Social Innovation in Industry 4.0
Professor J. Ramkumar
Professor Amandeep Singh
Department of Mechanical Engineering and Design
Indian Institute of Technology, Kanpur
Lecture 06
Use of Social Innovation in Industry 4.0 (Part 1 of 2)

Welcome to the next lecture on Use of Social Innovation for Industry 4.0.

Social Innovation and Industry 4.0. When we refer Industry 4.0 it refers to Integration of Advanced Technology. These Advanced Technology has to be used effectively, such that your Social Innovation Process Cycle gets down in their timing, and you also have Sustainability and Scalability of your solution.

So, using these tools makes your Social Innovation robust, repeatable and reliable. All these terms are very very important. Making a solution for a stop gap arrangement is not the ultimate.

Making a solution for a scale up, learn, and then come and reiterate is one thing which is very very important. So, many a times what we do is, we do empathy study, then we clearly define the problem statement, then we try to ideate, then we try to make prototypes, and then we try to make testing.

So, this is a typical cycle for Design Thinking. When we follow this cycle, we do empathy study. When we do empathy study, we need to have two things, one is primary data, the other one is secondary data.

Majority of the secondary data comes from literature, published articles plus reports, interviews etcetera. The primary is predominantly collecting from the customer, from the unmet need people.

Now, you have to understand primary data and secondary data. So, there can be a situation where if you can try to plot it. For example, performance with respect to time, you can try to see as a graph like this. Maybe an idealistic case, maybe you will see a graph like this.

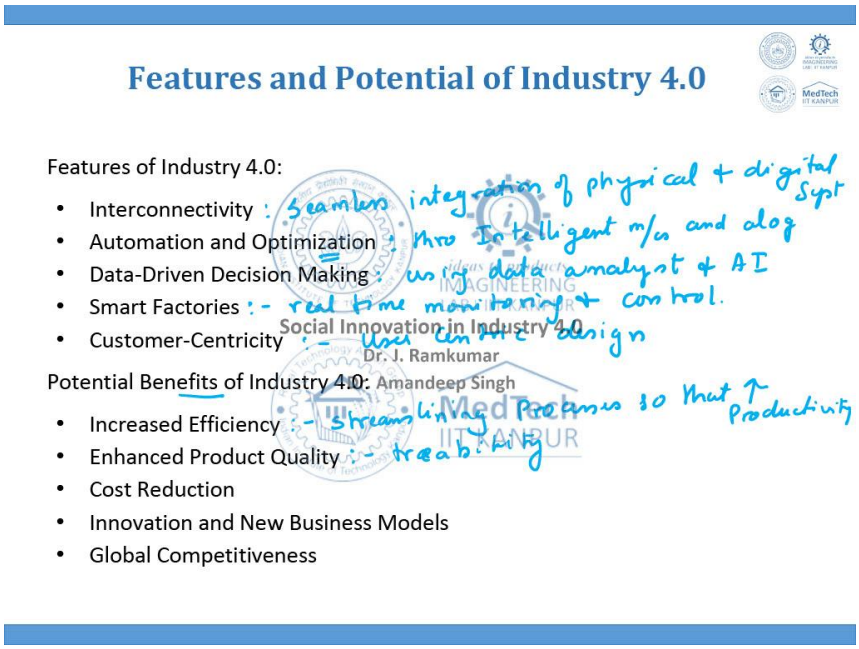
Now, if you have this data, how do you interpret that data, how do you make a model, such that the definition of the problem can be done very good. The good, here, means efficient, effective. So, for doing all these things, AI, ML, DL are very very important.

Next is Automation. Automation tries to make prototypes seamlessly without manual intervention trying to produce the output. And, Internet of Things is also very important. So, Internet of Things is connectivity between the sensors, between the server all those things are Internet of Things. So, all these things play a very very important role.

So, Industry 4.0 refers to the integration of Advanced Technology such as AI, Automation, IoT into Manufacturing and Industrial Processes. Social Innovation plays a very crucial role in Leveraging the potential of Industry 4.0 Technologies to benefit Individuals, Community and Society as a whole.

For example, today if you want to get the data of a particular cluster of people, what are their qualification, what are their sex, all these things by a click of a button, you will be able to get. Moment you get that, then the schemes, the policies, all those things can be planned with the existing actual data.

