United Nations Sustainable Development Goals(UN SDGs)
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SDG 9_ Industry, Innovation and Infrastructure Part 2

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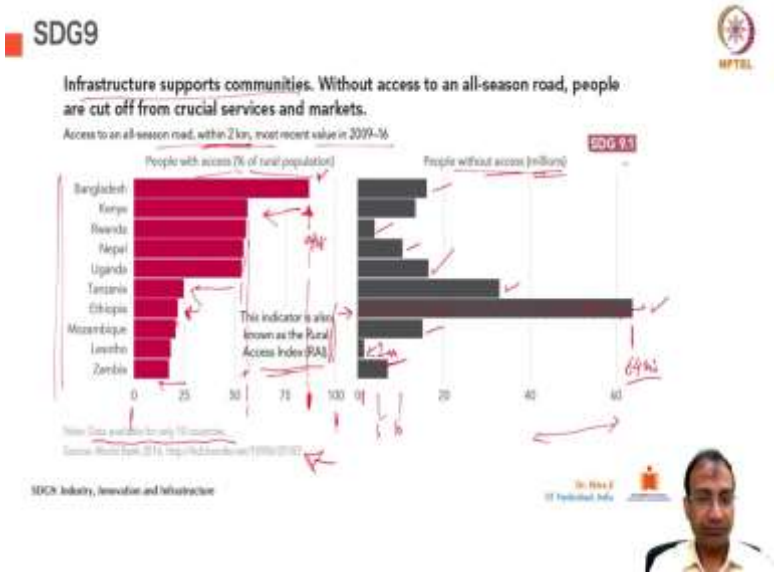

So, here infrastructure supports communities without access to an all season road people are cut off from crucial services in markets. Access to an all season road within 2 kilometer most recent value from 2009 to 16. So, people with access here percentage of rural population people without access in millions is given over here. So, like a different countries Bangladesh Kenya, Uganda, Nepal, Uganda, Tanzania, Ethiopia, Mozambique, Lesotho and Zambia. So, this is also known as rural access index RAI, so, from 0 to 100 percent.

In Bangladesh, if you see this place (())(1:28) like this rural connectivity is very high compared to like the rest of the others and this is somewhere it looks like close to like way above 85, 90, 87, 86 or something like that 86, 87. Here we have in Kenya I think you will have above like a 50, and then Nepal also and Uganda also in this range. And then there is another like a sudden drop if you see there is a huge drop here and another huge drop here.

Tanzania, Ethiopia, Mozambique, Lesotho and Zambia under 25, these are above like 50 anything in this range and this one is the only one having at this range. Well data was only available for the 10 countries for rest I think you can search the World Bank similar like this report, maybe for more additional data. People without access if you see in the Ethiopia has the highest above 60 it looks like it is a 20 like this thing then maybe 5, 4 or more, so 64 like

a million like people they have no access to road in the rural like areas rural access index this is talking about, within 2 kilometers like that so all season road.

So, this country has the very serious condition, almost two third of the population is deprived of this thing in the rural areas. And then after that we have Tanzania, then after that we have Uganda, then Bangladesh, and then Mozambique, and then Nepal, Rwanda and lastly, Lesotho, Lesotho only has I think this is 10, this is 5, so, perhaps 2 it looks like 2. 2 million people only have like no access to an all-weather road.

So, this is the data with this data you can understand like which country stands where in terms of people with access in percentage and without access in numbers. So, this is the percentage this thing and this is like in millions. So, percentage wise if you see this like Ethiopia this is only less than I do not like a 25, I think here around 20 around 20. And but number wise volume wise this is huge.

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And similarly, we have like other data sets also you can see in the slide. Manufacturing and other industries are large source of employment but many least developing developed countries have a small manufacturing sector. GDP per capita by sector value added 2000 to 16 constant 2000 in the year 2010 US dollar each country's skilled in independently. So, here this shows like this level, GDP per capita and all these numbers you see here at the top, as per 2016 and like this shaded area which talks about each sectors value added contribution to GDP per capita 2000 to 2016 and available.

And overall worlds if you see this is the range from 2000 to 2016, this has reached to 10,488 US dollars, and then Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, we can see these numbers 1030, 837, here we have only 218. Then Cambodia, Central African Republic, Chard, Congo, Ethiopia, Gambia, Madagascar, Malawi, Rwanda, Nepal is as 685. Solomon Island 1479, then Uganda 662, Tuvalu 3403.

