**R1 - Interview CECIC Huila - 26-6-2022**

**Specialties/difficulties:** Diana’s part is written in cursive, while Susan and Siva interventions are in bold font.

[Diana] *The other is here in Colombia, with coffee, and the other is in Africa, with invasive species, so it is very important, and thank you very much for this space because we know that there is a lot of information that you can support us with. So, do you have any questions? Maybe Susan now tells you a little more about the process. Anyway, we'll be here. Don't ask me anything, I can't find it out, I can help.*

Ok, understood, ready. I'm not going to look at you.

[Diana] *Yes, don't look at me, I don't help with any question because I don't know want the people who I know to tell me, “Diana, do you remember”, “No, I don't remember, I don't do the interview.” So, thank you very much [name], it is very important that you are here. Susan is going to start the interview, we start to record, and that's all.*

Well, then, my name is [name]. I am the legal representative, or the one who represents or directs the Colombian Cacao Research Center - CECIC to do... I will always do, when I have had to present about the CECIC, I always make a summary. A summary because the process has been very beautiful for me, very beautiful in the sense that it was born during a pandemic. Actually, all the meetings were totally virtual. Until today, unfortunately, we have not been able to meet with all the members, or the teachers, or the whole team, but it was born in the middle of the pandemic. However, the idea was conceived like four years earlier. At that time, I was working in the SENA. SENA is a public technical and technological education institution. It is not a university; it is an institution that only gives courses for technicians and technologists. I worked there as an instructor or teacher, whatever you call it, and following that, I am going to tell the essence of the birth of this idea, with the one who is currently my wife. At that time, we were workmates, and we started talking about cacao. She is a research lover, and so am I, and we started talking, and she told me “[name], a cacao research center, we have to contact it”, and I told her “There is none”, and “Well, why not create it?” That was the little seed, that was the seed for it to be born. I began to speak with the professors, with many people, with many people involved with cacao, with its research. A first attempt was unsuccessful because I was not strategic in that sense. Later, for reasons of life, I went to Fedecacao, which is the official entity that is supposed to “represent the union”. Let’s say it like this because that is currently in many things that it is not the time to talk about. When I arrived at Fedecacao, I became the head of research, and at that time, I presented the proposal to the director of Fedecacao, and he told me, “Go ahead, go ahead, there is no problem”, but they never showed interest. I proposed to them that the idea was to make a center where everyone was a member, and not where only one was a member, or a partner because in Colombia, unfortunately, in history there are many research and innovation centers, but the problem is that everything wants to be managed by a single entity, and sadly, in comparison, at least with other countries in the world, the resources that are invested in Colombia to carry out research are really very scarce. Therefore, I am going to say it, we have been taught to fight among ourselves for resources, for money. We all have the minutiae. So, Fedecacao did not support. I left Fedecacao, and the following year, I was having breakfast and I said “Hey, I'm going to return to the subject. I will return to the topic because it is important. I think it's important". That's where I started talking. The first person I spoke to was Diana. I met her when I was in Fedecacao, in a congress. Afterwards, I talked to the professor at the university […]. And in that way, I started. We started meeting, let's say it was about three or four months of calls, and on January 21st, 2021, we had our first virtual meeting with all the partners. Five months later, after many meetings and dissertations on the issues we were going to work on, the way we were going to work, which is not easy, the Colombian Cacao Research Center was born. The story is why it was born in Huila, why it stayed in Huila. If you don't know, I'm going to make a small parenthesis in geographical terms; the department of Huila, there is a place that is representative, or two, San Agustín Huila, where the archaeological statues are, and the Tatacoa desert, and that is a department, it is the fourth, it is the fifth-largest producer of cacao, or the one that produces the most caca in Colombia, and conscientiously, I presented the idea to them so that they would support us. We are working on it; they want to give us some financial resources to build the first headquarters. So, we have always had contact with them, and that is why it was the commitment that it was born in Huila, and not in Bogotá. In addition, there is an important detail to take into account, which is that almost all research centers are in the city or are born in Bogotá. There is an impressive centralism in Colombia, and at this moment you have realized that the regions are already gaining much more strength and determination to make decisions within their own territories. And, that the center is located in Neiva, in Huila, marks a pattern of saying, "this is from the regions and for the regions." There is no cacao in Bogotá because of its height and everything. So, it was born. There it stayed. One of the key points is that it is the first real research center in Colombia, already created and starting to work. We have already begun to advance in some activities, and the other thing is that it is the first research center, among all the centers, that involves academia, producers, and industry. If one compares at least with Cenipalma, which is the research center in Palma, or Cenicaña, or Ceniflores, those centers were created from the same guild, but without interaction, without involving the academia within its composition. This center is special for that, and as it is that special, the Ministry of Sciences did not understand us, and when we went to seek support in the official part, let's say in the organizational part, their response was simply, "Hey, we don't understand you, refer to the other research centers”. That means that we are unique, that we have had to understand each other from scratch, and there I am going to point out a key point, and that is that this center has been based on trust because it took five months... When we were creating it, it took five months to build it in that sense, trust. In Colombia, as I said before, there is a lot of competition for resources, and sitting down with 11 universities, explaining the idea to them, telling them, “Hey, come on, there is little money, but if a single entity manages it, we will be able to divide the earnings or things for each one of us. And not that one manages it and keeps everything, and the others will not be able to participate”. Hence, a part of the essence, one of the main components of that was trust, creating trust between each other. The other was understanding that not all universities have strong research in the entire cacao system. There are universities, such as the technological one, where Diana works, where its strength is transformation, the use of waste. They are not, we could say… They do not have the background in cultivation. So, well, we are going to look for support in other universities, such as University of Amazonia, or University of Nariño, that they have worked more on the cultivation. Thus, each university, each entity that comes to the center is because it has a strength, it has a purpose that it can contribute to the center. One point is that it has not been easy, and I know it is not easy, and that is why the center was created to prove everything, to prove that things do not arrive, that a university leaves, that we cannot advance in some processes because you should understand that the culture in Colombia, unfortunately, is a little slow, it is a lot of paperwork, it is a lot of things. So, it has taken us a year for the universities, for four universities out of the ten or eleven that there are, to give us the go-ahead to be an active member. The others, we are in process, and it is a process. Another of the characteristics of the center […], such as Daniel, such as Susan, such as Siva, without being responsible for their entities. If Susan wants to be a member, welcome, you pay a fee, and welcome, you're in. It has that peculiarity. Let's just say we're being very flexible in that process. However, we are also working on that because the day will come, when the center is a center for people and not for entities, and you understand that for a center to be able to participate in calls, it has to have institutional support, which that is what we are looking for in the future. That is little by little, but we are little by little developing activities not only of research, but of innovation and technological development. So, well, finally, the most important thing is that the center created five macro areas, or the main ones, its five trunks, as I call it, or five strong lines where we are going to work on. It is agroforestry, that area is going to work, or includes from the nursery, the seedling, to the harvest. This entire area will be in charge of all the processes and micro processes that are carried out in the crop. Therefore, diseases are worked there, pests are worked on, […], production is worked on.