Earlier, there used to be lot of redundancy of work. Now, after the Invasion of Digital and Industry 4.0 with Automation and Internet of Things, you will be able to have much more command over the data get run queries, and get the output, whatever you want to meter to the requirements.



When we talk about the Features of 4.0, we have Interconnectivity. So, here we will try to talk about a seamless integration of physical and digital systems. that is, what is the Interconnect, we are trying to do. It is a challenge. Opening of the door, closing of the door. So, now, IOT comes into existence. So, all these things are put together in a closed box.

So, then Automation and Optimization. This is also very important. This is done through intelligent machines and algorithms. This is Automation and Optimization. Optimization is very important. So, when you have lot of data, then you have to find out what is the data which is relevant, and how do you make an Optimization within the existing data, very important.

Today, there are several AI, ML tools which are used for sorting out the emails, sorting out the collected data, and finding out outlier points, reasoning out why are those points outlier. So, for those things Optimization plays a very important role. It also uses Data-Driven Decision Making using Data Analytics and AI. This is going to be that Google uses it exhaustively.

When we use Google search we have been using it exhaustively, this Data Analytics and AI which is in-built behind the scenes. So, we do not even bother about it. Smart Factories, it is for real time monitoring and control. Why is that very important?

Because there are two types of market, one is called the pull market, the other one is called the push market. Pull market means there is a unmet need. So, you are trying to pull the product from the factory. Push market means you have developed a product and you are trying to push it into the society.

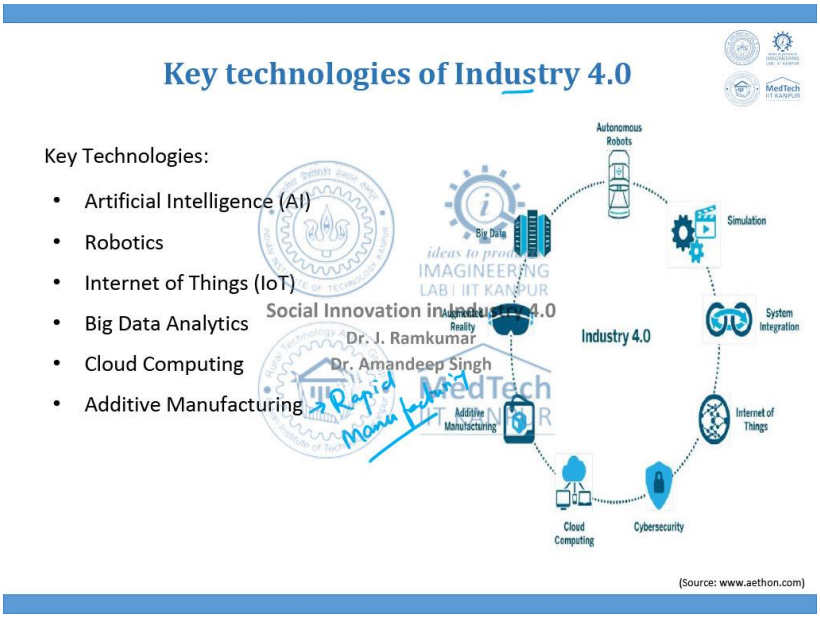
When we talk about Social Innovation, we always look for pull market, that means to say, unmet needs whatever are there and what do they want, and based upon the demand, you try to reorient the demand in the factory, and produce it, such that your Supply Chain Logistics are maintained very low.

Then, the entire deal goes around Customer-Centric, this is very important. The user centric design is the keyword in Social Innovation. The customer is the key person in the entire ecosystem.