So, it looks like among all of this, Tuvalu has the highest and Vanuatu has the second highest, and the least one I see is, is it Burundi? It looks like Burundi has the least one at 218 only. And different sectors, like you can see agriculture is by dark grey, services by lighter grey and pink other industries, and this magenta is for manufacturing and total, so that is the analogue bifurcation.

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Medium and high tech industry allows for greater diversification and offers better opportunities for skills development and innovation. Medium high tech industry percentage manufacturing value added. So 0 to 15, 15 to 30, 30 and above. So, here medium and high tech industry include manufacturing chemical, machinery, motor vehicles. So, this is the like data from UNIDO you can see including India, China, Japan, Indonesia, etc. and Brazil, Mexico, US, Canada and most of Europe, except few are in above 30 and over in percentage.

And then Russia, Pakistan, and Australia, New Zealand also they are under this range 15 to 30 and this light pink. Chilli and some Central American countries and many of the like African countries, Mongolia and Afghanistan they are under this, even Myanmar,

Bangladesh, Nepal also. There is no data for Bhutan and many other countries those are in green, it shows the status.

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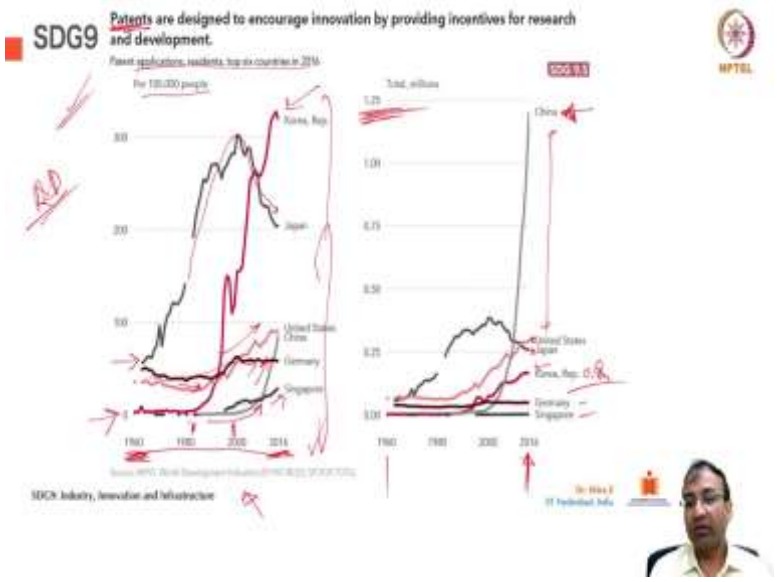

Patents are designed to encourage innovation by providing incentives for research and development. So, patents are one of the indicators you can call of new research and development like new R and D. So, how much it is happening and how many patents and patents are actually those like when you discover something a new mechanism, a new device or something, you go and register it or maybe new technology. So, that there are the benefits of patenting, that first of all everybody gets to know is such technology or such mechanism such technique is now existing, it works in so and so manner and other people also can, take benefit out of that.

And secondly, it registers in your name. If you are the innovator if you are the technologist, person or scientist behind this, in your name, so all of the future royalties and things if they might occur, they may come to you also. So, patent has lot of benefits and in a way it is an indicator of the growth and development of new tech. So, how much of that is happening that also you can see over the years, how different countries are performing. So, Korea's if you see they have registered a tremendous change. So almost close to at 0 and by the year 2016 they were at the top, above 300 patent applications per one lakh people. So, this is a percentage, not the absolute number of patents, it is just a percentage representation per one lakh people.

In Japan, it used to be a nicer in the older time to 1960, I think above everyone and gradually it rose also but in the later years, I think after a year 2000 or so, it is on decline. United States is rising sudden slight dip over here but now it is rising, while China if you will see almost close to 0 and from here 1980s and onwards it has started and a very steep exponential curve you can see for China. Germany also has kind of stabilize, Singapore is also increasing. So you can see the performance of different countries over here, so this is the source from WIPO.

