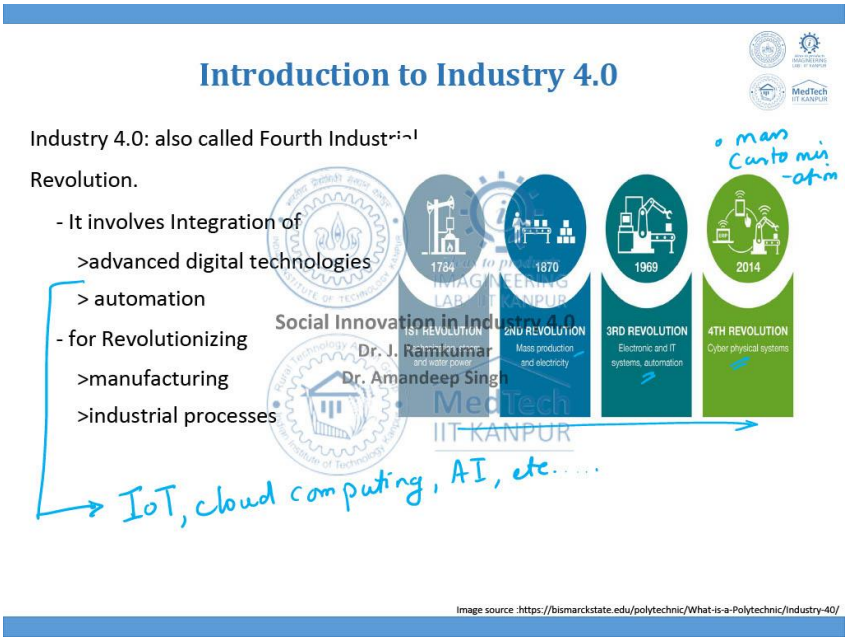
Social Innovation in Industry 4.0
Professor J. Ramkumar
Professor Amandeep Singh
Department of Mechanical Engineering and Design
Indian Institute of Technology, Kanpur
Lecture 04
Social Innovation and Industry 4.0: The Relation (Part-1)

Welcome to the next lecture on Social Innovation and Industry 4.0: The Relation.

This is what we will be covering in this lecture. The content for this lecture is going to be:

- Introduce first what is Industry 4.0
- Understanding Social Innovation in the Context of Industry 4.0
- Potential of Industry 4.0 for Social Innovation
- Industry 4.0 Application for Social Innovation
- Challenges and Ethical Considerations
- Case Studies where in which Examples of Social Innovation has happened in Industry 4.0
- Opportunities and Future Directions
- Conclusions

- References



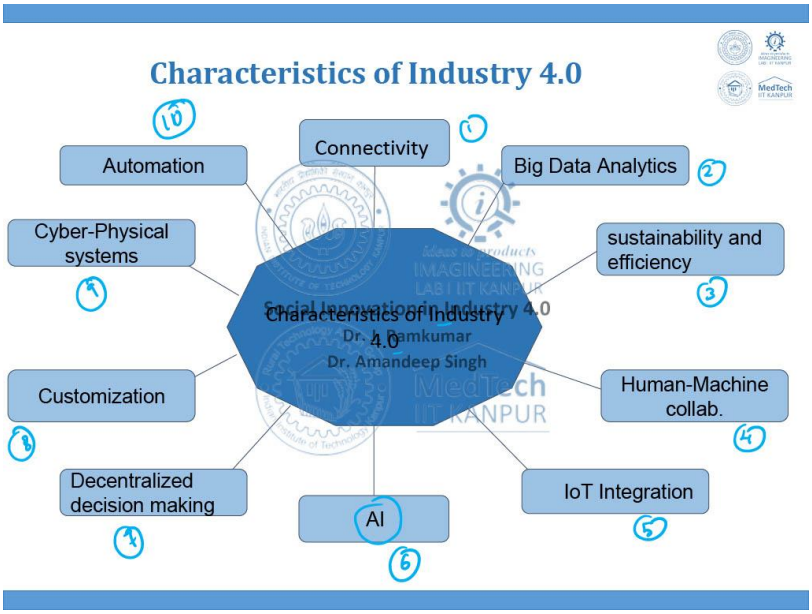
Industry 4.0 is also called as Fourth Industrialization Revolution.