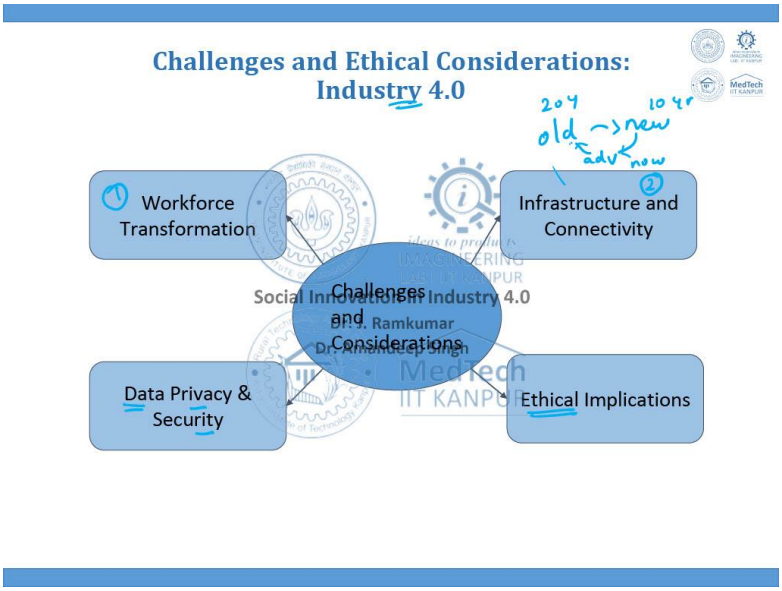
Unmet needs of the customer is the USP of Social Innovation. So, that is why, we try to push into user centric design, which is nothing but Customer-Centricity. The Potential Benefits of Industry 4.0 are going to be Increased Efficiency.

So here it is streamlining processes so that productivity improves. So, Enhanced Product Quality, it tries to have better traceability.

Then, Cost Reduction, Innovation and New Business Models, all these things can happen because of Co-collaboration Resource sharing all those things. Cost Reduction, Innovation and New Business Models and Global Competitiveness. All these things are benefits of Industry 4.0 in the use.



So, this we have seen in detail. So, I will just go through this slide faster. So, Artificial Intelligence is used in Key Technologies. Robotics is used, Internet of Things are used, Big Data Analytics is used, then Cloud Computing, AI is more towards Rapid Manufacturing. How quickly you manufacture, such that your prototype gets acceptance. So, these are some of the Key Technologies which are used in Industry 4.0.



So, the Challenges and Ethical Consideration for 4.0 is first biggest challenge.

First biggest challenge is, how are we going to change our workforces? Make them tech savvy, digital savvy, use the tools exhaustively, and try to do lot of Social Innovation. So, that is a biggest challenge, the change of workforce to meet out to the demand. So here, we will be talking about Upskilling and Reskilling, this is very important.

Using of excel data you have thousands and thousands of data, using that data, running a query, and then extracting what do you want. So, the excel itself you can teach them, how to write macro, and then these macros will be used to pull out the relevant data. So, Workforce Transformation is the biggest challenge.

The next thing is with the existing. You have old and new and advanced. So, there are 3 types of Technologies which are there. Old building, old infrastructure got converted into new infrastructure, from new it got moved towards advanced infrastructure.

So, then you try to connect old, new and advanced, so that you try to have the best out of it. What is old? Maybe 20 years before constructed, this is 10 years before constructed, this is now constructed, but the challenge is, it has to have a Infrastructure Connectivity done. You try to work on protocol all those things. So, that what it is.

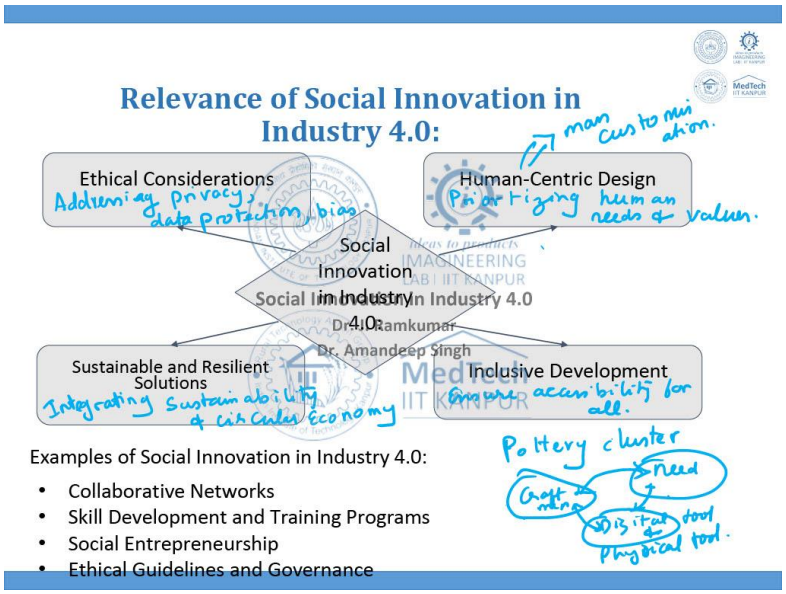
Then, Ethical Implications. So, that is a biggest challenge, try to produce what is required in a professional manner to meet out to customer demands, Ethical Implementation, and Data Privacy and Security.