And total millions you can see this China has surpassed everyone with a huge gap between this to the next (())(10:58). So 1.25 millions of patents over these years so this is the data from year 2016 and that is the status. United States has here 0.25, so little above 0.25 maybe 0.30 or so 0.28. And on Japan's close to 0.25. Korea's percentage wise it was the highest but absolute number wise which is under side maybe at 0.18 or something million, and Germany and Singapore. So this is the status volume wise and percentage wise you can see how many people per X number of people of the society are going for patenting and such activities and the total number.

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So, we are talking about growth of infrastructure industry and all of that and you may be aware often this iconic picture this building on the right side. This is a very famous landmark now, this is situated in Dubai and you may be wondering what this place is. This is also not Mars or any other place, as it looks like very barren and just few standalone buildings, rest is still very-very raw nature. But this is also the same place of like Dubai from the year 1991.

So, from 1991 to 2017 maybe less than a span of 30 years or close to 25 years, 26, 27 years period, you see this rate at which this has grown. So, this is really exponential in terms of infrastructure development facilities and all of that, tremendous growth recorded at this place. So, this is the rate at which things are changing at multiple locations across the world, where it is good that infrastructure, robust infrastructure is coming up, but there are certain downsides also, of like a change, which is happening at such a rate.

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This is 1970 you see how places are changing so rapidly, you see this mind boggling change. New York, you see these WTC World Trade Centre, twin towers over here in the background, and you see largely like any generic town from under 1876 to now, this is one of the biggest Metropolis on the planet with the huge infrastructure, huge facilities and

everything available at your disposal. So, much of change has come in now, in the last few decades and last century, these pictures are visual, proof of that change.

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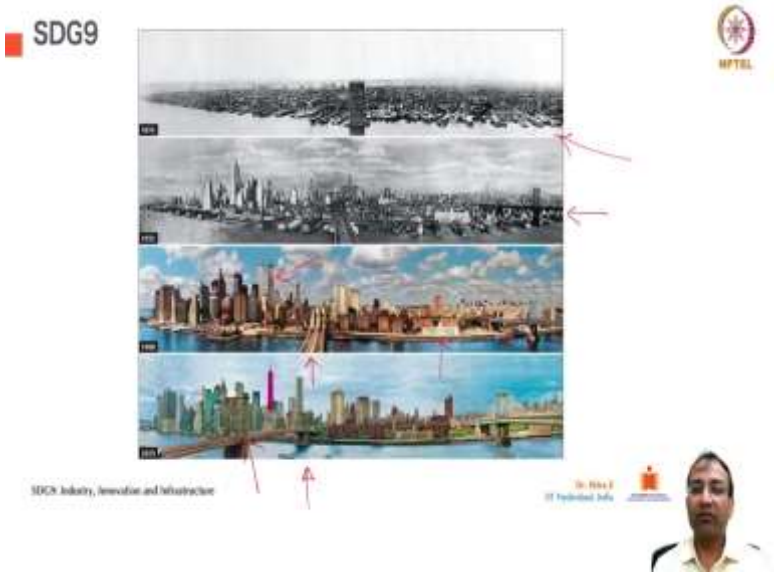

So, on one side, I wanted to discuss the impact of roads. So, in all of these places if you see irrespective of which country they belong to and all of that, the roads are very-very integral. In this picture also, you see this major even street arterial road, cutting in the middle. And similarly, you can see, these Metro routes or highways other routes and roads. In these pictures also if you see there is road cutting from this edge, internal roads on this side, this road is going in along this beach. And similarly you seen this bridge over here in the foreground then you look at this road here and there are multiple actually bridges on the landscape of a new you see another one bridge over here also in this picture.

So, impact of roads, because wherever there is a road there is a full chance and potential that you can easily and conveniently reach. So, roads are the biggest facilitators for the growth and development of economy, bringing in facilities of all sorts, making a place actually

habitable and all of those things. So, what are the impacts caused by road? So, maybe you can see a few. Biodiversity, it impacts on directly. Biodiversity is richness, animal abundance, behavioural changes, since these natural animals they are not accustomed to roads and infrastructure and all these things required by humans.

So, they are the ones who feel this, alienation and like change and brings in lot of change in their behaviour later aspects, habitat, aspects and many others. So that thing and then invasive species since transportation is now facilitated, so, there is a full chance that seeds and all other stuff are going to get scattered unknowingly even sometimes knowingly sometimes mostly unknowingly. Too faraway places where they are not supposed to go there is no nature's means and mechanisms of spreading seeds and plants to different places, but this very sudden very steep very high manual human caused spread of species from one place to another is also leading havoc for example you may be aware of.

