farmers. We come in competitively because we've been able to reduce our cost to create the fertiliser and therefore allowing us then to have a positive, uh, pricing point [00:24:00] for the merging farm.

Ntombini Marrengane: Can you tell us about some projects you're currently working on?

Orion Herman: Just in terms of the project that we are currently working on in KZN, uh, Cato Manor. So we are providing safe access to sanitation for

500 households impacting 2000 people where we provide full value sanitation into a household. So that means we actually put in a urine diverting toilet that offers for both ones and twos inside a household.

Uh, we create jobs through our frontline team. They collect the waste and then bring, they bring the waste into the depot. But not just, um, the sanitation. We also able to take off the kitchen waste. And the reason why we do that is because we're able then to offer the full value chain and be able to take the organic waste and convert it into high value products.

So the products that we are producing for this particular project is both the fertiliser from the urine, uh, black soldier flies for the faecal matter and kitchen waste, uh, which creates great compost. Our aspiration with this particular project is to reach 25, 000 households.

Ntombini Marrengane: Can you tell us a little bit about how you recruited the households to [00:25:00] join this project?

Orion Herman: And that's a good question because creating community trust is the key element and critical point on this. So we were able to engage with influential people within the community. And what we did was we created a nonprofit organisation called Ukuleleka, which means to be free. It was branded by the community, it was named by the community.

And we first engaged with regards to what was on the ground, what is the status quo on the ground and what, what does safe sanitation mean to the

people that we were going to serve? So we didn't come in with a silver bullet because sanitation, there is no silver bullet in sanitation. You have to understand what your end user requires.

So therefore, we were able to offer a. compost toilet, which is urine and faeces to offer the full value chain, which was important to our end user. Uh, and that's how we started to engage. We ran community events. We had training that we recruited from the community. Uh, and fundamentally the members of the community are the leaders of this project.

Ntombini Marrengane: [00:26:00] And is there a cost to the end user?

Orion Herman: Uh, not at this stage. However, we did find out in terms of all people willing to pay for these services, and we have a resounding 95 percent of the people that we engaged with are willing to pay for the services, and it was very interesting how much they were willing to pay for the services, and that just meant the demand and the need for this.

So, I mean, people are willing to have to turn around a month, um, for the services that have access to the toilet, as well as the waste management weekly. Um, so we are going to try it on in the next three months. We're giving a subscription model where they get for free now. Uh, and then after three months, we're going to start testing the subscription model on this.

Uh, and it's important to do this because this holds accountability, uh, for the technology that we provide and it creates jobs at the same rate.

Ntombini Marrengane: Exactly, exactly. And it also creates a sense of empowerment for the users, right? You're not doing them a favour with this technology. They can hold you [00:27:00] accountable for levels of service, which I think is quite important.

One of the cornerstone questions that we're asking all of our guests this season, um, across different sectors is, what does social innovation mean to you?

Orion Herman: So what social innovation means to me as an individual is that, you know, we get to change a generation in terms of improved health, right? Because as I mentioned before, the fundamental building block for improved access to sanitation is so large, so big, that it has a ripple effect with time.

Generations as a ripple effect with environment. And, you know, that's what gets us up in the morning is that we are able to change lives, especially for women and children, because women are the custodian of, you know, instilling health behaviours for the previous generation, for us being at the forefront of being able to provide access, um, as well as great jobs through waste entrepreneurs and changing the narrative around sanitation engineering allows, you know, to just impact [00:28:00] on that narrative.

I think that's, that's key for us and allows us to make a social change and environmental change, especially where we are as a society and as a human race.

Ntombini Marrengane: My last question for you is, why do you do what you do?

Orion Herman: I'm a family man, so I have four children of my own. Um, the biggest thing that I needed to do is show my children that you can make a difference.

What seems impossible is possible if you just keep on believing and, you know, leaving a dent in the world, changing in a positive spectrum because we may chase and You know, artificial, uh, sort of like artificial dreams, but I mean, really making a tangible impact on society, uh, and changing it for my own children, leaving them a legacy of impact.

That's why I do what I do, you know? And I think that's the culture we have within our organisation is to make a difference every day. We don't see the organisation as a commercial model. We see organisation as impact first and commercial model comes. Um, and that's why we do what we need to do is just to change lives.[00:29:00]

Ntombini Marrengane: Thank you so much, Arianne and Caitlin, for sharing your insights with us. It's really quite remarkable what can be done with this

supposed waste product that is universal to all humans. Tech like this really can drive our society towards a more just and equitable future. Thank you.

Orion Herman: Thank you so much.

Ntombini Marrengane: So what does this mean for you and me?

A big question is, can we change how we think about sanitation and water use? If we challenge ourselves to look for opportunities, we may see that innovative sanitation has the potential to yield water savings, generate eco-friendly fertiliser, sustainable building materials, and new jobs. It's amazing to think we can harness our biology to create opportunities for sustainable communities and greener environments.

Thank you for tuning in to season four of the Just4Change podcast, powered by the Bertha Center for Social Innovation and Entrepreneurship. If you're interested in hearing more about Curious [00:30:00] Connections, then make sure you subscribe to this podcast so that you don't miss any of our upcoming episodes.

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This podcast is produced by 2Stories in collaboration with the Bertha Centre for Social Innovation and Entrepreneurship. Written by Linda Scarborough, produced by Carol Williams, with audio, editing, engineering, and sound design by Kozi Mzimela, with production assistance from Without a Doubt Agency. Special thanks to the Bertha Centre team for their input on the series. For more information on resources used to create this episode, please refer to the show notes.