**Sorry, the connection was a bit weak. Could you repeat the last part?**

Yes, perfect. Do you understand me now?

**Yes, now, yes.**

Perfect. So, the second area is agroindustry, so it includes everything that is post-harvest, the use of the grain, the husk, or the *cacota*, as it is known, the development of new materials from this raw material, and everything. That's like the strength of that area. The third area is very close to the second, and that is the bioeconomy. It is the first center in Colombia that has the bioeconomy as a main area, and in Colombia four or five years ago, the subject began to be discussed, and cacao and its system because remember that cacao is not a monoculture, cacao is a system. So, the idea is to take advantage not only of cacao, but also of the accompanying species, such as agroforestry, trees, or fruits. So, that is like the concentration of the bioeconomy area. It will enable us to create materials, substances, in the direction or within the framework of that bioeconomy. That is the third area. The fourth area is the Socioeconomics section. Thus, there we work all the part that is family, peasant, cacao economy. We work on everything that is statistics, everything that is social studies around the cacao chain. In fact, all the statistical part of numbers, and information that can be used for the design of policies or support for the creation of policies, that the Ministries of Agriculture or Commerce, or of […] here in Colombia. In that area, it is important to mention that a friend is together with us. Her name is [name], and she is doing her PhD at the University of Pennsylvania, in the United States, and she is very sensitive, she has that sensitivity for the social part, the gender part, the inclusion of young people, that here in Colombia is a huge problem. It is more immense than *Phytophthora*, more immense than diseases; the issue of youth is an essential issue, it is a very important problem, and we are already working with [name] on the creation of projects aimed at ensuring that young people do not leave the countryside. In this new government, and we cannot be oblivious to the new reality that is happening in Colombia, it is time to begin to change many things, and begin to implement new technologies, knowledge. Therefore, this area allows us that. One of the ideas that was discussed, and I'm going to give a sneak peek because I think [name] could not join us at the last meeting, is that we are working on the construction of an observatory of the Colombian Cacao System. So, this is a space where we can gather all the information possible and start analyzing the chain as up to date as possible. If one realizes, in the statistics, the only more or less up-to-date statistics are those that Fedecacao has in production, but one that tells us how many young people there are, how many leading women cacao farmers, where the market is going, that is not there. That information is very difficult, it is very dispersed, so the Observatory, that is the goal, is to consolidate all that information and start doing analysis, from the academia, but let's say it with a very pragmatic, very functional purpose, for the producers and the industries. And now the last area, and I think the fundamental one, is the transfer of technology and knowledge, and appropriation. So, that technology transfer, here in Colombia there has always been said that we are going to transfer knowledge, technology, but if it cannot be analyzed, there is very little appropriation, or it is very unlikely that the producer takes that knowledge, takes that technology and applies it to his crop. It is very difficult. The result is the very low yield that Colombia has in cacao. I don't know if you know, but there I am going to open a parenthesis and a make a comparison; Ecuador, which is a neighboring country, is six times smaller in cacao area than Colombia, but produces seven times more per area than Colombia. So, that leaves us with a challenge because how is it possible that we are bigger, but produce less? Thus, there is enormous potential for that, and this area enables us to do that, to come up with ideas. In this area, we are working with Professor Gustavo Gutiérrez, from the University of Amazonia. He is an expert on the whole transfer issue, he talks a lot about communication and innovation, and innovation networks in the field. So, he has that philosophy, he has that knowledge. Hence, the idea is to start implementing those mechanisms. Hence, there are five areas that we intend to cover the entire cacao area. It is also important that in the chain we are also going to work with industrialists, so it is not uncommon for us to design machinery in the area, at least in the second area, which is agroindustry, just as it is not uncommon for us to be able to begin to generate marketing mechanisms for the commercialization of cacao and by-products. One piece of information that I think you will be very interested in; cacao, in Colombia, we are only using 10%, which is the grain. 90%, which is the husk or *cacota*, plus the mucilage, which is the honey or slime that comes out of the grain, we are throwing them away. In other words, it's that simple, and there is enormous potential there. In Colombia, the Industrial University of Santander, which is also a member through professors Luis and Javier, they are working on the subject of biorefineries. So, we have to start working on that step by step. Thus, that's the story and the summary. I think I expanded a bit, but I want to be as clear as possible. The center is designed to break many things, starting with financing. We have always been financed in Colombia by the Ministry of Sciences, and this center also allows us to work with international cooperation resources. Almost all international cooperation projects here in Colombia are aimed at transferring knowledge, at innovating. The center has that capacity, and many of the cooperation agencies sometimes fall short as they do not have an entity to support them. So, the center was born for that. The point is that we are barely here, this center is a child, a baby, but with enormous potential for growth. There are four more universities that are waiting to be able to enter, or that wish to enter the center; we are in conversation on the issue of financing. The financial issue is a key issue in Colombia, and we must implement that culture whereby the center manages the resources, but that there is something for everyone, and not that the center is going to start keeping everything and for the others there is not anything. So, it's a culture. It was born as a result of the failures of other research or innovation centers that have been made in Colombia. So, this is what I had to tell you, and what a pity that I took a little longer.

