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Interview

THE ROLE OF EDUCATION IN FOSTERING ENTREPRENEURSHIP AND INNOVATION: INSIGHTS FROM DR. BHAVNA AMBUDKAR

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Dear friends, the interview transcription was done by machine and later reviewed. We are aware that it is imperfect. If you wish to collaborate with improvements, you are welcome to contact us southbchem@gmail.com

ABSTRACT

Background: Dr. Bhavna, an experienced leader in education and innovation, has held various leadership positions, including head of department, dean of alumni relations, and president of the institutions innovation council. She has been instrumental in initiating the alumni cell at her previous organization and establishing world-class state-of-the-art laboratories in collaboration with the automotive sector. **Aims:** Dr. Bhavna's efforts aim to create an ecosystem for innovation and entrepreneurship within the institute and beyond, encouraging learners to consider entrepreneurship as a career option and fostering innovation in the electronics manufacturing domain. **Methods:** Dr. Bhavna's approach involves raising awareness about innovation and entrepreneurship among learners, fostering collaborations between academia and industry, and establishing world-class state-of-the-art laboratories to bridge the gap between academia and industry. **Results:** Dr. Bhavna's efforts have resulted in a strong alumni network, with graduates across the globe contributing to various domains and positions. She has also established world-class laboratories in collaboration with the automotive sector, fostering innovation and startups in the electronics manufacturing domain. **Discussions:** The Ministry of Electronics and Information Technology plays a significant role in initiating innovations and startups in the electronics manufacturing domain. They have generated a separate vertical for startups, which poses challenges to innovators. If a solution is validated, the ministry handholds the innovators, incubates their ideas, funds them, and helps them reach the market at the national and international levels. **Conclusions:** Dr. Bhavna's vision and efforts toward fostering an ecosystem for innovation and entrepreneurship within the institute and beyond are commendable. Her experience and achievements in various leadership roles, including as the head of the department and president of the institutions innovation council, have added significant value to her professional and personal life.

Keywords: *Bhavna Ambudkar, innovation, Entrepreneurship, Electronics, Healthcare and Agriculture*

Luis: So, good morning from Brazil, Dr. Bhavna Ambudkar. It's a pleasure to speak with you again.

Dr. Bhavna: Same here. Good morning, Dr. Luis. Yeah, and it's happy to be on this forum, which we can say is a precourse for the Southern Journal of Sciences conference, which will be held in 2024.

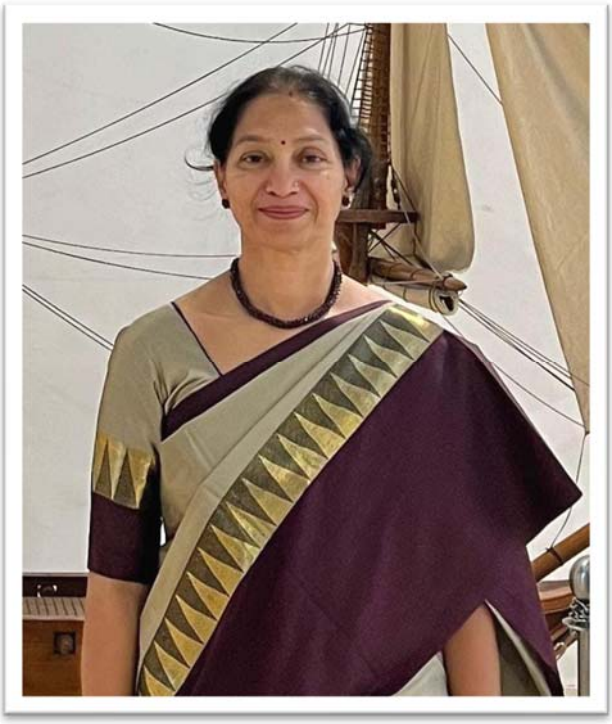

Photo Dr. Bhavna Ambudkar. 2024.

Luis: Yeah. It will be held in Mendoza, Argentina, and Vassouras, Rio de Janeiro, Brazil.

Today, our interview will be published in Portuguese by the Periódico de Química in English by the Southern Journal of Sciences, and we will share our interview with a local television station. The content of our interview will be shared under a Creative Commons license.

Dr. Bhavna, thank you for taking the time to receive me.

It's a real pleasure to speak with you again. I believe it's almost two years since our last interaction.

So, to join the spirit of our interview, could you please present your engineering career and how you achieved your current position?

Dr. Bhavna: First of all, thank you, Dr. Luis, for allowing me to share really what I have dealt with over the years. Looking back, as you asked me about my career, I was passionate about being an engineer, although I excelled in biology and sciences, I would say. So, ideally, I would be academically fit for a medical line.

But then I was a passionate candidate at that moment to choose engineering.

And that is how my engineering career started. I did my engineering in electronics and telecommunication background because that was when India was established in various domains.

I was fortunate to get a seat in this field, and I graduated with a degree in engineering in the field of electronics. Post it, I did my master's in electronics and telecommunication. Subsequently, I went for my doctorate in electronics and telecommunication engineering. I was fortunate enough in my initial years to join an industry that worked in core electronics related to capacitors. So I got an experience.

Then, I started my journey with a research and development organization working on a power supply, or, as we can say, an uninterrupted power supply. But then I got a deviation towards research, and I thought that this power electronics may not help me in my career. This is not the right call for me, but research is a call for me.