- It involves Integration of
  - ❖ advanced digital technologies like IoT which is Internet of Things, Cloud Computing, then AI, etcetera. So, these are some of the advances in digital technology.
  - ❖ You will have automation also as part of the technology. Today, the Bluetooth which is used for communicating. Let it be Alexa, let it be communicating between a smartphone and an air conditioning in your house, let it be your smart phone getting integrated with switching on, switching off of your microwave oven, your induction stove etcetera.

Now, you see advanced digital technologies have led to major automation. This has Revolutionized manufacturing and industrial processes. If you see Industry 4.0, it has got evolved over a period of time.

The First Generation was more towards Mechanization, the Second Generation was more towards Mass Production, the Third Generation was more about Electronics and the Fourth Generation is nothing, but Cyber-Physical systems. When I talk about Cyber-Physical systems, you should understand the concept of Mass Customization comes into existence. What is Mass Customization? No two variables or customers will try to have a same solution, but they can have a similar solution. So, the Cyber-Physical systems leads to Mass Customization. This is where the world is moving towards Mass Production.

Then came Batch Production, today it is Mass Customization. The Industry 4.0 is more towards Cyber-Physical systems.



What are the Characteristics of Industry 4.0?

First is Connectivity. We moved from physical connection to virtual connection, a wired connection to a wireless connection. We were initially talking about 1G, 2G, we are talking about 5G, 6G today. The Connectivity has improved, the bandwidth has improved and multiple systems can be integrated, one on many, many on one. All these things have started coming. The biggest Characteristics of Industry 4.0 is Connectivity. If Connectivity is not there, Industry 4.0 is not there. Connectivity place a very very important role.

Second is Big Data Analytics. Writing a code to understand the data, represent the data in a usable form is Big Data Analytics. Now with this Big Data Analytics people are trying to identify the customer needs and customer wants.

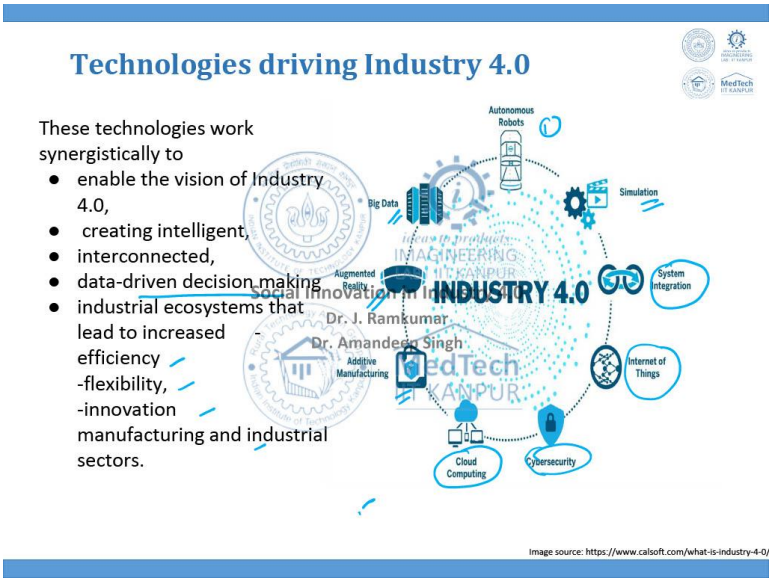
Next, Sustainability and Efficiency is part of Industry 4.0. We look for efficient solutions, we look for sustainable solutions. Sustainability and Efficiency is something which is very important of Industry 4.0. That means to say, any solution you come forward, you put forward, there has to be a component of sustainability, scalability and efficiency.

So, Industry 4.0 also looks at Man-Machine Interface or Man-Machine Collaboration. It is not Machine-Machine collaboration, we look at Man-Machine Collaboration.

Then, Internet of Things Integration, then Artificial Intelligence, ML, DL, it is all part of this.

Then, we have Decentralized Decision Making. The instrument itself will have its own intelligence to sort and try to pick solutions. So, here in which the Decentralized Decision Making is very very important, then Mass Customization, Cyber-Physical systems and Automation.