These are the 4 big Challenges and Ethical Consideration when we start doing Industry 4.0. When we try to integrate Industry 4.0 to a Social Innovation, you should understand that data is something very very important. So, this data has to be maintained for their Privacy and Security.

So, this slide tries to talk about the Challenges and Ethical Consideration for Industry 4.0 very important slide. And, you should understand all those things play very difficult role

and when we try to integrate Industry 4.0 and Social Innovation, it is not going to be a easy task. Here the society is a large set of data and the data has lot of noise. Signal is also there, noise is also there.

You have to apply filter and based on that you try to take it to Industry 4.0 tools to get the best out of it.



So, the Relevance of Social Innovation in Industry 4.0. These 4 are the major pillars on which Social Innovation in Industry 4.0 happens.

Under Ethical Consideration we have Addressing, Privacy and Data Protection along with Bias. So, these are the important things which has to be considered under Ethical Consideration.

When we talk about Human-Centric, it is more of Prioritizing human needs and values. So, Human-Centric is nothing but Mass Customization. So, anything and everything you develop in Social Innovation, it has to be Human-Centric. So, the empathy study plays a very important role and we try to prioritize the human needs and values.

Next is, Sustainable and Resilient Solutions. We have Integrating Sustainability and Circular Economy. I have asked you to go through the Principles of Circular Economy in the previous assignment. I hope you would have gone through it.

So, under Sustainable and Resilient Solution, it is an Integration of Sustainability and Cyclic Economy. Then, Inclusion Development is to Ensure Accessibility for all the other important things which is to be considered for Social Innovation through Industry 4.0.

So, when we talk about Inclusive Development, we are trying to do inclusive development for learned people illiterate, then we are trying to put a community of people together.

Then, we are trying to make old age people. So, for everything we are trying to do it. So, Inclusive Development is, for example, developing toys for elderly people, it is a big challenge today. And, there is lot of wooden toys required, because at that age they do not have the gripping force like youth.

So, wooden toys have to be made, these toys have to be safe and making toys through Social Innovation, for example, there are lot of toys today which is coming from the bamboo cluster, there are lot of toys which are coming today from the textile cluster, there are lot of toys which are coming from the wooden cluster, toy cluster. Lot of toys are coming only keeping towards elderly people.

The market is very huge, there is an unmet need, but when we say bamboo it cannot be only one, and bamboo when you try to do, it needs a lot of human intervention. So, trying to do something like that, and this is what falls under Inclusive Development. Ensure accessibility for all, is part of Inclusive Development.

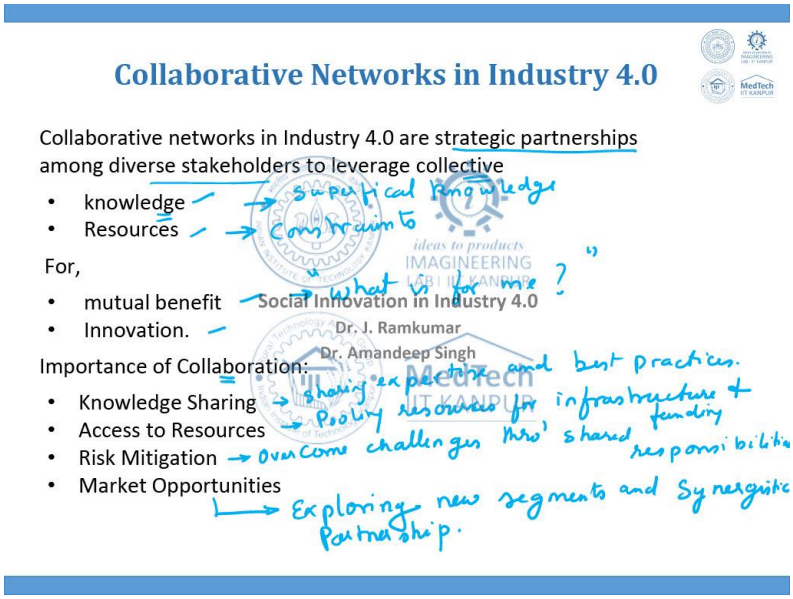
So, when we try to look into various examples of Social Innovation in Industry 4.0, we always look for Collaborative Network. Let us take a simple example of pottery cluster. So, there is a craftsman, he knows all the skills, there is a need, there is lot of skills of digital tools and physical tools. So, the need comes to the craftsman or it goes like this, from here it goes like this, and then from here to here also you have a connect.