When in the earlier decades just after independence India used to import food grains from other different countries. And in some shipments and from US actually of the wheat these many offering these Gajar Ghas what we call it in I know, in Hindi. So, that chilli plant, and its seeds actually came through that those shipments and they got scattered across the India and now it just becomes such an menace and invasive species, which is dominating on the local species, I think and it is not going to get away.

Plus the hazardous case it is not good for the human habitation also it causes skin irritation and, asthmatic situations and breathing related issues and things that. And unknowingly actually people because it comes within a look at teeny tiny small shiny flowers, at the top of it and it is that small teeny tiny like a flowers. And it is such a bad impact now, that health wise and spread wise and even to the other local plants which are there on this place. So, (())(18:39) suitable examples, why one should prevent, travel of invasive species. Then, of course, the biggest problem, noise pollution, air pollution and disturbances and all sorts of pollutions and things. Deforestation, because there is a need and the humans they know best how to exploit nature and exhausted it of its resources, so all of those things. Resource extraction, hunting, and overall land use changes and fragmentation.

So, if you see if this used to be a forest and now there is a road passing in between, so now this forest is going to get split into two, causing disturbances for these animals to cross over because, their habitat is this whole piece of land. So they are going to get killed while crossing these roads and things. So, it brings actually fragments the whole ecosystem into

multiple smaller segments and eventually it kills them. So, there are huge impacts of road infrastructure. So, this is just to sensitize that how one can avoid such bad impacts.

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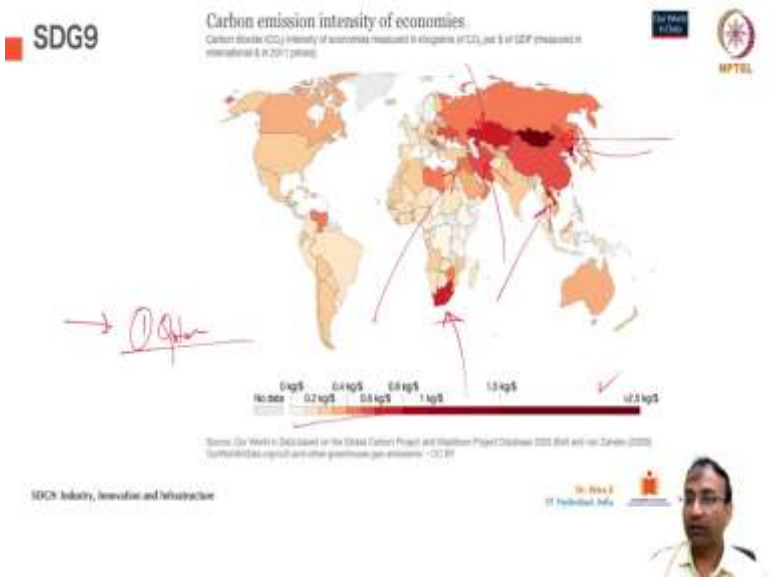

Further coming down to carbon emission intensity of different economies. So now you can see Mongolia is one of the highest impacting one. And one of the highest I think top most impacting country on this planet with the huge pollution and all sorts of impact is the Qatar is from middle eastern regions, and it is one of the highest I think that holds the place 1 and overall impact on the planet. So, this country must gets and indicated to reduce its emissions to such an extent and bring to the controllable limits. Apart from that we are seeing Mongolia and North Korea over here and Cambodia it looks also is like that in the Southeast Asian I think country and South Africa then further and then a few more from Central Asian region.

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Number of air transport passengers carried by in the year 2019. So, in this one you can see of course, 400 to 800 million, passengers perhaps US, China and Brazil, they top the list, I think perhaps US topped the list. Then we have UK, Russia, Australia, India, and a few more European countries. And majorly if you see these African nations and a few from I know Eastern Europe and this Central Asian region, there may have been the lower numbers, this is from this source, maybe you can search for the latest data.

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Railway passengers carried in 2019. So, in this one you can see clearly China and India they come at the top and then the Japan, Russia and a few European countries, then USA. So, as per the analysis of environmental impact of these different transportation sectors, railways is

considered to be one of the most optimized one, most green one. So, because it does not emit so much of exhaust as compared to the aviation industry and any other personalized vehicle vehicles also. So, this should be promoted as transportation preferred transportation system.