If you see all these things, if you will try to have a better life or better success by integrating Industry 4.0 into your Social Innovation, you do not have to worry too much on Automation, you do not have to worry too much on Cyber -Physical systems, but Decentralized Decision Making is very very important. Then, Internet of Things Integration is very important.



Technologies driving industry 4.0 are few of these technologies, which are available in the market. The first one is Autonomous Robots. The Autonomous Robots can be passive, active, can be wired, can be wireless all these things. So, it is an Autonomous Robots which can take a decision and which can try to interact with the external society for a decision.

Next, Simulation is part of it. When you do Social Innovation people always feel that let me do, let me understand person by person, and then I will try to collect more data, but collecting more data is time consuming and costly. So here, what we do is, we collect some data, we have a Simulation, we try to match, and then we try to have an understanding of the situation, and try to move towards innovation. So, Simulation is also

part of the Social Innovation. You try to simulate the crowd, you try to simulate the demand, you try to simulate the pattern of people. When you try to create a niche market, you try to do Simulation, but here, it is not an Engineering Simulation, but a Social Simulation. The pattern of which the population moves, the pattern in which technology seeps into a Society Simulation.

Next is System Integration. So, when I said co-creation, co-collaboration, sharing resources, System Integration plays a very important role. Internet of things is very important, there are sensors to monitor and they define and tell you. For example, currently there is a huge crisis in India with respect to tomato production. The cost of the tomato which sometime used to be around about 5 rupees a kg, today it is around about 200 rupees a kg. Why did all these things happen? Because the rain was not sensed properly, the yield was not extracted properly, the yield was not stored properly where in which this created a huge scarcity. Of course, there was a spread of virus which tried to hamper the deal.

Why all these things happened and the agriculture was faced a major crisis. There were not many sensors and these sensors were not integrated to understand, predict and promote or tell the customers agriculturist what is to be done. The social impact is a huge loss of the yield which has added a financial drudgery for a society of people. A Social Innovation can play a very very important role by integrating the sensors.

Next is Cybersecurity. The data, whatever I have, has to be protected and kept such that it cannot get tampered.

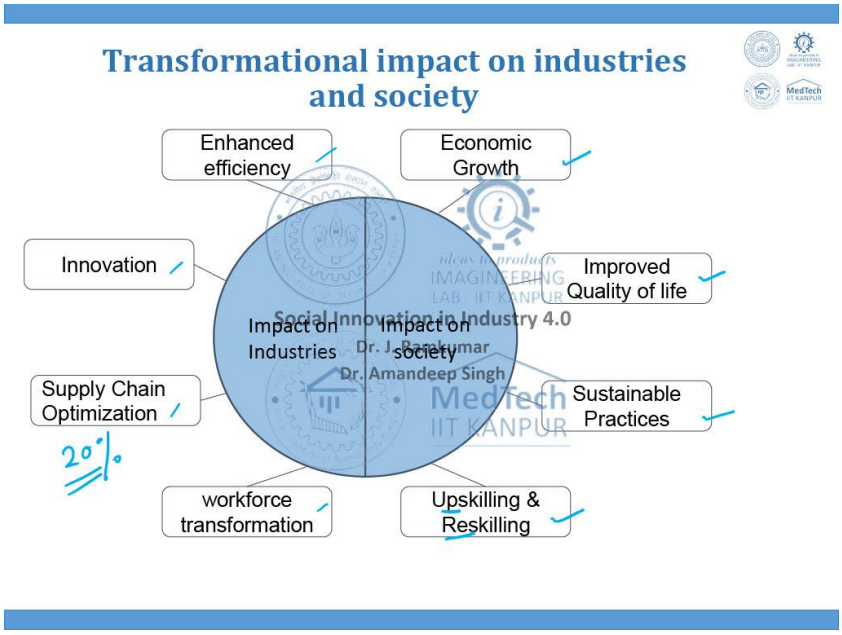
Next is Cloud Computing. Now the servers are getting removed, the cloud space is being allocated, hardwares are reduced, the cloud space is used for sharing and doing data. Lot amount of prototypes can be made using Additive Manufacturing. Augmented reality is going to give a new feel for the Industry 4.0.