**No, thank you very much for this introduction. Thank you very much. We have some questions. First, you have said that there are now four partner universities in your center, which ones are they?**

Yes, that is the University of Nariño, the Technological University of Pereira, the University of Amazonia, and recently the University of the Llanos, which is the eastern part, it is all the plains, all the savannahs. They are the four. The other universities are under the title of the people, of the professors who are accompanying us. So, for us, it is important that the rector of the university says, "Come on, I relegate the professor so that he represents us", that is the connection. But anyway, all the universities are there, contributing.

**You have said that it is the first research center in the cacao sector, but in other sectors there are institutions like this. Do you know why? Why isn't there, before there wasn't a cacao center?**

In cacao, there was an attempt, Susan, in 2008-2009, Fedecacao, as I told you, before it was the Federation, which consolidates all the producers, or a part, and they did have an attempt. They created it, but the point was that this entity remained on paper, it remained there, it never continued. When I was in Fedecacao, I tried to rescue it, but unfortunately, there was a lot of paperwork, a lot of work, and it was easier to create a new one. The point is that Fedecacao, and there is an uncomfortable situation here, is that they are very closed, it is a very closed entity, they don't like to share. So, we invited Fedecacao to take part in this entity, but so far, we have not had a response. But, nevertheless, we will continue. The day they decide to participate, they will be welcome.

**So, you have told a little about the issues you work on. What do you consider the biggest challenges in the cacao sector in Colombia?**

The biggest challenges in cacao, I think the social part is fundamental. In other words, what I was telling you, the inclusion of young people. Here, in Colombia, there were people talking for a long time about generational succession, or change, that I am going to change my father, or my grandfather, for me, or for the grandson, no, people must understand that it is inclusion; how to put the dad, the grandpa, and the young man on the same scenario. How we share knowledge; the grandfather, the father knows a lot about driving, but the youngster knows about new technologies, new processes, or mechanisms. How do we bring those two things together, those two worlds, and make cacao more sustainable? I believe that this is the first point to work on in Colombia, with [name], to whom we have talked for hours and hours about the importance of this topic. The second challenge is how we sustain cacao and make it more productive, more profitable, much more so in a climate change scenario, which is another issue. It is an issue that is already in Colombia, in the world. This year, precisely, we have it, we had it; It has rained a lot, the rains have been reported in Colombia, and this has generated that the same production has begun to decrease. The same thing that happens with coffee, or with any other crop, when it rains, the flower falls off, and if there is no flower, there is no fruit. It's that simple. But we also imagine, and I ask myself, this year it has rained a lot, what happens if next year it doesn't rain? If there is a summer, a time of enormous drought? Cacao is very sensitive to that, what are we going to do? Those issues. As for the rest, I think they are day-to-day issues, or what follows from the latter, the whole issue of diseases, pests. There is also a topic, which is how we take advantage of cacao, and that's where Diana comes in, which is cacao husk. How do we put biorefineries to work and start producing new biomaterials, new substances, so that the producer has another resource left? I'm going to give you a scenario; the producer always sells the cacao beans, why doesn't he sell the entire cacao fruit? "Look, [name], I'll sell you this cob for 1,000 pesos," to give an example, and knowing that all this cob, all the fruit, is going to be used. Obviously, this is a medium and long-term plan, but that is where we have to go, how to take advantage of the fruit itself. I would think that those are like the three areas currently because more can come out.

