



UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION



# Industry 4.0

Preparing for the 4<sup>th</sup>  
Industrial Revolution

World Summit on the Information Society (WSIS) 2017

Panel discussion

# CONTEXT

In April 2017 UNIDO and ITU signed a joint declaration with the objective of forming a strategic partnership in order to complement each other's mandates. The crucial role of inclusive and sustainable industrialisation, as a major driver of sustainable development, and the role of Information Communication Technology (ICT), as an engine for social and economic growth, as well as achieving the UN Sustainable Development Goals are all clearly recognised. The partnership sets out to broaden engagement with stakeholders in order to have meaningful impact on SDG-9 (industry, innovation and infrastructure).

The joint declaration provides the framework for cooperation, particularly in the areas of:

- ▶ Innovation policy in converged ICT ecosystems, and
- ▶ Digital transformation, broadband infrastructure, Internet of Things (IoT) and connecting the unconnected.

Within the framework of the joint declaration, UNIDO and ITU co-organised a special session on SDG9 at the World Summit on the Information Society (WSIS), in June 2017.

The Special SDG 9 Session, held during the WSIS forum, looks at the reality of working together in the field of ICTs with the aim to reach sustainable industrialization and foster innovation. As a part of the special session UNIDO held an expert panel on 'Preparing for the 4th Industrial Revolution'. The main orientation of the session addressed how to face the challenges related to the adoption of Industry 4.0 in order to implement a coherent strategy leading to preparedness. Issues included: employment generation, government policy, infrastructure support, and the role of development agencies assisting developing countries.

**The first industrial revolution was triggered by water and steam power to move from human labour to mechanical manufacturing. The second industrial revolution built on electric power to create mass production. The third used electronics and information technology to automate manufacturing. The fourth is the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Industrial Internet of Things (IIoT), and cloud computing. Industry 4.0 is gradually implemented, often with digitalization as the first important step. Digital technologies allow for new business models and value-producing opportunities, and are attainable for most developing countries.**

# SYNOPSIS

Despite its name, the concept of Industry 4.0, or the 4th Industrial Revolution, is not solely about manufacturing, even if manufacturing is the main sector involved today; its broader connotation includes concepts such as smart transportation and logistics, smart buildings, oil and gas, smart healthcare and smart cities. A more general description is that it concerns the digital transformation in, and of, global industrial markets with an impact at macro, meso and micro levels. Industry 4.0 is of particular relevance for all aspects of SDG-9. In addition, it has wide-ranging implications for most of the other SDGs both from the side of supply and demand.

Effective diffusion of the Industry 4.0 vision, digital transformation, and leverage of third platform technologies, such as big data and the Internet of Things (IoT), takes place at different speeds and is related to a variety of challenges being faced at the levels of government, support institutions, and in particular the firm. Nevertheless, what is clear is that there is a level of inequality in the requisites, e.g., ICT infrastructure, needed for adopting Industry 4.0 amid sectors as well as between developed and developing countries.

Industry and policymakers alike recognise the huge opportunities for growth offered by digital transformation, interconnectedness and new manufacturing technologies related to Industry 4.0. Together, these occurrences are driving new business models, sustainable and efficient use of limited resources and the cost-effective production of highly customizable products, denoting an unprecedented transformation in industry, flexibility and agility.

On the flip side, there is the challenge that organizations at different levels might have difficulties to adapt. For example, governments could fail to cushion the workers affected or to harness the new technologies to capture their benefits while mitigating their consequences. In the longer term, adoption of Industry 4.0 could lead to a shift of power from the public to the private sector, which needs to be better understood. A growing income and wealth inequality could lead to fragmented societies with potentially disastrous outcomes. Meso level institutions meant to support industry could rapidly become obsolete and irrelevant unless they too upgrade themselves in line with expectations relating to Industry 4.0. Finally, implementation of Industry 4.0 at the level of firms, especially SMEs, is a costly and disruptive affair. On the other hand, failing to make the necessary investments is likely to negatively impact their productivity and competitiveness.