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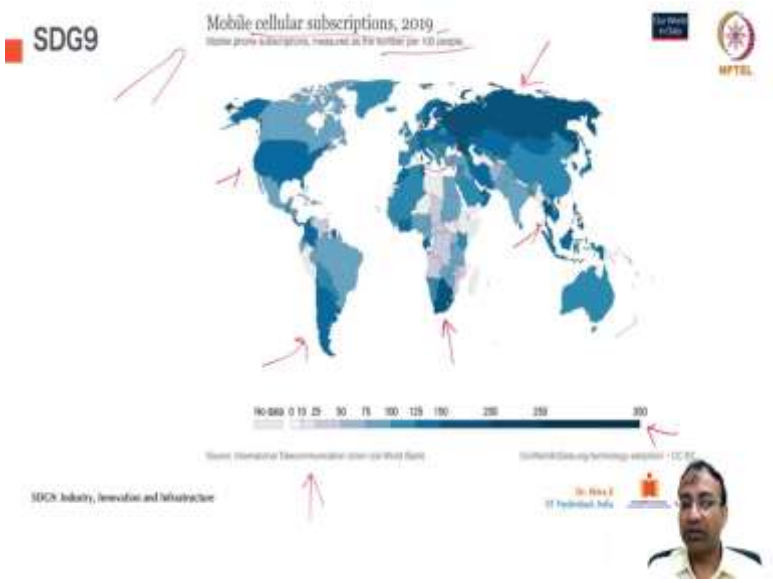

Finally, further we have a mobile cellular subscription as per year 2019, number per 100 people. So, you can see 350 is topped by South Africa here, I think Russia also has the highest concentration, Indonesia, US, the South American countries, these Eastern European countries, International Telecommunication Union can check for the latest data.

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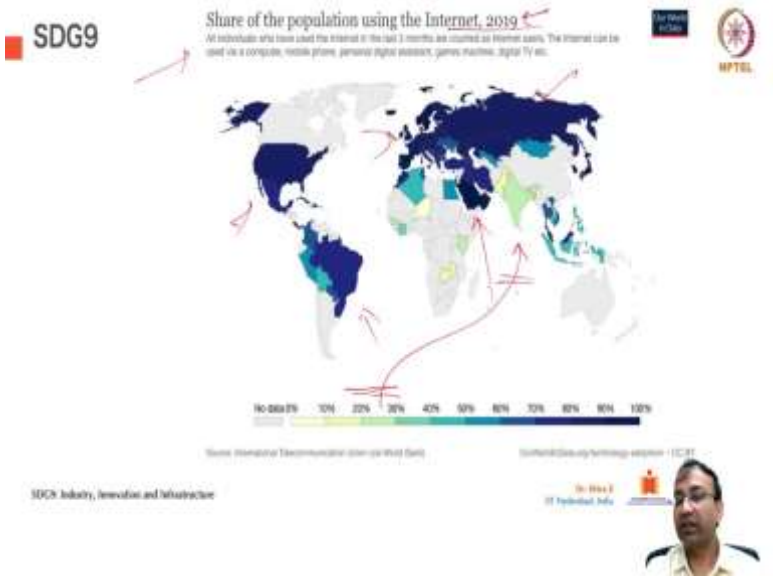

Then we have share of the population using internet. So, you can see these Middle East countries they have highest concentration then most of European countries, Russia, North America, Brazil, India comes into the lower ranges you can see perhaps this is the percentage, between 20 to 30 as per the year 2019, you can check for the latest data.

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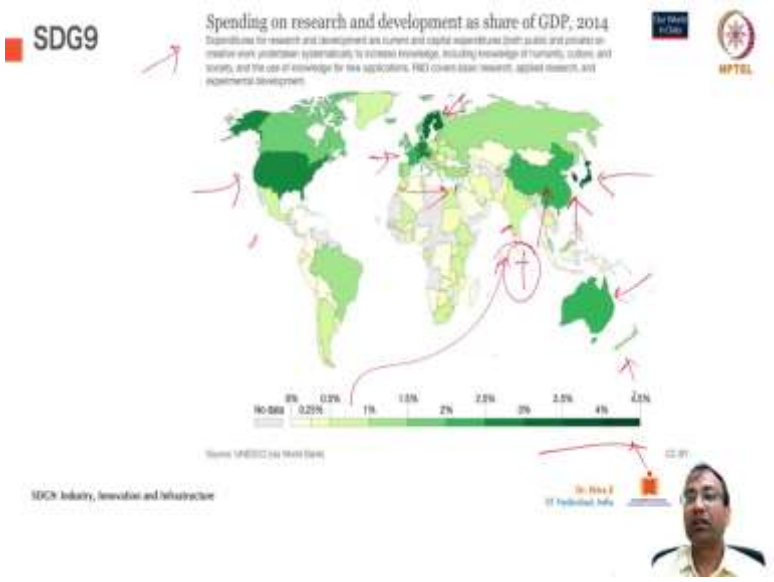