**For example, on the subject of bioeconomy, you have said that it is an approach of your center. What are the studies or what things are happening on this subject in the cacao sector?**

The cacao sector, well, the same, what I told you before, how to take advantage of all the potential. That is, how we take advantage of the husk. It is a circular economy because the peel is taken, fuel can be extracted from the peel, fiber can be extracted, lecithin can be extracted, and everything is used. Everything is immersed in the bioeconomy. So, how do we begin to produce colorants that are friendly to the environment, that are natural substances that are not going to pollute? A fiber? Fiber can be useful to us, I understand that it can be used for human food, as well as for animal feed. Or lecithin, or pectin. We, in Colombia, a country that imports almost all the pectin used in the chemical and pharmaceutical industry because here we have all the potential. And I'm going to give you a piece of information that I got just like that, as they say, by observing. Cacao production is 63,000 tons of dry beans per year. Annual cacao husk production is around 700,000 tons per year. Why? For every kilo of dry grain that I take out, I produce ten kilos of cacao husk, or husk. So, one more or less, doing that basic math because obviously, you have to look at other factors, but it is a potential. I mean, we have 700,000 tons of raw material there for free, so why don't we start taking advantage? I am aware that it is worth time, it is worth money, but it has to be done, one way or another. So, that, the bioeconomy, allows us that. And there is another component that I am forgetting. The use of the entire cacao production system. In cacao, not only cacao is planted, but forest species are also planted, a type of wood. In the Colombian Amazon, other species are planted, such as […], other species of cacao are planted, which can allow us to have another economy or other products. Or, even easier, in the first three years, when you plant cacao, in the first three years, you can plant beans, you can plant corn, you can plant any other crop that allows us to pay for the families' food security or generate also income while cacao begins to produce. All of this is the system, and all of this is what we have to begin to rescue. Colombia around thirty years ago had been doing these things very well; they were very smart or very disciplined with that, they planted the corn, they produced a good corn, a good bean. From one moment to another, sowing stopped. The only thing that is planted is plantain or banana in some areas, and that’s all. So, it is like rescuing all those potentialities that cacao has as a system.

**Do you know why these practices have been stopped?**

In part because the economic opening came, free trade agreements, it became cheaper to import beans and corn than to start producing them. Research on corn, and that's a good point. Almost all the cacao in Colombia is produced in the mountains, and obviously, there is no technology available in the mountains and there is no way to mechanize. So, everything is manual. Corn prices were very low, very cheap, so the producer said, "why am I going to plant corn, I'd rather go and buy it in the city and that's it." Then, little by little, those habits, those crops, began to be abandoned. But right now, in Colombia, where it is much cheaper to produce corn than to import it, we have to start, rescue that again. Obviously, with new technologies, no longer doing the same as thirty years ago. You have to start changing. We have to see how we can change these accompanying or associated crops.

**You said that you produce a lot of waste, such as cacao husks, which you are not taking advantage of now. Do you know why you don't take advantage of it now? What are the challenges in that regard?**

First, it has not been taken advantage of it because of the lack of knowledge. Here's one of the criticisms. When we started with the center, that was like the second meeting, and I'm going to be honest on this, I'm going to be very direct; In Colombia there is a culture with professionals, with master's degrees, professional master's degrees and doctorates or PhDs, they have a very high ego. The ego is on the moon. Then, everyone started to meet, “No, it's that I'm the best at this, and I do this. And we are going to do a paper, and a paper, and a paper...”, I told them, “Gentlemen, we are flooded with papers and theses in Colombia, and we need all that information that is in the papers, or in theses, let's begin to transfer the farmer that. It is useless for you to continue in pectins, in the transformation of husks, in colorants, in cacai yields, if we cannot transfer that to the producer. We do absolutely nothing. You win, you win because the universities pay you to write a new paper, or to participate in a congress. That's the dynamic. So, let's start transferring." That has been the problem, Susan, Siva, and Diana. Once with Diana, I think, and with other professors, we began to do the calculation, and more or less, 80%... In other words, of the 100% of research that is done in Colombia on cacao, 80% is done by universities. What I told them, then where is that knowledge? Where do I see a producer from Tolima, or from Tumaco, from the Sierra Nevada, begin to implement this technology? Where do we see that a new economy begins to develop, as happens in cacao, that does not have to be chocolate? So, that's the point, Susan, that I think, and the other thing is that, since we lack that, obviously there hasn't been an interest from some private investor to say, "Hey, come on, I have some resources, I'm going to invest". If you don't know, obviously you don't understand, and then you don't invest. So, I think it has been mainly all that.