And, the last one is Storing of Big Data. Though all these things looks to be on a higher side when I put the term called Mass Customization in Social Innovation. All these people participate and bring in efficiency to the system. These technologies work synergistically to

- enable the vision of Industry 4.0
- create intelligence
- interconnected
- data-driven decision making this is very important. In Social Innovation data-driven decision making is very very important.You cannot give by here say like, when I introduced in the beginning slide itself innovation, start asking 5 times,

why this happens, go to your root cause and then develop it. So, when we are having all these things, it is data-driven decision making.

- The industrial ecosystem that leads to increased
  - ❖ efficiency,
  - ❖ flexibility,
  - ❖ innovation,
  - ❖ manufacturing and industrial segment, they all are technology drivers for Industry 4.0 which can yield a betterment in Social Innovation.



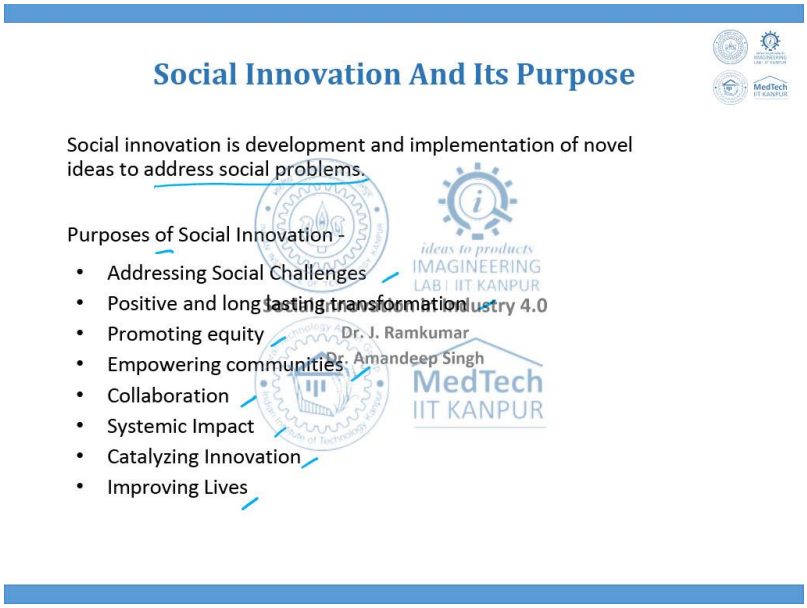
The Transformational Impact on Industry and Society. Impact on Society, if you see, Economic Growth, Improved Quality of Life, Sustainable Practices, Upskilling and Reskilling. I studied computer programming 20 years before using a Fortran language. Now, I have to learn a python language because the world has changed, it is Reskilling. Remove whatever is there in the past, try to learn everything fresh.

Upskilling means I have done a version 1 I am going to do a version 2. So, the Transformation Impact on Industries and Society, when you talk about Society, it is going to be more towards Upskilling, Reskilling, Sustainable Practices, Improved Quality and Economic Growth.

When we look at Impact on Industry, Enhanced Efficiency, Innovation, Supply Chain Optimization, and Workforce Transformation. So, all these things are part of Impact on Industry. Supply Chain Management is where Optimization is a very very important topic.

Today, while agricultural yield are shipped from one place to the other, close to 20 percent of the yield gets rotten or gets to beyond a level of usage while transportation. Safe transportation and efficient transportation is very important.

Today, in Supply Chain, we are talking about right time, right quantity, right price at the right space delivery. So, Supply Chain Optimization plays a very very important role in technological transfer.