From there, I moved into academics, leaning towards research. And since then, I have been an educator. Over some time, I have taken many roles because I do not like to stick to one thing. So, being an academician is my basic profession. But along with that, I do several things. As I said, I do research. I develop certain things which surely would help not only me because I am the last in the priority list, but obviously to someone in and around the society, the community. And it may not be a very big research, which really should be appreciated because I don't go for it. But surely I will make it a mark that it is work which will help to solve, which might be some small percentage of the problem. And that is how I work. And this academic has given me the strength to do this with a team of students and aspirants who are in and around.

So, it has ever helped. And that is how I think I have moved into my career. Today, I would say I am not only an academician because I have 25-plus years of experience in this academic field

as a professor in the academic category. But along with that, I am an innovator. I am an entrepreneur. I am a design thinking expert. And this is how I would say my career has asked me to move further. So this was a bit of the thing what I would say I would like to share.

Luis: That's very good. If you allow me, I would like to ask you another question regarding the beginning of your career. When you decided to choose engineering, not biology or medicine, did your family support your choice? How was that path?

Dr. Bhavna: I think it's a big story. Moving from a completely different domain was a 180-degree flip, if I would say because my father was dreaming or too passionate to look into his to look towards his child as someone who serves society.

He was a real social reformer. And he used to work for society. He always dreamed that my children should serve society in one way or another. And that was the basic reason why he was looking towards his children as a medical, I being the eldest. And somehow, even my academic growth has shown that my academic excellence was also in biology. Various ways I used to get connected with nature all went very well. So it was everywhere that it could be said that she could be a medical doctor and surely that she could go with the society.

But I don't know. As I grew up, I came across certain things and am an avid reader. So I used to read books a lot. And among this how I grew, I don't know if I look back, I would say during those days tried to recollect, I would say, I should have something concrete way, which will really revolutionize and might be, unfortunately, although I was ever blessed to have the exposure to all the, I would say, updates and the knowledge which is required at that age. But typically, when I compare, I think either I learned or got influenced towards that engineering field, it went into my mind, or it was somewhere some consciously which I caught up is that engineering will help you to make this concrete rather than this biology. And that was the simple reason from where I knew. So this was the base of it.

Now, how it took a turn? It was really, I would say, a war between my father and me, typically not my mother, because she supported me in this. But my father typically looked me over and over, wherein people look forward to getting admission to this public medical university, and I got it. And now again, moving from there to this side was a big game.

So it took many efforts for both of us, not only for me, but even for my father, to mentally prepare himself for what he was looking for. She excelled and got a seat in that academic domain as a medical academic.

Still, she wants, and she is at that moment. I would say I was a bit stubborn about it, but no, I'll go for engineering. So I stood, and then I think, okay, it's okay, that is how my journey started. But again, that's not the end of the story. Let me tell you. I realized this over time, and I don't know for the last ten years. I'm working in the medical field with engineering. So I worked in health care a lot and then realized somewhere inside me that I'm a medico, but I wanted to do engineering with medical sciences, and this is what I'm doing today.

Luis: That's very good. It was quite a turn that your father had to take, and you two, and I'm glad you took this path because we can talk about it today. It's very good.

Dr. Bhavna: Yes, so maybe we should share. I feel we should share because someone somewhere must be in the position where I was in a dilemma some years back.

Luis: Yes, I can say that, at least in Brazil, engineering it's not a common path for ladies to take. So it's very rare, not very rare, but it's not as common as other courses. That's what I mean.
So moving on because I believe that you are busy. Okay, let me make my next question.
As an experienced professional, what are your thoughts in integrating entrepreneurship and innovation into engineering education curricula?

Dr. Bhavna: Thank you for the question. This is my passion, and this is what drives me today.

The simple question is, as I said, why I moved from medical to engineering.

So why? I had given a question because I had never looked into that. I wanted to make that change concretely, which I thought at that moment may not be possible with medical. Maybe I was short of my thoughts.

I do agree.

Today, when we do engineering and have many years of engineering experience, I see people, or the aspirants or the candidates, engineering undergrads, work on projects, build certain projects, and study certain subjects. At the end of the career, if we really try to ask to have learned 40 subjects over a period of your course of undergraduate engineering, what does that which is going to help you further?

And then they don't have any answer because they get confused. The thing is, they are not clear about it. So the question here is, then, I went into reverse engineering. Let me share it with you. And the reverse effect told me, what is this? Why does this happen? So, that was from the point of view of an academician. This is the question. My students do not have any answer to this. So what is the answer to this? Because they don't know where to apply for the subject and at what point in time.

So, I got the answer to the first question. Second, if they want to apply to any course they are learning at that point, how should they do it?

There is a curriculum called project-based learning in undergraduate education, and they should apply that. But is it really happening? And then I found out it was not happening. How should it happen? And from there, I took over something called innovation and innovation. Then how do you start with it? So, the first thing to do is to start with it.

Do not go with the mindset that you want to build a project. Go with a mindset that you want to build something that will help resolve something, apply something, or for usability. If you find out something about this, you will get to find a solution. So that is innovation.

If you find out this, the second thing is why someone should use it. If I say Dr. Luis, I do have something, why will Dr. Luis use it? Unless it is tasted. So, if it is to be tasted and validated, it is a product. So, in simple words, it is entrepreneurship. That is how I embedded innovation and entrepreneurship into academics, playing the three roles together.

Luis: Thank you very much.