**And according to you, what is necessary to transfer this knowledge to producers?**

To the producers, well, that is an issue that we are working on right now, with the Red Cacaotera, and the Red Cacaotera is a slightly smaller cacao center, but it only works with cacao associations. So, Fedecacao is different because it works with associates and non-associates; Red Cacaotera does work only with associations, and Red Cacaotera is an entity that is expert in working with resources come from international cooperation. For example, if I work with them, and we have worked with Swisscontact everything that is Swiss cooperation; everything that is German cooperation, JZ, USA-eat, from the United States. And one of the things that Red Cacaotera told us was, “Gentlemen, we are going to present some projects, but all the part of innovation, of technology transfer, we are going to leave it to the center. We are going to hire the center so that you can take care of that.” So, I think that at the end of the year, we will begin to do that, we will begin to transfer that technology. It is not easy because Colombia is very different in each region. In other words, cacao is not worth the same in Colombia, such as in Tumaco, or in Tolima, it's very different. So, we start to transfer, we start to build that. You know this is trial and error. Although, well, now there is a lot of knowledge in that. Thus, we are starting with that, and the idea is to start creating mechanisms. We have to try, we have to build pilots, and we have to say "Hey, it worked, we're going to follow this way". As I told you, we are open to any quality of resources, such as international, or internal calls here in Colombia. The idea is to also work with royalty resources from municipalities and governorates. We understand that, in other words, there is money, what happens is that you have to start looking for it and do better management, but there are resources, not the ones we want, but there are. So, there we are, Susan and Siva, at it.

**Okay, thank you. I would like to show an image of the concept with which we work. So, I'm going to share my screen, can you see it now?**

Yes, perfect.

**The concept is called BioHub. It is like a cluster that can organize new value chains from biomass that is not used now, and the idea is that in this green part, it represents different communities that produce biomass, such as agricultural residues or forest residues, and are transported to a biorefinery, where they are transformed into different products, such as biofuel, which is the focus of our project, producing biofuels for the maritime sector, but also in this process different products are also produced, such as biochar, which can be used again in the communities, and what we want to understand in our field study here in Colombia is if it is possible to organize a BioHub in Colombia, and how it can be organized so that it is beneficial for the final actors, but also for the region that produces the biomass. We want to understand what the possibilities of such a system are, but also what the challenges or obstacles are. Well, I would like to ask you, how do you see this concept and what do you think are the benefits that this system can generate.**

Well, starting that, you are heading in the same direction that we are starting to work on and propose. I mean, that's it, it's the same thing. Obviously, I would think that we have to start looking at what technologies you have developed and what technologies have been developed here in Colombia, on a small scale, and how we begin to complement them. One of the consequences, or the effects that always happen in Colombia, is that we tend to collect a lot of technology, but we don't know how to adapt it to the situations in the country. Coincidentally, about a year ago, I was helping a colleague, a friend, he was specializing in pectin from cacao, and one of the critical points that he found in his thesis, in his monograph, it is the issue of logistics in the transport of that waste. We have a huge quantity, but how are we going to transport cacao husks? I don't know if you know the size of the cacao fruit, which is very different from cacao. In coffee, it is a small bean.

**Yes, we have seen it in Fedecacao.**

Exactly. So, the fruit itself is big. And the other is the variability of fruits that exist in cacao. I mean, Colombia manages clones, many different clones, and each clone has certain morphological and size characteristics in the fruit. There are small fruits, there are more elongated fruits, there are fruits where the thickness of the husk is much thinner, there are others where it is much thicker. So, I think that this type of technology is very good to start working on. This is how a pilot is made. I have always told those from the center, "Let's start with something small, with a pilot, in a typical region of Colombia", and typical means in the mountains. Obviously, if we are going to work on the flat part, it is much easier; cars enter there, tractors enter, trucks enter, but how do we begin to adapt that technology to the mountain range? Or how do we start to adapt that a little bit in a way where it's much more viable? Great idea about biochar. Right now, you know that Colombia, with the new government, is working on an energy transition, where the oil issue is not worked on, where what is wanted more than anything is to avoid the exploitation of that hydrocarbon in about fifteen, twenty years. Well, then, let's start generating this type of technology, which will give us added value. You speak there of the biomass of the agri-food part, of all the fiber that is extracted from cacao, it can serve us for children, for young people, in the human part in Colombia, as well as for the animal part. And all the chemical and pharmaceutical part. So, I think we are going there well. We are connected, as it is said here in Colombia. The issue of biofuels, well, I understand that studies have been done here in Colombia. They have done about six or ten studies on the production of bioethanol from cacao mucilage or honey. Therefore, I think it's important. There the challenge is how we are going to implement it, that is, how we can do that, and how we are going to feed those plants. Because I suppose, and correct me if I'm wrong, that these plants have to be working all year long to be profitable, and what is the minimum raw material capacity needed for this type of technology to be profitable?

**Yes, that is a subject that we are still researching. Well, the technology we are researching is called hydrothermal liquefaction, I don't know the correct Spanish word. The idea is that you can use biomass that has a lot of water and is a system in which there is high-pressure and high heat, and from that you can produce a biofuel, or a biocrude. But all that technology is new, so now it's not commercial, it's not commercial yet, but it has a lot of opportunities. And yes because you said that there is...**

Ah, liquefaction! There, Siva wrote in the chat. Thank you, Siva!

**Are there already studies, pilot projects in the use of husks?**

Yes, here in Colombia, yes. Here in Colombia, the Industrial University of Santander, in Bucaramanga, they have a plant. That, by the way, I think that in a few weeks, I am going to meet with one of them, with Luis, Professor Luis, with whom we are going to work on the subject, on how do we begin to look at this type of equipment and technology, on how we begin to create a project where we start to make a pilot. Obviously, something very experimental, but that allows us to generate knowledge and data, in order to say, "Well, we are going to produce a plant that is going to produce so many kilos of biomass per year, per day, but we need to be harvesting every day". One of the key points here, Susan and Siva, is the synchronization of the harvests with the functioning of the plants. Cacao, in Colombia, has two harvest peaks a year, and depending on the availability of water in the crop, I can have cacao every month. This would be the idea, that every month I am extracting cacao, but there is a large part that does not have water available. So, it depends on the rains. Thus, if there is no rain, there is no cacao. Then, there begin to be these problems of synchronization of the harvest with food, and what we are going to generate is that the plant is not working, and it is going to have losses, obviously. Hence, that's another thread there.