Then we have spending on research and development a share of GDP. So, as a share of GDP, if you see, this Nordic country, here this Israel and Japan and South Korea and even US, they are spending the highest in terms of our share of GDP, they are in the dark green shade. Then comes China, Australia, New Zealand, Mexico, many of these European countries and then in the lower edges, it is India is also there, I think 0.5 to 1 percent that is the slab we are in, this must actually increase, because if you want a prosperous and strong India, I think we must insist on robust R and D.

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So now I will give you some examples how the impact of products and services and other things items can be minimized by efficient and sustainable design and planning exercises. So, this is one commercial product I have taken as a case study, how Voi contributes to the UN Sustainable Development Goals SDG 9. So Voi and sustainable industry, innovation and infrastructure. So, this is the slide which talks about so these are the components you can pause for a minute and see the details motor controller, battery controller, system controller, IoT controller, connectivity, location, accuracy, motor, battery, lights, turning indicator, throttle and brake. So, these are the components of this bike.

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So, what they have done so far on innovation front? We have championed major innovations that have made e-scooter sharing safer, greener and more efficient supported by our city Innovation Fund. On battery technology, what they have done? Voi was the first operator to commit to savable batteries in 2019, a leapfrog innovation that cut our emissions by 50 percent made our operations safer for our employees. We are investing in best in class battery technology and analytics with partners nautical and extend the lifespan and ensure second life applications for our batteries. We share findings with partners and industry networks to accelerate the safe electrification of transport globally.

Inclusive parking infrastructure innovation, Voi has worked closely with a number of disability advocacy groups across Europe such as the Royal National Institute of blind people to develop safe parking structure solutions that consider the needs of vulnerable groups. We have developed over 250 scooter parking racks, made from recycled materials, we have pioneered a number of parking innovations to promote responsible parking such as our parking cop feature which analyses parking for at the end of each ride and has reduced non complaint user parking by 37 percent.

So a lot of improvement on these terms. So you can see in the numbers also. Advanced GPS, Voi is investing in state of art geofencing technology that is revolutionizing the GPS accuracy and safety of micro mobility. Safety research, Voi is collaborating with the University of Warwick and the RNIB to develop a sound that can warn vulnerable people of approaching scooters.

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Well, their targets clean batteries of course more improvement because still if you see renewable resources in the most bad disadvantage is these energy storage systems majorly batteries, because batteries still consume huge number of resources and have heavy metals and other stuff. And other chemical compounds which are toxic and hazardous to the environment, human exposure or any other animal or plant exposure. Some of those chemicals like carcinogens also causing severe problems in the human society. So, clean batteries is the need of our if this gets done, like negativity around renewable resources, renewable energy resources such as solar will be addressed efficiently.

Cut battery production emissions by 30 percent by developing a battery pack with Europeans producers by 2022. Circularity, increase second life applications, so that these can be used again for all safe batteries. Safety and parking innovation, then we saw sustainable infrastructure, environmental certifications.

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Then there is another case study of this flow tack maybe you can search these case studies separately for understanding. Flow tack, optimizing traffic flows for smoother journeys and cleaner cities. So you can see there is this indicator.

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So, here we will see what we have done so far. With road traffic forecast to grow at alarming levels across the globe, council planners and transport authorities must keep our towns and cities accessible and people moving without impacting the environment. The award winning traffic optimization solution Flow tack launched in year 2017 does just that. Flow tack forecast and optimizes traffic flows at the network level, providing gear control to keep cities moving and therefore supporting SDG 11 in enabling sustainable cities and communities.