That's a very nice way to start the students on this path. And it's very important. As the chief mentor in charge of the entrepreneurship promotion and innovation cell, Dr. Bhavna, what are your goals and vision for fostering the entrepreneurial ecosystem within the institute where you work and beyond?

Dr. Bhavna: Thank you, Dr. Luis, once again, for helping me to share my vision for this.

Being in charge of this entrepreneurship promotion and innovation cell at Symbiosis Institute of Technology, a constituent of Symbiosis International University at Pune in India, I would say the vision here goes to spread the or to create the ecosystem for innovation and entrepreneurship. Because the first thing today is the aspirants, the learners are not aware of what innovation is and what is to be done with this innovation.

So, I think this is much needed for each of us. The first thing to know is what it is and how it will help anyone develop oneself.

The second thing is that once they are aware of this innovation, then the second step would be to go for entrepreneurship. I agree because today if we look into it, less than 3 percent of learners would say I would like to be an entrepreneur. There are ample reasons for this, and the reasons might be pressures from family, society, several things, liabilities, and all those things we agree on.

But then, as the head of the cell, I would really look into bringing it to the notice to the students that with all these constraints, why not to attempt for this when there are less liabilities during your undergrad, I would say the undergrad tenure. So, liabilities are less. Test yourself, and consider whether you can innovate or be an entrepreneur.

If it gets succeeds, it is okay. If it does not, it is also more okay because you will have a number of learners, and you can start with your career. So, that is the basic vision of creating this ecosystem for innovation and entrepreneurship.

The second thing is obvious: we look towards having more entrepreneurs than employees. So that is one of the goals.

I would say the third thing is how we can resolve the problem at the local, regional, and planet levels. So, we should create people who can resolve the problems for ourselves and the society, the community, and the planet at large.

And the last term, when you say commercial, is because without commercial, nothing can move.

So you should educate learners to the extent that they start generating not after graduating but when they are in the tenure of learning as an undergraduate to get an instance of entrepreneurship. So that is the vision, I would say.

Luis: Thank you very much for sharing your vision with us. Dr. Bhavna, moving to our next question. You have held various leadership positions, including head of department, dean of alumni relations, and president of the institutions of Innovation Council. What have been your key learnings and achievements in these roles?

Dr. Bhavna: So, very first thing, over some time, I would say that among all these leadership positions, I held the dean of alumni association position in my previous organization for almost 23 years.

Luis: It's a long time.

Dr. Bhavna: It's been a very long time, and I would say I was fortunate to get the chance to initiate this. So, I initiated the institution of the alumni cell at my previous organization.

Yes, so I would say what I got educated on today might be more of the experiences which have been given by my alumni rather than me getting learn or me learning every day. So that is the best part of my life, I would say. Twenty-three years, and you would say all those years, the graduates who moved out of the institution. They are connected with you. They are across the globe. They are doing wonders. They are in many domains. They hold many positions. They are not only employees. They are employers. They have come up with certain new things. They have done which is immeasurable. Contribution to society, the nation, the community, the planet, and something else, and you just think you are a person who communicates with them every other moment while holding this position, which adds value to you both professionally and personally. Let me tell you, I still remember LinkedIn was launched in the early 20s. So 2000, 2000, 1, 2. I guess so. I was not knowing. I had my account on it, and I was wondering how this happened because it was thus my alumni who would see that. Now, just see for a while, I would say as an educator, as an academician, it's my prime duty to see that my student gets educated or the aspirant or the learner who really is looking towards getting educated gets educated, but now the role gets flipped. My alumni would ever see ah mamma is there everywhere.

So what more do you need? And the last statement I ever say I'm so blessed that I feel I'm the just person in the world because my bank balance is with so many pure hearts who go towards me in my bank balance.

Luis: That's very good.

Dr. Bhavna: That was the experience of being and being of that alumni association. The second experience as a head of the department obviously has aided me a lot to my professional life because every day you come up, you start your day not only for yourself, but you are supposed to see that there are 500 lives to whom you are to add value every other day and to these 500 lives there are 50 people who are going to add value to these lives. You will plug for all these 550 people to make the outcome at the end of the day. So this is just to add value, but then you will have to plan the day and how the resources would be in place. Do you need to add something to them so they can have certain things added to their life? What is the network that needs to add value to this complete process of adding something to others" lives? So that was the most enriching experience because it was day-to-day, and you had to handle it.

So that was the biggest experience. Obviously, I would have tons of gratitude to the management and the organization who gave me this experience for a very big life tenure by their trust in me. And the third thing you asked was now the Innovation Institutions Innovation Council president. So, that is completely related to the Institutions Innovation Council is one of the ideas of the Government of India's Ministry of Education's Innovation Council. So, every university or educational organization should establish this council in association with the Ministry of Education, which is the Government of India's dream or a way to enable this innovation and entrepreneurship ecosystem. Again, I was fortunate enough to get this opportunity in this organization and a previous organization because I worked closely with the Ministry of Education's council. I got an opportunity to be a frontier in all the plannings, all the visions, and points they came up with, and in fact, to their examination, I turned

up as a scholar, I would say. Hence, I was blessed enough to be a president to be. I would say someone who was appreciated the Institutions Innovation Council, which I headed as a president for four years. It was always the highest ranked across the nation institute, and then with this even, I got an opportunity to mentor five higher education institutes in this domain. So it was a lot of enriching for me, and it happened to me in my professional and personal life.

Luis: Dr. Bhavna, thank you for sharing your career with us.