**Yes, because we also want to know what the obstacles are for there to be a new value chain, with the BioHub concept with which we work in this area.**

Excuse me, Susan?

**What do you consider the obstacles or the challenges to create that BioHub in Colombia? From waste.**

Yes, that is, I think that the first is to find an area where we can have availability of this constant biomass, or the most constant. The first thing is logistics, how are we going to transport that husk? An idea that I proposed to Luis and Diana at some point, and I still support it, and I was forgetting. It is that you know that Colombia is a producer of chocolate or fine flavor and aroma cocoa, and that has allowed the opening of new markets. Mainly in Europe, in Germany, in the Netherlands, Belgium, in England. And one of the issues, at least, in the cacao network where I am, is the entity that has led the process in the construction of processing plants. So, it is to gather the cacao from a village, or from an area, ferment it, and dry it all in one place. So, we are standardizing post-harvest processes, or fermentation and drying. What does that allow us? It allows us to offer the same characteristics of chocolate and cacao always to customers. If I buy cacao from Pedrito's property, or from María's property, the fermentations and drying will be different, and very possibly I will have very poor-quality cacao. So, what I proposed to Luis and Diana is, how do we create a project where while we are extracting cacao, in the same place we are taking advantage of the husk and everything? That is, that the producer does not take double work to do that. So, there arises a concern, and I leave it to you to help us, it is how to pay the producer then because we are going to pay him for the amount of cacao in slime, but that is another point. You know that the cacao in slime is the one that still has mucilage, so what is done in the centrals? I receive cacao in slime, I do not receive the fruit. I receive cacao in slime in a bag, and I put it in some drawers to ferment. There the challenge is, I am going to receive the whole cacao fruit, how am I going to pay the producer? An economy is generated there, and that is a challenge because it has not been done in Colombia. An example and I am going to give you specific data, slime cacao is being paid 70% less than dry cacao, that is, I am paying more or less 8,000 pesos in dry cacao per kilo; in cacao in slime, they are paying 3,200 pesos per kilo. I think that's 70, or 60%. So, of course, the value paid to the producer is reduced because it is delivered in slime, I have to ferment it and dry it. The question is, how are we going to implement it? How are we going to design that price or cost matrix for a fruit if it is by weight? Why? Because many times I will have a very large fruit, but where I will have a few cacao beans. So, I say, "Well, that's where I have to start thinking about that relationship." Actually, if I pay per fruit, but I know that I am going to get more out of the husk, and I am going to have a market where I am compensated for that value paid to the producer, and what price? In other words, that is an economic study, and I think that it is possible to make a thesis of exactly how that price can be managed, being the fairest. I support the philosophy of win-win, that is, you and we are going to win, then, there I leave that concern to you who are experts so that we can begin to analyze.

**But do you think the producers would be open to changing their practices? Because it is a very big change. Now it is very common to produce everything and dry it. So, just producing the fruit and drying it, how do you see this change?**

That's a challenge, Susan and Siva, of course. It is a completely new thing, in which we are going to say to the producer, “listen, I am not going to buy your cacao in slime or even dry, leave me your fruit”, and he has to see that, “I sold so many kilos, and it was much better for me”, or at least, to have a better income than selling cacao in slime or dry cacao beans. That, at least, we have to analyze. There are many factors. I think that the economic part has to be worked very well because the Colombian producer, if they pay him well, and the price is good, he does whatever it takes. The Colombian is like that, the Colombian cacao grower is not like the producer of our coffee, who does look at the costs and says "well, yes, it is coming out cheaper, more profitable." The cacao farmers, no. So, you have to look at that issue. The other thing is to make sure that all the fruits that they are going to sell me or that I am going to buy are healthy. Why? Because as a result of the effects caused by the plants, or *Carmenta*, or by diseases, *Phytophthora* and that, I am going to have some affected husks, which I do not know, chemically or biologically speaking, how they are going to affect me in the production of a certain substance. I would believe, and I dare to say, that if we can set a pilot, that pilot can solve many doubts, and it is to establish a new economy. That is what the center is about, it was born for that. It's proposing new things, breaking certain customs, and that's a big challenge, Susan and Siva, it's a big and very interesting challenge. Also, it has potential. Well, what can I tell you, if I am going to sell a kilo of dry cacao that normally costs 8,000 pesos, although the producers here are complaining. Put 9,000 pesos on it, that's very easy in dollars, 2 dollars per kilo. Two dollars more or less, or 1.80 in euros because there are slight differences. That is, if I am selling those two dollars per kilo in cacao, and I am wise, and things go well, how much does the cacao fruit give me where I can get more profit? Am I going to receive the same two dollars just for picking the fruit and selling it and that's it, and I save the fermentation, I save the drying, I save all that? Or do we raise it a little more, to three dollars, four dollars the fruit? Then, he might say, “Well, three dollars is 12,000 pesos, or 15,000 pesos per kilo”, and he says “Well, this is profitable”, but as I say, that has to be studied because the processors also have to win. In other words, everyone has to win. That is like the essence of our business. But I think it can be done, Susan and Siva, I think so, design a very innovative strategy, and the other thing, I think it is a project that we can also involve young people. The young Colombian right now is very involved in technology; if he sees a biorefinery in his field, "Wow, the machines, the condenser, all the stuff!" They get interested. That is a direct effect that can be given, and we can say to the boys, "hey, you have that biorefinery, study, and manage it, and administer it." That can also be another case. So, with that, we are encouraging young people to stay in the countryside and not come to the cities to endure the cold, or to endure stress. So, I think the key may be over there, Susan and Siva.