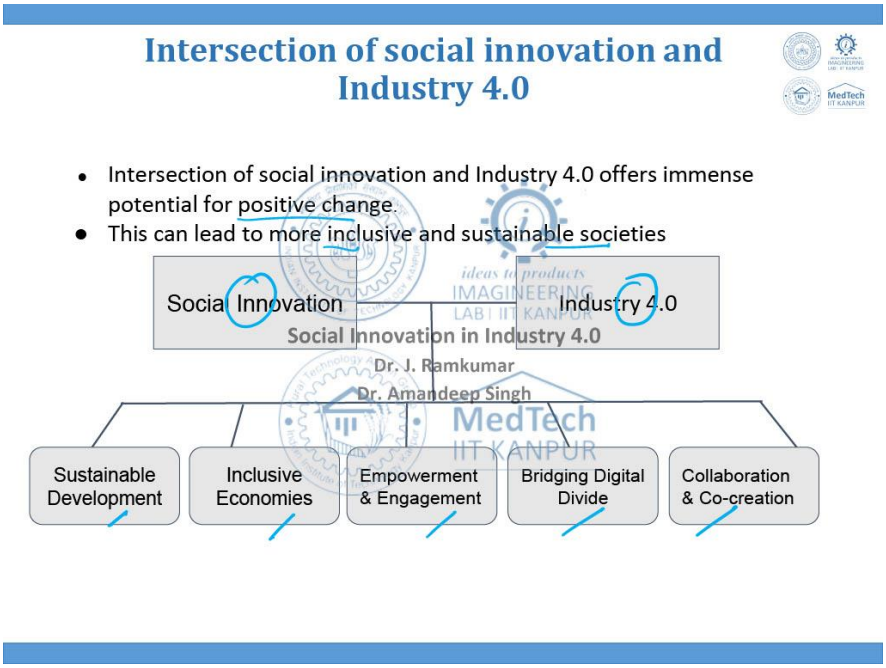
The Social Innovation and Its Purpose.

Social Innovation is development and implementation of novel ideas to address social problems. The Purposes of Social Innovation are-

- Addressing Social Challenges
- Positive and long lasting Transformation
- Promoting Equality
- Empowering Communities
- Collaboration
- Systemic Impact
- Catalyzation of Innovation
- Improving Lives.

During the time of COVID, lot of street vendors lost their job. Now, these people already run on a critical number financial game. If you ask them to stop their business, the family gets into starvation. These people have to be revived, there has to be a business model

where in which these people will be given loan. At end of the day, they should repay the loan through a digital platform and sustain make profit on a daily basis. So, here is a social challenge. COVID street vendors how do they improve the livelihood. So, this is what is the Purpose of Social Innovation.

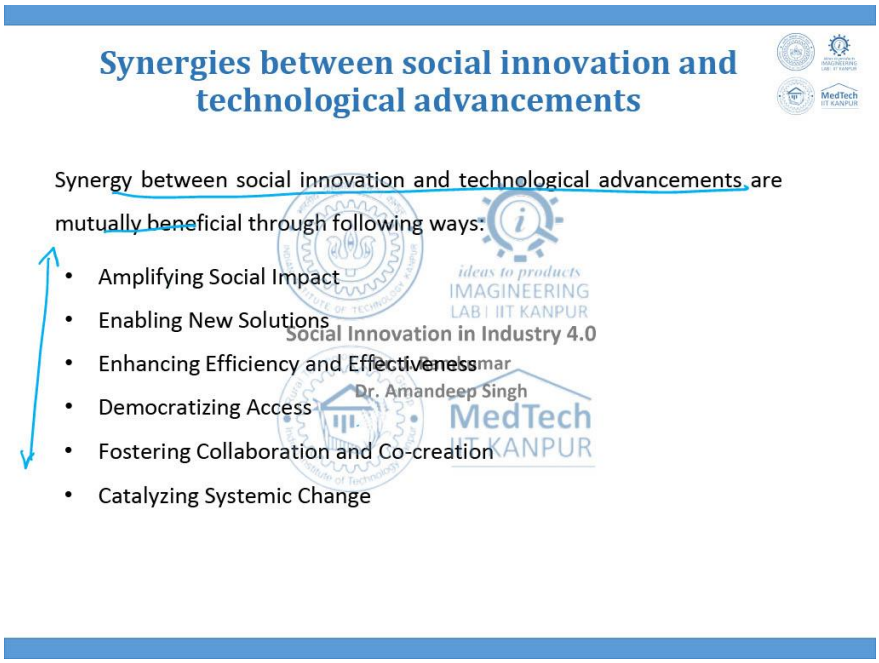


The Intersection of Social Innovation and Industry 4.0 goes like this.

- So, the Intersection of Social Innovation and Industry 4.0 offers immense potential for positive change.
- This can lead to more inclusive and sustainable societies.