So, what I am saying is that by having a collaboration network between a craftsman, customer and digital tool and physical tool. So, the digital tool can be platforms for sale, physical tool can be understanding the customer need, developing tools which a craftsman can use such that he can improve the productivity. So, there is a Collaborative Network which is an example of Social Innovation in Industry 4.0.

The next one is going to be Skill Development and Training Program. Government of India spends lot of money in Upskilling and Reskilling. Skill Development is very important because the cluster people will understand more the customers rather than the expert going and understanding.

Many a times, we always look at symptoms and we develop solutions, but we have to go to the root cause in developing. When we have to go to the root cause and develop it, more amount of skill is required in identifying the root cause.

The next one is Social Entrepreneurship Programs are run based on the Social Innovation in Industry 4.0, and ethical guidelines and governance are also some of the examples of Social Innovation in Industry 4.0.



So, when we talk about the Collaboration Network in Industry 4.0, they are all looking for strategic partners. See nobody is looking for a weaker partner, people are trying to shake hands with each other, where in which they look for a hand with the same muscle power like them.

So, Strategic Partnerships are one thing which is used. The Strategic Partnership can be in terms of knowledge, can be in terms of location, or can be in terms of digital platforms, whatever it is. Our Strategic Partnership among Diverse Stakeholders to Leverage Collective Knowledge and Resources.

Today, Resources is something which is getting into constraints. Knowledge is though said freely available, it is all superficial knowledge. So, the Knowledge, whatever we get here is all, one step knowledge.

Here is a query, here is an answer for that query, but if you ask a next question, why is that? Then, it will not be able to tell you. So, the Knowledge, whatever is getting shared, is today available, is superficial knowledge. and the Resources are something which are getting more and more constraints today. So, Strategic Partnership among Diverse Stakeholders to Leverage Collective Knowledge, Resource for Mutual Benefit and Innovation.

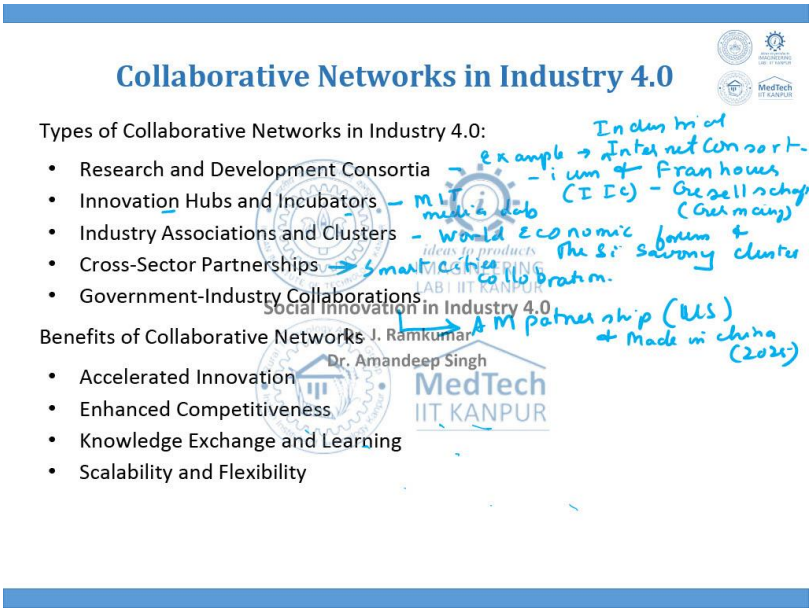
So here, you have to understand, what is for me, is a question, which you are supposed to answer for every stakeholder in your ecosystem. For a customer, the product what is the benefit, it is going to give, for a manufacturer, by developing what is the benefit, is going to give, for a connect in between the manufacturer and it what is the benefit he is going to get.