Now, moving on to my next number of questions,

It's regarding the production of electronics in India, okay? As an experienced professional in the fields of electronics and telecommunications, what is your assessment of India's current capabilities and challenges in the production of electronics?

Dr. Bhavna: You had posed the right question. Yes. I think this was done by the Government of India a few years back. What are the challenges for the production of electronics and related fields in our nation today happy to say before I touch upon your question that the Government of India has taken a deal, and we are already driving the semiconductor mission of producing the things in India itself.

So now, touching directly upon your question, yes, today the thing is as if I will say yeah, India has always seen itself in the production of electronic components, and that is how we grew. It was not today. In fact, when I shared the start of my career, I said I worked in an industry which was producing capacitors so they were Asian capacitors, which ABB now overtakes because ABB is a well-known industry related into electronics, so I was working I started my career with it so India is always into the production of electronics components but moving with the pace of the industry growth and today's thing that is semiconductor obviously we have to reach that, and that is what is taken over so at this stage we are working simultaneously, Government is driving this, and with this driving for last three years, India has come up with certain of its semiconductor chips which are already into the market called as making India.

So, for certain processors anyway, as everyone knows, the fastest processor paramp computer was devised in India and Pune. I take pride in being a Pune in India, so it was in Pune itself. So similarly, we are coming up with certain things like we have devised our own chips, we have devised our microcontrollers, we have come up with our number of things, and yes, we face for the acceleration of this production of semiconductors typically, which we call as electronics domain is the highest today in the world.

Luis: I see that reading the news, sometimes we see Indian aerospace companies that manufacture airplane radars and many parts. Are those parts made in India, or are they bought and assembled in India?

Dr. Bhavna: Not only that, even space tech missions have been taken a lot, and it's not only space tech missions but making India for that complete space tech mission is also one of the things which is taking an accelerated pace in India.

Image: Space tech missions from índia.

Gerado com IA (Microsoft Copilot) · 11 de junho de 2024 às 6:18 PM

Luis: It's very, very important that I wish India all the best of luck. I hope to see Indian products here in Brazil as well, and maybe someday we can manufacture them in Brazil, too. It's a big step, but I have hopes.

Dr. Bhavna: Yes, the third part, just to add on to this, even India is working a lot into two more domains. There are a number of domains, specifically related to electronics, healthcare devices, and medical devices, coming up every other day as India is being made up with new innovations. That is also a great thing that is happening the most in India.

The third thing related to electronics, which I would like to bring to your focus, is something telecommunication 5G and 6G are on a roll everywhere across the world, but the Government of India has taken the motto of developing 6G completely by making India, and we are towards it.

Luis: I believe that's really in the future. In Brazil telecommunications, we are in 5G now. Are you already working on 6G?

Dr. Bhavna: Yeah, we have started working

Luis: I would love to see the results as soon as possible.

Dr. Bhavna: Yeah, I hope so. Let's keep our fingers crossed because this world is looking towards it, and India has taken the challenge to make it, so it's our next vision.

Luis: Very good. Please allow me to ask another question regarding the collaborations between academia and the industry. Is that okay? How can academia and industry collaborations be strengths to boost domestic electronics production?

Dr. Bhavna: So number of steps are happening now which was not in place few years ago I would say but it's already in place because the very first thing is academia as well as industry has taken one of their verticals to show the outcome in a year that how much academia is signing its or I would say handshaking with the industry similarly industry how much is contributing towards academics to grow in terms of industry because always there is a gap we ever see there is a gap between academia and industry so to bridge this certain things are already happening at a very accelerated pace, I would say, and hence with this what is happening center of excellence which are being I would say which are being initiated by the industry are coming to the academia I would like to share with this the organization which I am working with **Symbiosis Institute of Technology Symbiosis International University of Pune** has recently developed the world-class state-of-art laboratories which are being given by one of the best I would say automotive sector on that is Bajaj. Because Bajaj is one of the famous industries worldwide that is developing motorbikes and they have come up with the big center of excellence at Symbiosis, this is one step ahead, which goes with your question.

The second thing that will happen with this is a separate curriculum that develops the skills of the students who will be educated in these specifically installed laboratories. So, it will typically be hands-on with the advanced technology in these advanced equipped infrastructure laboratories so that they can be directly a part of the industry working with this advanced technology, which is the most happening thing at this moment in India.

Luis: That's very good. Fundamentally, the student has already gotten out of academia and into the industry.

Dr. Bhavna: Yes.

Luis: That's amazing integration.

Dr. Bhavna: In fact, I would really like to take a step ahead, and I would invite Brazilian universities to visit the Symbiosis International University of Pune to see this to see how, at the first floor, the students move into the academic classes and then move to the second floor to these state-of-the-art advanced laboratories to get themselves educated with the advanced technology.

Luis: I hope to see it.

Dr. Bhavna: Most welcome. Yeah.

Luis: So my next question Dr. Bhavna. What role do you envision for incubation centers and startups in driving innovation and self-reliance in the Indian electronics manufacturing sector?

Dr. Bhavna: Already in place, I would say it might be Dr. Luis must be thinking whatever I start with, I said this is happening this is happening, and I would say yes, India is at the very right time wherein things are already in place.

India's government vertical is called the Ministry of Electronics and Information Technology. So, this is playing a very, very big role in initiating typical innovations and startups in the domain of electronics manufacturing. So, how is it happening? I'll just give you a few examples of how it is happening. What I'm sharing with you is that they have generated a separate vertical for something called startups, and these startups pose certain challenges to the innovators.