**Okay. We also want to understand which are the actors that have a role in the sector and what their relationship is like. I would like to show another image. Here we have made a graph in which we have put different actors, and their position on issues of power, if it is high or low, you can see it on the left, or their interest in new chains, in the BioHub in which we work, if it is high or low. We want to understand which actors have to work together to achieve this, what their relationship is like and what their position is. I would like to ask you how you see this block, and the actors that are here, and their position, if they are correct, or maybe we have to change it a little bit.**

Alright. Susan, can you do me a favor? Can you enlarge the Word document a little? It is that I only read the letters of the curve. If you can expand it.

**Like this?**

A little more. That's perfect, yes. Thanks. So, there it is, you have the national government, the regional government, there is Fedecacao as the entity that manages the fund or represents the union, cooperatives, Senicacao. Well, that was before Senicacao, now CECIC. Communication platforms, national government... There are the technology providers. I think it's necessary there, it doesn't let me see the bar here, I don't know how the bar moves here, it doesn't let me see the graph well. Wait for me to see if pressing here. Oh okay, perfect. Academia, transportation... I think that there is a need for industrialists. Industrialists are needed because we have two large companies, which is La Nacional, and Casa Luker, and the others are the small industrialists, which is Archocol. That Archocol itself is part of the center. They are there.

**Do you think that these actors have an interest, have a role in a new value chain with waste?**

I think so because of the fact that they are going to win anyway, Susan and Siva. In other words, they win in the sense that they are going to obtain a very good quality cacao, and a very good chocolate, and at the same time they are going to win with the waste issue. In other words, if I can sell and start producing certain substances or raw materials that work for me, well, I'll do it, I'll work on it. So, I think I could deal with it. Well, here we also need another topic that is associations, which is another actor. Here you talk about cooperatives. Actually, there are very few cacao cooperatives in the country. However, there are many associations and I think they would also be very interested. In itself, the cacao farmer has been an identity that was born, and I will tell you a little bit of history so that when you are more immersed, the cacao farmer network is dissidents, or let's say that they were previously members of Fedecacao and did not share the guidelines of the latter company and created their own company called Red Cacaotera. Red Cacaotera is an association of associations, and they are very interested in looking at how to make the cocoa business something profitable, something sustainable, and this type of technology goes in the same direction. So, I think they can also involve the associations, that the national government itself, by law, the national and regional governments have to seek more collaboration with the associations. Therefore, it is much easier if I do a project with an association, its development is much easier than working with five or ten producers who are not associated. Hence, that is another actor that we can involve there.

**And the power that associations have, do you think is high, low, or medium? Where would you put it?**

But what do you mean by power? To acquire the technology?

**Yes, power in a new value chain. Their power to, I don't know, make decisions.**

Yes, they have. Moreover, by law, Susan and Siva, they must have that power. They are lately making many decisions at the national level on how the new chain is to be managed. Here, in the center we have a concept, and it is not to work in a chain, but in a network. Everything really ends up being a network, but well, let's not get out of it because that's another topic. Let's say that the associations are beginning to take a lot of popularity, mainly in the implementation of new technologies, and the creation of new markets. I mean, a long time ago, cacao, with chocolate, it had the same markets because it was Nacional de Chocolates and Casa Luker, and Fedecacao, which are, let's say, the three largest companies, but the associations began to create new markets. So, they began to transform their own cacao, to make their own chocolate, and they simply began to look for new markets. Thus, based on that experience, I think they can do it with those kinds of technologies as well.

**According to you, how is the position of the regional government, for example? Do they support projects in the Bioeconomy section or in the cacao sector, or what is their position on those issues?**

Susan, it is the law. There is a law, there is a document... There is a CONPES, the CONPES is a document that is produced or issued by the national government and gives as guidelines to all interested parties for production or for the start-up of the economy. So, there are some tax benefits there. If I work, I'm going to get a product. Let's say, I'm going to take a pectin out of the husk. Based on the husk, sorry, cacao, well, you, bioeconomy, you don't have to pay certain taxes because it is the way in which the Colombian state encourages this type of technology or market. So, there is a CONPES, which protects. More than protecting, it encourages the bioeconomy via taxes, and also resources.

**According to you, are there other actors now missing in this picture? Associations, industry?**

The industry, exactly.