How is this benefit? Is it going to be sustainable? Are we looking for organic growth? Organic growth means you grow, I will also grow. So, let us grow together. So,

something as Mutual Benefits. Knowledge Sharing and Resource Sharing leads to Mutual Benefits and Innovation.

The Importance of Collaboration is going to be Knowledge Sharing, where in which the Sharing Expertise and Best Practice. And, sharing best practices is very important. The next one is Access to Resources is pooling resources for infrastructure and funding. The Importance of Collaboration, you will have this.

Then, Risk Mitigation, it is to overcome challenges through shared responsibilities. The last one, Market Opportunity is exploring new segments and synergistic partnership. So, these are the Importance of Collaboration. Good practices or best practices has to be shared. Resources have to be pooled, challenges through shared responsibilities, there will be challenges. So, you have to Risk Mitigation, and then the Market Opportunities. These are some of the Importance of Collaboration.



So, when we are trying to look at Types of Collaborative Network in Industry 4.0, the first one is going to be Research and Development Consortia. Example, you will have Internet Consortium and Fraunhofer-Gesellschaft, which is in Germany. So, you have Industrial Internet Consortium which is called IIC, one of the example.

Type of Collaboration is Industrial Internet Consortium or Fraunhofer-Gesellschaft in Germany. They are some of the examples for Research and Development Consortia. Innovation Hubs and Incubators. For example, this you can try to take it as MIT media lab. MIT media lab is Innovation Hubs and Incubators. So, lot of things happen in this, and several countries are trying to mimic the MIT media model in their countries, such that they can promote the Innovation Hub and Incubation. Industrial Associations and Clusters.

For example, this is World Economic Forum and the Silicon Valley Savony Cluster. When we are trying to look at Cross-Sector Partnerships, it is going to be Smart Cities Collaboration, this is our example.

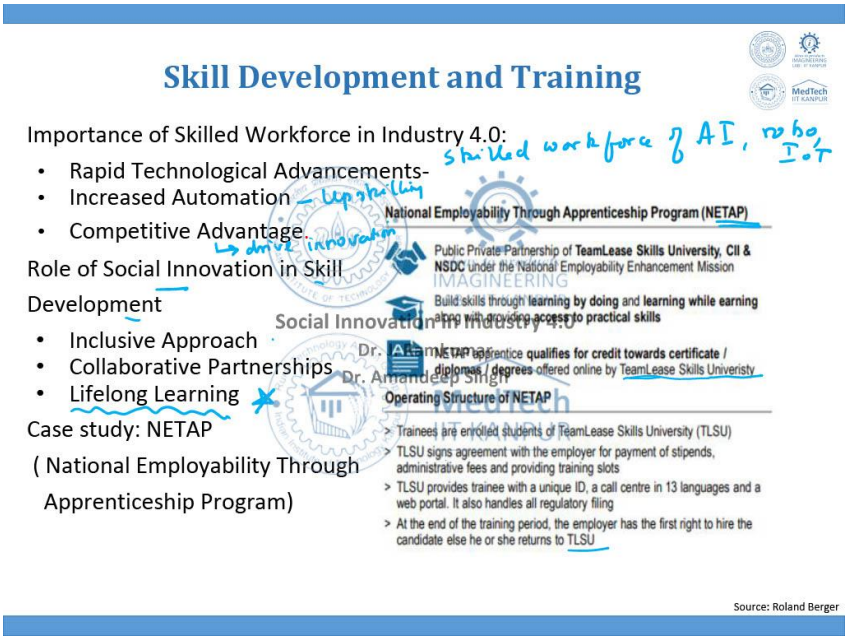
When we talk about the Government-Industry Collaboration, it is going to be Advanced Manufacturing Partners, which is in US.

The other thing Chinese government has taken, Made in China 2025 initiative. Like Make in India, China has also done it. So, these are some of the Type of Collaborative Networks in the Industry 4.0.

You have Research and Development Consortia, Innovation Hubs and Incubators, I have given all the examples. Industrial Association and Cluster which is the World Economic Forum and the Silicon Savion Cluster. And then, we have Cross-Sector Partnerships is Smart Cities Collaborations, Government-Industrial is AM Partnership in US and made in China in 2025.

These are some of the Types of Collaborative Network in Industry 4.0. What are the Benefits of Collaboration?

Accelerated Innovation can happen, Enhanced Competitiveness, Knowledge Exchange and Learning, Scalability and Flexibility, which we have already dealt.