Yes, you will have to apply your solution to these challenges and the rest of the thing if it is validated that this is worth this idea. The Ministry of Electronics and Ministry of Electronics and Information Technology, which is abbreviated as MITEI, the next role to handhold and incubate these ideas to register them as startups to fund them to build and validate their idea to hand hold them that they reach the market to further handhold them to reach the market at the national and the international level. So, a complete channel is built by the Government at universities like ours. Symbiosis International University is the Symbiosis Center for Entrepreneurship and Innovation and Incubation Center. So, this incubation center works fully on this idea of incubating the students or the team who has such an idea. They incubate, they nurture, they further help them, they guide them, to build their idea, to validate their idea.

They network with other organizations and other government agencies like MITEI to raise funding with investors to grab the funding and see that these ideas are built concretely and brought to the market. So, this is how it is happening, and at this moment, my vision also goes like this.

Luis: Those are several important steps, and it's very important to see the government support for nursing the projects to the initial phase to the market phase, correct?

Dr. Bhavna: Yes. So it's not only academia, universities, organizations, and startup culture but also the Government that drives all those things to take it to a flourishing end.

Luis: That's very interesting. We see the process of deindustrialization in many places, and in India, we see a growing and flowering industry. It's very nice to see these things. Congratulations.

So allow me to ask one of your passions. The electronics in healthcare. In your curriculum, I saw that you mentioned some projects. I believe that it was with your former university Dr. Patil Institute of Technology, correct?

In the fields of physiotherapy and dental college, could you elaborate on the applications of electronics in healthcare that you explored during your time at Dr. Patil Institute of Technology?

Dr. Bhavna: Yeah, so I would say more. I could explore that only because it was 25 years of my association with the previous organization, as you mentioned. Yes, for last, almost even, thank you for remembering that that is my passion.

So last ten years working in this domain, exploring what I would say with all verticals, what I had to do professionally as head of the department, dean role, or various other roles. What I was exploring with, fortunately, I had a mentor who is no more, but I really like to say something about it. I would say Dr. Madhu Patil was a scientist with NASA and then was invited to India sometime long back when I was born. He was in India working on certain very, I would say important projects for the Government of India, which I may not be able to share.

Image: Eletronics in healthcare.

Gerado com IA (Microsoft Copilot) · 11 de junho de 2024 às 5:43 PM

But then again, his other line of passion was medicine, medical electronics, and some of the law of attraction worked, and I got my mentor and Dr. Patil with his guidance, I think my passion

took over. So, somewhere inside, I wanted to work, so that was his guidance and my passion. So, I worked on a number of projects. I might not have taken everything to the market, but really wherein I had given my input, and I'm working on certain projects today also.

So, as you rightly mentioned, one of the projects I would like to say was related to physiotherapy. It was in association with the College of Physiotherapy with the previous organization, which is on the floor, I would say, and which is still working in the OPD for the patients. So it's a simple thing: any person who is having knee pain at a certain age has knee pain or had a certain accident, which lessens their strength in the muscles so that they cannot have a normal walk. In that case, physiotherapy people try to strengthen the muscle with muscles with various techniques. Now, what happens?

They try to strengthen the muscles, but they cannot gauge it to read the strength every other day, and then to date, there is something that happens very manually to gauge it.

So, we have come up with these physiotherapy projects that automate the strength of your muscles.

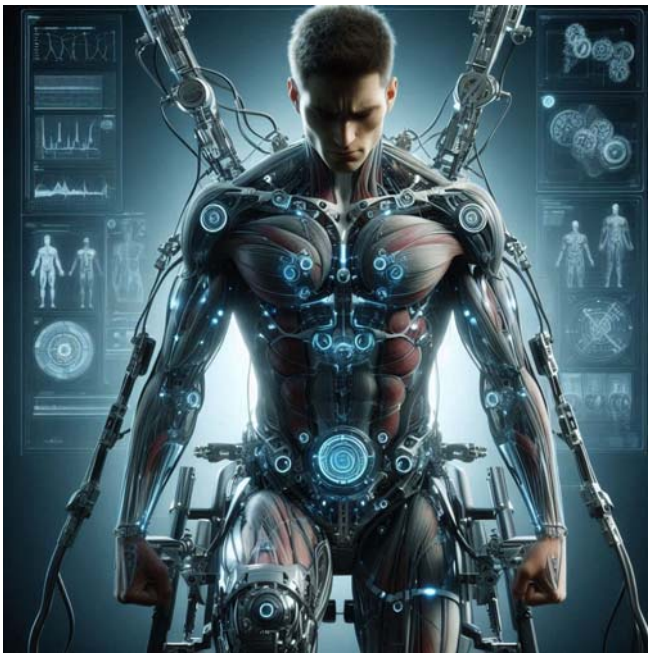

Image: Eletronics in healthcare.

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Luis: That's very interesting.

Dr. Bhavna: So that's yes. That's the reading that gives the strength of the muscles that happen with the physiotherapy treatments or the settings that are given to the patient. The second thing if there is something I would say a neurological disorder might be with age or with some accident. People are not able to do motor functions. Their reading their sense I would say their reading, as well as their hearing, may get delayed due to the lethargy in the neurons that are called motor functions.