You have Social Innovation in one side, Industry 4.0 on the other side. These two things join together in giving up the five important pillars. Sustainable Development, Inclusive Economy, Empowering and Engaging societal people, Bridging Digital Divide, and Collaboration and Co-creation. These are the five verticals.

On these vertical stands Social Innovation and Industry 4.0. Social Innovation, when it is combined with Industry 4.0, these are the benefits or these are the pillars which are going to transform the connection.

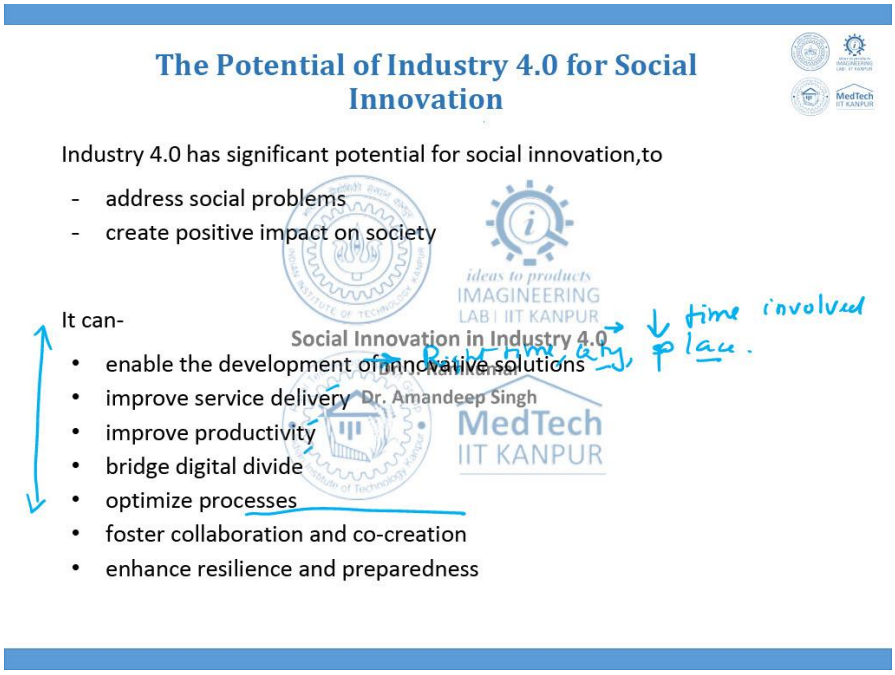


The Synergies between Social Innovation and Technological Advancements.

The Synergy between Social Innovation and Technological Advancements are mutually beneficial through following ways:

- Amplifying Social Impact
- Enabling New Solutions
- Enhancing Efficiency and Effectiveness
- Democratizing Access
- Fostering Collaboration and Co-creation
- Catalyzing Systemic Change

All these things are very important because they are going to give a mutual benefit.



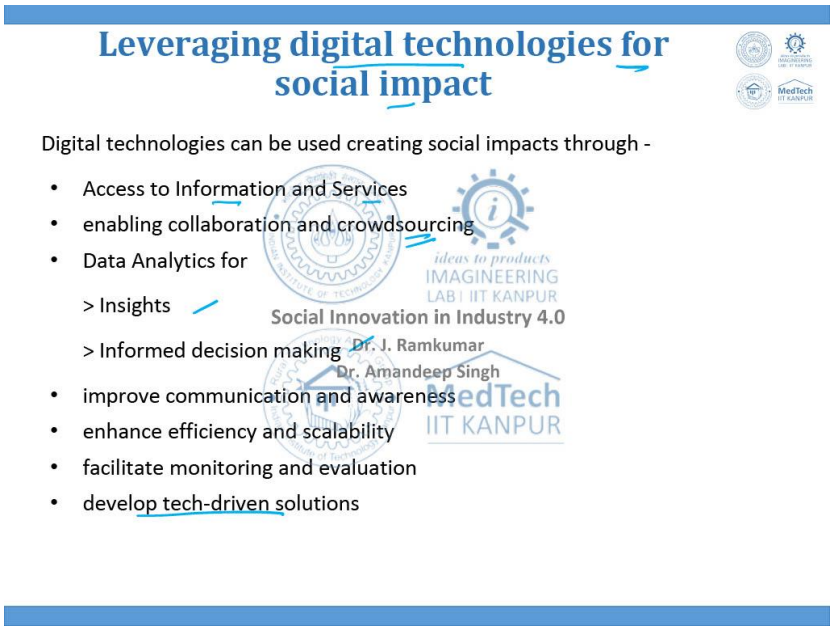
The Potential of Industry 4.0 for Social Innovation.