By implementing Flow tack in Deventer, we have already seen a reduction in the number of vehicles having to stop at junctions across the city, which leads to CO2 emissions reduction between 7 to 18 percent. And reduction in NOx emissions by between 11 to 26 huge percentage of saving in CO2 and NOx, like nitrogen based oxides and different other compounds. So well what it does it optimizes and shares this information on the internet so that new oncoming drivers who are heading to particular street or a road can send the save themselves off to congested traffic, so this optimization is I am sure in contributing a lot. More such innovations are needed at market level where all of us can benefit.

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What have we done so far more cities across the world are introducing flow tech to create cleaner cities where it is more pleasant to live and work. In the United Kingdom feasibility studies are underway and the demonstrable impact on traffic flows has been recognized by two leading industry award schemes. Flow tack was awarded the technology innovation prize, the Chartered Institute of logistics and transport annual award for excellence.

Pitted against stiff competition this is a agree that floe tack led to the field as a ground-breaking innovation with poor results. Flow tack also won the road visionary award at new civil engineering magazines Techfest Awards which recognised organisation that push boundaries developing pioneering ideas to effect major change in the global growth sector.

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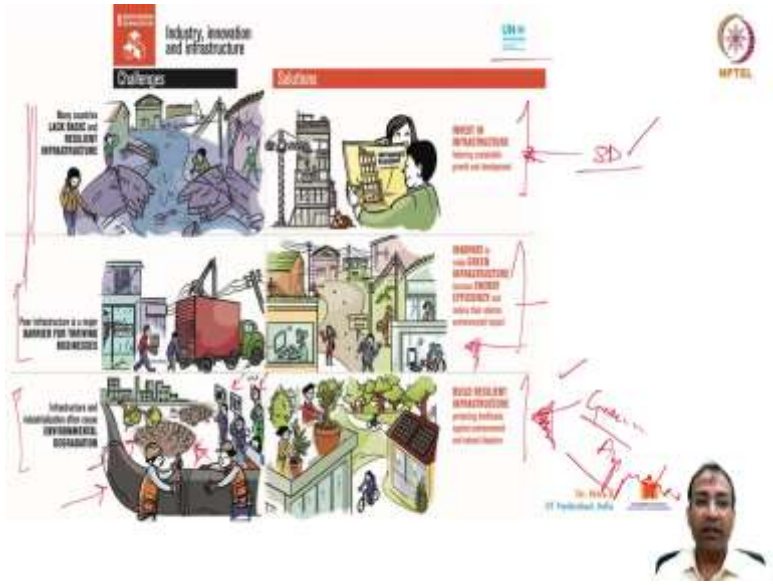

With this, we have come to the end of final slide where we will see some challenges and solution from UN Environment. More countries lack basic and regional infrastructure, that is the true condition, look around your villages and towns if not cities, they lack majorly on the infrastructure part. Well, more investment in infrastructure in these areas, fostering sustainable development and growth because anyways, things are happening, if things should happen in a responsible way, they can be channelized to fall under sustainable development.

Secondly, poor infrastructure is the major barrier for thriving businesses. Of course, poor infrastructure does not allows businesses to grow it does not gives guarantee that supply of things will be ensured, whether it is energy or production materials or even you are sending your goods to the other places, how efficient that system can be. Innovate to make green infrastructure, increase green efficiency and reduce the adverse environmental impact. So, solving all of these, but using green aspects in mind is an essential factor over here.

Lastly, infrastructure and industrialization often cause environmental degradation. Well, this is a very common prevalent thing across the world. Whenever there is infrastructure or industrialization growth, it happens at the cost of environment, so that should not be the case. Actually, if you see in this illustration or these people are protesting against such heavy infrastructure facilities because, it happens at the cost of you can see here either felling trees or grabbing the land or removing habitat of other species, killing all other animals, removing those animals from those habitats, because there is a habitat like a loss. So, they have to vacate they have to run and not all of them will be able to find a new place, lot of them will end up in dead.

So, that is a situation well what can be done? Build resilient infrastructure, protecting livelihoods against environmental and natural disasters. So, well growth and development should go but hand in hand with the greener approaches, because only then, this can be taken care of. So, that is a situation with this, we have come to this end of SDG 9, we are discussing industry innovation infrastructure. You should refer UN website for the latest reports and data sets, for understanding connected with your locality, with observations from your place, it will be beneficial. So, thank you all for joining. See you in the next lecture.