So again, the device, the product which is being developed and which is working with the OPD of the hospital, works on this. It tells you what the delay is with that patient and what sort of therapy the physiotherapist should add on so that this goes nearer to accuracy. So that is physiotherapy I would say the product which is developed I was a part of it along with the physiotherapist Medico from the previous organization, and both of us has developed it. In fact, the doctor has achieved so many appreciations and laurels because she has presented it in various international conferences, and we are even having a patent for that. We have developed a patent, so I would say that about the first product.

As you said, The second product with the organization is still ongoing because a prototype was developed, and we are in the phase of developing a product out of it. So, I would say a glucometer measures the glucose level of your body non-invasively. Luis: Very interesting for diabetes

Dr. Bhavna: Yes, non-invasively with your breath, breath analyzer, something like that. So, a prototype is developed, and the product is in the phase, which is the second thing I would say.

The third thing I still remember about your conference two years back was that I had given a keynote.

Luis: I was going to ask you about that I fell in love with that project, the non-invasive dialysis.

Dr. Bhavna: So this was something wherein my mentor was there, I would say Dr. Patel, and it was Dr. Patel's idea because the previous two ideas were solely of mine, but this idea which I, which was with Dr. Patel, my mentor

Dr. Madhu Patel, and it's a simple non-invasive device as you have heard earlier also to detoxify.

Luis: Yes.

Dr. Bhavna: Yes, so that it is, or you can see how things are detoxified from your body. So, it's one of the simplest and the non-invasive ways that does not hamper anyone. In fact, people who have to go into that mode of what we say who the **creatinine level** once it goes beyond. So, in that case, this is one of the helpful ways, but still, we haven't come up with the product because Dr. Patel is no more, and it is validated that the complete product is ready but not commercialized and not taken to market. I wish it happens soon.

Luis: Me too. I really enjoy this project. You know, it's a very nice, very interesting concept, and when you look at it, it's so simple. Can everybody say why it was not thought about before?

Dr. Bhavna: Yes, that is what innovation is.

Yes. So I just wish that very soon, it would get commercialized and it would go to society so that people could use it in a very easier way.

And the fourth thing that is coming up, which I'm currently working in almost our prototype ready because I've worked on parallel work for the last five years. I'm doing it's a very simple thing; the way we do headphones for hearing things, you will have a wearable band that will measure your brain signals. It might be right now Dr. Luis is in Brazil, and I'm here, and it might be Dr. Luis is wearing that brand, and somewhere it is getting notified what are the brain signals showing Dr. Luis status of it, whether they are cool whether they are stressed whether it is in what domain it is. The moment it reaches, it indicates that it is at a stressed level. We will try to bring it to the normal level without you doing anything so that it does not impact your physical or mental health.

Luis: That's another very useful tool, and we could have had that sometimes during our day work when you have very stressful situations. It could allow us to go back to a more polite way of work.

Dr. Bhavna: yes

Luis: also I want to see that in the market it will be very good

Dr. Bhavna: Teah, sure, sure, very soon it will be there because it's on flow, yes, so I think I have shared three or four things. There are many things, but I think I have already shared three or four things with you.

Luis: What are some emerging trends or technologies in the field of electronics that could revolutionize healthcare delivery in India?

Dr. Bhavna: Very hard question because India is working in the healthcare domain and advanced technology. I would say it's nanotechnology.

Luis: Nanotechnology?

Dr. Bhavna: Yes, because whatever device, whatever medical device comes up, whatever we device, it should be of a sort which should be affordable not only in terms of economics, not only in terms of cost but, for example, as I said that I'm coming up with something which I called as read your mental state, I said a few minutes back in the previous question of years so it should be something a very small patch or a very small variable which no one else should be able to make it out then only and in that case it is nanotechnology which should help in doing the things so it's again a part of semiconductor have a chip development move further towards nanotechnology. So, that's the advanced technology, obviously AI; we cannot forget AI because artificial intelligence has to play a role in all of these things to see how things could be very intelligently settled, so these are the advanced technologies.

Luis: regarding AI, it's a very small question. Okay? I have seen several companies, most of which are Americans, developing AI products. We also have a Brazilian company that I became aware of today. I am very happy for them and hope they have a bright future. Is there any… Let me reformulate the question of how many companies in India are working on the development of AI.

Dr. Bhavna: I would have two or three different answers for this. Yes, you said America has companies working on AI. I would say companies are in America, but the people who work there are Indians.

Luis: yes, that's true.

Dr. Bhavna: Okay, coming because I would say India and AI are the questions, so I tried to map it. Second, two minutes back, you raised certain questions related to electronics in India, and I said the Government is doing this. Again, coming back here, the Government has taken a mission of AI development in India.

Luis: So, will the Indian government develop its own AI project?

Dr. Bhavna: The Indian Government will develop, already companies are developing, there are all the companies use you name a company might be it could be if I'm not to spell as we say the worldwide companies if you say IBM is working into AI. Suppose you say any other company, Google, that is in India. Google initially came up with two or three offices in India, but it only had one or two offices. The offices have grown, and people are working on AI in India. So, it's a complete Indians and AI sinking factor, I will say, and that is how it is.

To share with you, let me share again that Symbiosis International University has its own research center called SKY Symbiosis Center for Artificial Applied Artificial Intelligence, and it is doing wonders working in several research domains, including AI in the medical health sector, AI in engineering, AI in all the applications. So AI is the future somewhere, and yes, India will have India is having companies who are working to generate AI, who are working on the development of AI, who are working on applications of AI, and who are into developing AI, so it's complete all the domains are at this moment available for having a presence in India.