- It addresses social problems.
- It creates positive impact on the solution.

It can-

- enable the development of innovative solutions. So, it can reduce the time which is involved. Time involved in creating solutions, in developing solutions.
- it improves service delivery. Again, it is trying to improve the efficiency, right time, right quantity, right place. Right time, you say, within half an hour, right quantity I need one third of a pizza, whatever it is quantity, at a right place without damage, is improving service delivery. So, when we do Social Innovation, try to integrate supply chain, this supply chain will have more and more technology in it, and then you try to improve the service delivery.
- improve productivity
- bridge digital divide
- optimize processes
- foster collaboration and co-creation
- enhance resilience and preparedness for the society. Resilience means whatever change happens, the society should be able to withstand that change. And, preparedness is they are prepared for a huge transformation which happens in the society.

So, the Potential of Industry 4.0 for Social Innovation can have all these possible benefits.



Leveraging Digital Technologies for Social Impact. The Digital Technologies can be used creating social impact through-

- access of information and services. I told you in the one of the previous lectures, when people collect the product from the women folks, who are working at home on a part time basis, they try to enter the number of their output, they try to get thumb impression of the women folk and the delivery boy whatever it is, then immediately it gets accounted and if the money gets transformed. So, you are trying to Access to Information and Service.
- Enabling Collaboration and Crowdsourcing
- Data Analytics for Insights and Informed Decision Making technology plays a very very important role.
- Then, Improve Communication and Awareness, for that also technology plays a very important role. For ex- Digital newspapers, sharing of news.
- Enhance Efficiency and Scalability technology plays a very important role.
- Facilitating Monitoring and Evaluation
- Develop Techno-Driven Solutions.

All these things are benefits which are created by the Involvement of Digital Technology for Social Impact or Innovation.

The Enhancing Efficiency and Effectiveness of Social Innovation.

Industry 4.0 can contribute to Enhance the Efficiency and Effectiveness of Social Innovation through Initiatives like:

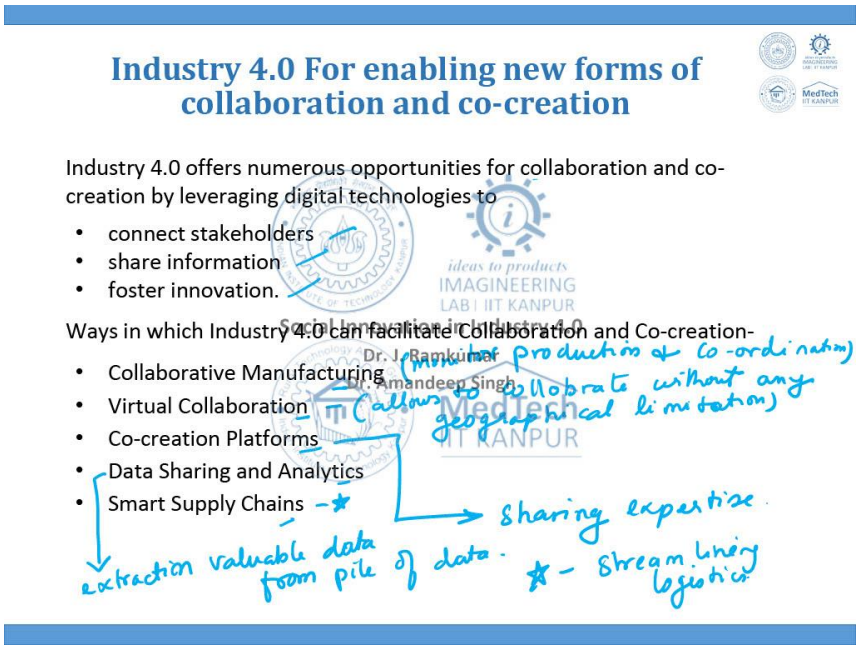
- Automation Optimization
- Data-driven Decisions
- Resource Management
- Collaboration and Co-creation
- Monitoring and Evaluation
- Enhanced Communication and Engagement
- Scalability and Replicability

These are some of the initiatives through which Technology and Social Innovation can join hands in improving the Efficiency and Effectiveness.