Skill Development and Training when we try to talk about, the Importance of Skilled Workforce in Industry 4.0 is going to be Rapid Technological Advancement.

People should understand they are required Skilled Workforce of AI, Robotics and IoT. There is a skilling required. So here, I have already told you Increase in Automation is going to be Upskilling. And here, Competitive Advantage is Skilled Workforce Drive Innovation Productivity.

So, here the Competitive Advantage is going to be Innovation and Productivity. So, these are the Importance of Skilled Workforce in Industry 4.0. Rapid Technological Advancement, they should be imbibed.
Increased Automation is Upskilling and Competitive Advantage is there. The Role of Social Innovation in Skill Development are Inclusive Approach Collaborative Partnership, and Lifelong Learning, which is very very important, which we all try to forget.

So, there is a Case Study which is NETAP (National Employability Through Apprenticeship Program) is one thing, which is part of NETAP. The National Employability Through Apprenticeship Program. In NETAP, you will have Public Private Partners for TeamLease Skills University, CII and NSDC Under the National Employability Enhancement Mission Government of India. So, these are all the major points. The next one is, Building Skills Through Learning by Doing and Learning While Earning along with Providing Access to Practical Skills.
NETAP apprentice Qualifies for Credits Through Certification like Diploma, Degree offered online by TeamLease Skills University. So, the Operating Structure of NETAP is going to be Trainees are Enrolled Students of TeamLease Skills University. They sign agreement with the employer for payment of stipend, administrative fee and provide training slots. They also provide trainee with a unique ID, a call center in 13 languages and a web portal. It can handle all regulatory filing.
At the end of the training period, the employer has the first right to hire the candidate else he or she returns to TLSU. This is a program where in which it has been integrated keeping Social Innovation and Skill Development where it is focused towards 4.0. This is a very important program which is initiated by Government of India.

So, Inclusive Growth in Social Welfare. It ensures Inclusivity in the Digital Transformation Process, Equal Access to Technology, where in which it is bridging the digital divide. Digital Literacy Programs, where in which this is given, especially for marginalized groups. This User-Centric research we have already discussed. It is Prioritizing Inclusivity.

So, the Addressing Social Disparities Caused by Industry 4.0. It is going to be Job Displacement and Reskilling, Income Inequality and Regional Disparities. So, these are some of the things. So, here the workers are affected by automation. So, there is a Job Displacement.

Income Inequality initiatives for fair wages and economic opportunity. Regional Disparities is infrastructure investment for under privileged region. So, these are the issues to be addressed by social disparity caused by Industry 4.0.

It is not that so easy to connect Industry 4.0 and Social Innovation, there will be challenges, there will be ethical challenges, there will be social disparity. All these things have to be handled properly, such that this can be implemented in a big way.

Social Innovation Initiatives for Inclusive Growth and Social Welfare. Digital Inclusion Programs.

This is empowering marginalized communities through digital access and training. So here, these programs should be run for empowering marginalized communities through digital access and training program. Social Entrepreneurship is to promote social enterprise for inclusive growth. T

hen, Community Engagement Projects. These are very well done in developed countries. Community Engagement Project is there. In our country also, lot of projects Swachhata Abhiyan, all these things are also part of cleaning city, skilling city, Wok India, Run India. All these things are Community Engaged Projects where in which the people are involved in developing it. So, it is Engaged Local Communities in Industry 4.0 initiative.

Then, Policies and Regulation Framework. We are here trying to talk about Prioritizing Social Welfare and Ethical AI usage.

And, when it is Impact Investing, this is going to be Investing in projects for positive social and environmental impact. So, these are important. Social Innovative Initiative for Inclusive Growth and Social Welfare. So, these are the programs which are done Digital Inclusion Program, Social Entrepreneurship Program, Community Engagement Projects, Policy and Regulatory Frameworks, Impact Investing. So, all these things are very important.

Today, after this Social Innovation has come up in a big way, people have started spending lot of time and money in coming out with impact measurement schemes. I try to establish a product which has plastic in it, what is its impact on the environment in due course of time?

So, that is what is, Investing in projects for positive social and environmental impact. Moment you do more and more automation. Then, there will be lot of joblessness. So, you have to have some balance and make sure that it brings positive social impact. Thank you very much.