Luis: That's very good, and I don't think we will have to wait too long because AI is evolving so fast. I want to see amazing results and hope they bring us a better future.

So, I will go to my next question because it's a very important part of electronics in agriculture. I think that's a challenge that both India and Brazil face. My first question is, while your expertise lies primarily in electronics and telecommunications, have you explored or considered any electronics applications in the agricultural sector?

Dr. Bhavna: Yes, I have come up with two prototypes. The first is tasting the soil. Soil testing is already there because soil testing is in existence. There is nothing new in it, but the thing is, the farmer has to take the soil to the labs to get the results. So we have come up with a very low-cost simple thing which any farmer or which any person can have it just go and test the soil and find out what's the quality of the soil so that's the prime thing when you come to agriculture the prime thing you should have the quality soil so that whatever you are going to have the yield will be the highest that's the first thing.

The second thing now is that you need to have the proper climate. I would say this environment is not fertile, but it would be good to have a good yield, which is where everyone today is dealing. As you said, it might be India, or Brazil, because India is also a base agricultural land. The prime thing in India is agriculture, but then again, I would come up with something. The Government is working a lot into this. We are using drones into this agriculture system today, and drones are already a part of this. These drones are not only used for sowing the seeds. These drones are not only used to see the status of the plantation on the fields, but even the drones are used to see how can we water the plants? How can we look into what is not in line with the growth of the thing, which is an obstacle to the growth of the yield so all such research work and at a certain point of time things are brought in place things are going on it's a happening thing it is not yet happened, but things are moving in this direction.

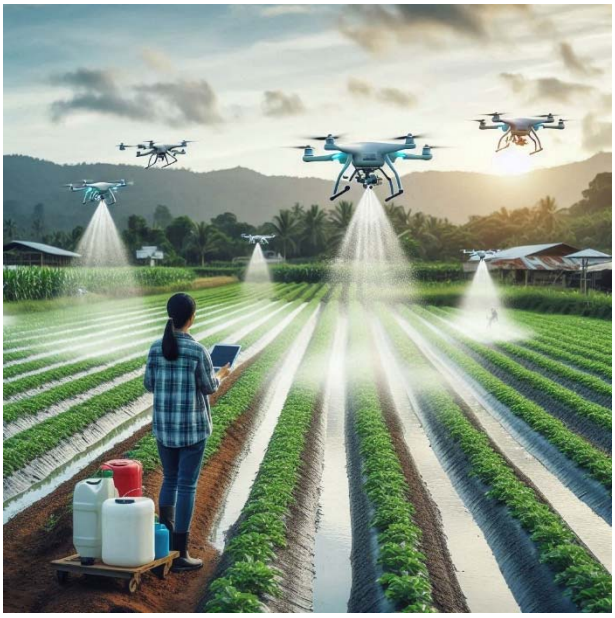

Image: Drones for agriculture.
Gerado com IA (Microsoft Copilot) · 11 de junho de 2024 às 5:55 PM

Now, one more thing which I have come up with one of my team of undergrad students is very simple. In agricultural land, a basic nuisance, I would say it's called as a nuisance because no one can help it, and it abruptly comes up after any season you find that certain weeds come up, it's an undesired thing, but that's the law of the nature, so half of the manpower today goes into removing the weeds because this is and these are the undesired plants which comes up and if you don't remove this then your fertilizers your chemicals your bio-fertilizers these weeds will eat them so it's needed to remove these weeds and I came up with something a very very simple thing a simple robot which will help to remove these weeds instead of man labor. A very simple robot which works on solar and which works that that's remote control so where you need now ten people man labor of 10 people with 10 hours for three days, now it will take one hour with your simple mobile phone to work it remotely, and you'll get the plain land so certain things like this the third project which I worked with my team of undergrads this was a post-grad student, and this was the yield which you get might be you have certain fruits with you find out what's quality and what's the content because so many fertilizers chemicals used nowadays in agriculture. So, what's the quality of the result that you are going to get might be a vegetable or might be a fruit, and we have come up with a system that gives the contents of that fruit whether it is in a ripened state if it is in the ripened state what's the sweetness of it? What would be the sweetness content of it? What would be its chemical content of it? Something like this I have worked personally as you have asked the question other than that things are really coming up people have replaced so many things in India, making India has really created a revolution in this domain also Luis: Yes we I followed some developments from India, and everybody says it's very nice and impressive the accomplishments so allow me to go I have two more questions.

One is smart farming and precision agriculture. They have gained attraction globally. In your opinion, what role can electronics play in improving agricultural productivity and sustainability?

Dr. Bhavna: I think electronics is the major thing that will help sustainability and growth in agriculture. As you said, it should be precision agriculture or smart farming, so smart farming consists of something that we call most of the things automated, and most of the things that will reduce man labor so that it gives accuracy. So, both things can be achieved with electronics, and let me share one of the things a colleague like me with one of from one of the universities who also works in the entrepreneurship domain. He has come up with something that we call as “electronic bull” because for cultivating lands to make them fertile every time before we grow something on the land to make it fertile we need to have bulls who go through this and make the land fertile so that's the process of farming agriculture. So now he has come up with the bull who will do all these things, he will help to make the land fertile in the expected shape, he'll help to sow the seeds, he'll help to cut the seeds, he'll help to collect the seeds and put it in one way. So that is one of the ways of smart farming he'll help to even spray the fertilizers that electric work, so that is one of the ways of smart farming because electronics will play a role in doing all these things you need to have some microcontrollers which will do all these automatic things.