Industry 4.0 for Enabling New Forms of Collaboration and Co-creation.

Industry 4.0 offers a Numerous Opportunity for Collaboration and Co-creation by Leveraging Digital Technologies to

- Connect Stakeholders
- Share Information
- Foster Innovation, protect innovation, get stored more things in innovation.



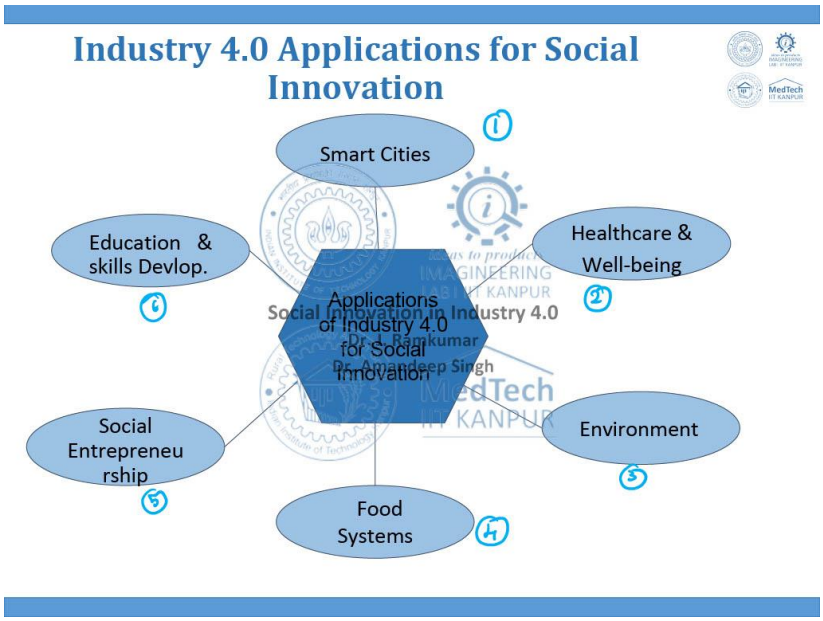
Ways in which Industry 4.0 can facilitate Collaboration and Co-creation-

- Collaborative Manufacturing
- Virtual Collaboration
- Co-creation Platforms
- Share Data and Analytics
- Smart Supply Chain Management.

So, what is Collaborative Manufacturing? Here, we try to monitor the production and co-ordination. Then, Virtual Collaboration, it allows to collaborate without any geographical limitation. This is Virtual Collaboration.

Co-creation is sharing expertise. Data Sharing and Analytics is extraction of valuable data from pile of data. And, Smart Supply Chain is more and more of streamlining logistics.

So, these are the ways in which Industry 4.0 can facilitate Collaboration and Co-creation Collaborative Manufacturing, Virtual Collaboration, Co-creation Platform, Data Sharing Analytics and Smart Supply Chain.



Industry 4.0 has several Applications in Social Innovation. One major thing is Smart Cities. Government of India has identified more than 100 smart cities across the country.

When we say 100 smart cities, it is all more focus towards Social Innovation. Try to reduce the energy consumption, try to reduce the water consumption, better waste management system, try to Collaborate and share resources. All these things are part of Smart City. Industry 4.0 is exhaustively used for Social Innovation in Smart City Implementation.

The second thing is Healthcare and Well-being. So, here is also a place, where in which the Big Data, all these things whatever I said here, play a very very important role. You can see here Big Data plays an important role, Simulation plays an important role, System Integration plays an important role. So, all these things are very very important.

So, Healthcare and Well-being is the next important thing. The Environment is the third thing where Industry 4.0 is more focused towards sustainability.

Fourth is Food Systems, fifth is Social Entrepreneurship, sixth is Education and Skill Development. At all these places Application of Industry 4.0 is done for Social Innovation.

Thank you very much.