**Thank you very much. Siva, is there something that you would like to add? [Siva explains the idea in English]. Siva wants to know if there are concrete projects in the future in which cacao residues are going to be used or exploited.**

No. No. Simply, no.

**Why not?**

Because of ignorance. It is that there is no such transfer, or it is not very attractive yet for many industrialists or investors, it is not easy for them to say […], the importance of this, the potential it has. Or simply because not, simply because all the knowledge has remained in the theses, stored there. I think there is like a test experiment, I think, that there is like a test that they want to implement in flat areas. In the Meta, in the Meta Department, I don't know how it will be, but as such, that they are implementing that on a large scale, no. Not really.

**[Siva] You have said that you are also very interested in the subject of biorefineries. Do you believe or know people who are working on the issue of biorefineries in the department of Risaralda?**

The only thing I know that has worked on the part of the use of the husk, not in biorefineries as such, but in the use of it, has been Diana's team. I think they are the only ones. When I was in Fedecacao, we reached it, there we approved a project. Or we didn’t approve it, but we participated in a project with funds from England, from Newton funds, for the use of the husk. That was two years ago. I don't know how that ended. I really think Diana was involved in it. She participated or was participating. I don't know, I missed that information. But as such, biorefineries up to now, the only entity that has been studying that has been the Industrial University of Santander.

**[Siva] Siva wants to know how sustainability looks like in the cacao sector.**

In the sector?

**Yes.**

Alright. In the cacao sector, sustainability, let's say that now it is a word that has been used a lot for the projects that are being created. This very important term is used, at least, when working with international resources; in Germany, there it is used. It goes well to the topic. The Swiss cooperation, but they also are more interested in the quality issue. USA Eat is also on the sustainability issue. And they are seeing sustainability as how we do so that more is produced. How do we begin to work on the issue of irrigation so that, if a season occurs, a time of drought, how do we sustain the crops? However, until now, really, it has not been clear, and it is not clear what sustainability means because sustainability can be sustainability of the crop or sustainability of the economy. If we are going to talk about sustainability, the first thing we have to think about, especially in Colombia, is how we mitigate or how we adapt to climate change. That's where the key point is. Actually, we are managing sustainability because there are some forests. Right now, there is a very interesting topic. It is how we certify cacao or the system in terms of everything that is the carbon certificate market, that now is a certificate. At least in Colombia, it is a certificate. So, how do we begin to look at that and how does that help sustainability, but that's a little part. I would think that mainly it is adaptation. That is what it is, there is radical doubt about the word sustainability, how we begin to adapt without affecting both the crop or the cacao farming system as such.

**One question, if we need some data, can we ask you or the center for information?**

Yes, of course.

**Thanks. Thank you very much.**

With pleasure.

**[Siva] I would also like to know because you have said, that there is a researcher, [name], who is working on social issues. Is it possible to connect with her? I would like to contact her.**

Yes, of course. I think Diana has the contact, in the team, in the center. If you want, I'll send you her email, yes, of course.

**Thank you very much. You have talked about someone's thesis about pectins, and the challenges also on the subject of logistics. Can we read this thesis?**

Yes, I will speak with [name], I tell him if he can send it to me and I will share it with you so that you can advance this technology.

**[Siva] We are going to organize at the end of our field study here, of our research, we are going to organize a Workshop, where we want to bring together all the people we have interviewed in these weeks and discuss some options for this BioHub or this new value chain. Therefore, we would like to invite you too, if you have time and can participate. We are going to send more information, but now we would like to invite you.**

Thank you so much. And yes, of course, I will attend. It is very interesting.

**I don't know if you have any questions for us, or something you still want to tell, or share.**

How do we start working together? How do we begin to select, to develop some pilot plants here in Colombia? How do we begin to generate this new cacao culture? You are in the Netherlands, right?

**Yes.**

I really liked the model, I have followed the Dutch model very closely, mostly through Wageningen University, of how academia and science have allowed the Netherlands to be one of the most important countries in the world in the agricultural issue. I really liked that approach. So, how do we start? Even with agreement, a joint work, some design to work and share experiences. The Netherlands is a very innovative country, and I think that Colombia needs that. Right now, we have a new government that is betting on it, and it is going to bet on that, and we can look at things. In any case, here in Colombia, welcome, when you can be here, we are going to Huila, we are going to Tolima, we are going to show you Colombia, and we begin to develop joint research. I mean, I don't see any problem with it. Then, you have the resources, too. Here, we have very few resources, but we have all the desire, and let's say, the strength and ideas to start bringing this technology to a good end.

**Thank you very much. Well, I have to say that this is a first step. We are doing a field study, and the technology is also new. So, but the key of what we want to do is sharing all the information that we are going to generate and from there we can see what we can do next. But it is the first step that we are doing now.**

Yes, okay, but whatever information you need, it's fully available here, and the idea is to start building this together, in support of it.

**Thanks. Finally, I would like to confirm that you agree that we can use the information that you have given in this interview, in publications, or in something that will follow from this.**

Yes, of course.

**Thank you very much. So, that was it. Thank you very much for all the information and your time.**

Thank you very much, Susan, and Siva

**[Siva] Thank you.**

With pleasure, and here we are.

**Thanks.**

Okay, bye.

**Bye.**

Have a good day!

**You too, have a great day!**