Image: Electronic bull for cultivating lands.

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As you asked precision agriculture, I think I have worked on a project that will give you yield quality. So, that is precision agriculture, I would say. Really, go in a precise way. How much water content is required for your plantation right now? So that is, again, precision agriculture, find out the texture, the moisture, and the quality of the soil, define you need this much potassium right now in

your soil because that is needed for the best yield if you are going to have this crop. Find out you need this much water this is required, and this much more is needed so water accordingly that will be precision farming so that is again which will happen with without electronics it is not possible so electronics is the heart of all these things on top of it you add anything might be AI or everything that will work but without electronics, nothing is working.

Luis: That's true. Now allow me to go to my last question, and that's because of experience. I had some problems. How can we enhance the resilience and durability of electronic devices and systems to withstand harsh environmental conditions, enabling them to have a longer operational lifespan in the agricultural sector?

Dr. Bhavna: I think the electronic devices that come up are very sensitive. They are susceptible and not like something that we call as robust. We can build a robust device, but with making India, the first step is to develop a chip and a component. Once we do that, then that would be the next step to have a resilient or a robust electronic, not chip, not device, but a chip inside which will really withstand, but as far as right now, what I can say things are quite robust, yes, but you cannot say that they will go lifelong obviously.

Luis: it's impossible.

Dr. Bhavna: yes, we need to just work to see what quality results they will give over a longer time. That's what we can say. Yes, so resilience has to be there, but obviously, it will be within a defined period only.

Luis: that's very good. I have done some projects for pleasure, to say the least, and I have encountered some difficulties with the oxidation of the components. I hope to have more reliable things that will last longer.

Dr. Bhavna: I can resonate with what you are saying because we, too, have encountered, typically, certain things in the water tank because you are working into that domain, so I could relate to it very easily. I could resonate, and if you put something into that water tank after 13-14 months, it's absconding, I would say, because it gets rust and it melts. It's nowhere, it does not exist, so you come from that way. I got that question because that project came to my mind, how it got rusted, and it got melted, and it's no more, so someday we had put some project, and now it's nowhere so that is bound everything and hence. I said the first thing right now is our vision is to develop things, and surely, we'll add quality to them so that they do not get rusted or cause certain things to get rusted. Yes, but certain projects are getting developed, and typically, I would say in this area because when you put a system inside water, as you said, the thing here is to find out the contents of that water might be. I'm just taking some examples so we can do it without entering the water also, there is something that has come up that…

Luis: that will be the future.

Dr. Bhavna: Yes, no, no, it might be a place people use. Research work is going into this domain, so we'll take off something like that. We can have one more discussion on this letter at some time related to this because I know this is of your fashion, this is your ink

Luis: yes.

Dr. Bhavna: I know that, yes

Luis: Dr. Bhavna, I'm sorry. In the name of the journals and the conference, I would like to thank you very much for taking the time to receive me. I really want to see you at the conference; it will be a pleasure to hear from you again.

Dr. Bhavna: yeah, so thank you for this opportunity to share my views, and really, again, I also wish that I represent Symbiosis International University Symbiosis Institute of Technology in your conference, which is going to be a collaboration of a number of universities ten plus universities as you had shared I know, so we can even add Symbiosis International University to this list of 10 that is what I would like

Luis: yes, thank you. It will be a very good collaboration if we can get to a, how can I say, agreement, and it will be a pleasure to receive you virtually students and, if possible, one more speaker because you are already with us. Thank you very much

Dr. Bhavna: thank you
Luis: It is my pleasure to speak to you. Good morning to you.

Dr. Bhavna: Thank you, and good evening.

DECLARATIONS

1. Limitations: The interview is limited to its content.

2. Funding source: The host funded this interview.

3. Competing Interests: The host has worked for the journal for many years, and this may have influenced the interview.

Conference invitation. (now related to the interview)

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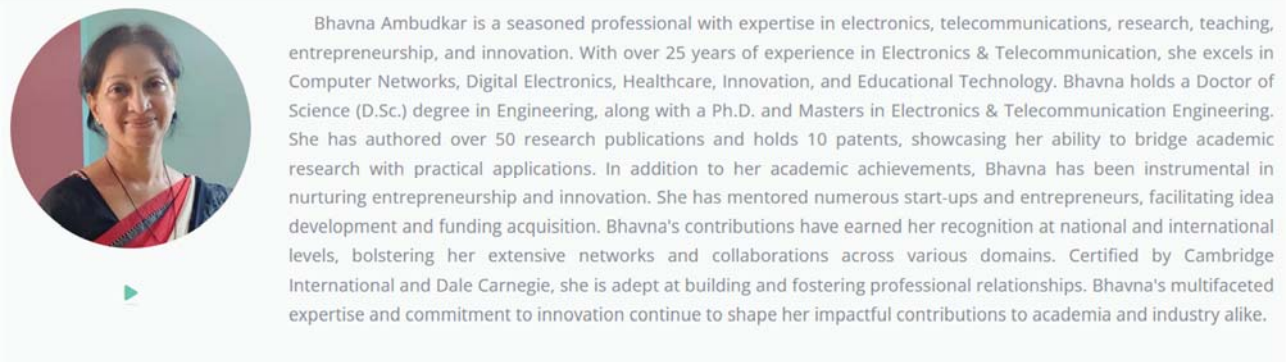

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