It is essential to understand the role of government in this process, be it in developed or developing countries. In particular, there is the need to set the foundations for change, with preparedness being key. A first challenge faced by governments is the imperative that they cultivate an understanding of the future and remain informed of the potential implications of the opportunities and risks ahead.

Secondly, there is the need to ensure that the necessary infrastructure, including that pertaining to energy and ICT, is in place in order to support adoption and implementation of Industry 4.0, as well as reap the benefits from the enormous advantages of technological change. Government needs to be an enabler of change!

Thirdly, there must be an understanding of the potential impact of change on the role of government, the relationship between wider society and companies, and other organizations. Although this is beyond the scope of this panel discussion, this is a wider issue that needs to be considered, particularly during the planning process.

Finally, it is crucial that governments maintain social cohesion in an era that has the potential for major disruption, such as instability in the labour market and significant changes in income and wealth distribution.

Within this session we intend to address a number of key issues, namely:

- ▶ the importance and role of a coherent strategy leading to preparedness for Industry 4.0;
- ▶ policy challenges related to the adoption of Industry 4.0;
- ▶ the impact of Industry 4.0 on employment generation and attendant skill requirements;
- ▶ the importance of the knowledge-base and issues related to support infrastructure particularly for firms' innovation and productivity; and
- ▶ the role of development agencies in assisting developing countries to prepare and adopt industry 4.0 in an effective manner.

## PANELISTS

### **Ms. Ratika Jain**

Executive Director of Manufacturing at the Confederation of Indian Industry

### **Prof. Sami Haddadin**

Professor and Director of the Institute of Automatic Control at Leibniz University Hannover

### **Mr. Sebastián Díaz Mesa**

Chief Marketing Officer of public accelerator of Start-Up Chile





## OPENING STATEMENT

In her opening statement, Ms. Fatou Haidara, Managing Director Policy and Programme Support at UNIDO, underscored that it is important for developing countries to prepare for the inevitable advent of Industry 4.0, reaping its benefits as well as mitigating its less desirable outcomes. There is no doubt that Industry 4.0 will have a profound impact on all of us, be it on the factory floor, at the level of the household or the public sector. It will be a possible game changer, impacting advanced economies as well as developing countries and economies in transition.

So what are some of the implications of adopting Industry 4.0? On the positive side, it will raise productivity and competitiveness, save on resources and promote the circular economy, which are all crucial for enhanced welfare. However, there are several other issues, including the impact on income distribution, jobs and the environment, which are less well understood. Thus far, analysis and discussion have focused mainly on the implications of Industry 4.0 for advanced economies. This is to be expected because they are leading the development and adoption of these technologies.

Focusing on developing countries and economies in transition, it is important to note that this is a large and heterogeneous group of countries. As such, some of them have already started implementing aspects of Industry 4.0; others are preparing themselves to embark on the journey of implementation, while some still need to prepare themselves for the consequences of other countries' implementation. Without wishing to pre-empt the ensuing discussion, it is also clear that UNIDO and ITU will need to review their approach to and supply of technical assistance in order to simultaneously work with all these countries at various levels of preparedness.

Many developing economies have missed earlier technology waves due to the high cost of technology, lack of absorptive capacity, weak infrastructure and skills and information gaps. This has resulted in large GDP and productivity gaps, and hence wide welfare differentials, vis-à-vis for example OECD countries. Failing to take advantage of Industry 4.0 risks accentuating such gaps further.

To enable developing countries and economies in transition to respond to the challenges, maximizing the benefits of Industry 4.0 and minimizing its less desirable outcomes, the international community, through collective actions, has to continue to deliver and strengthen its portfolio of services.

More concretely, the multidimensional and multifaceted challenges involved in transferring the benefits of Industry 4.0 to developing countries and economies in transition require new and innovative partnership approaches in delivering our services on the ground. She highlighted that “To this end we are particularly delighted that UNIDO and ITU are successfully partnering in order to prepare developing countries for the implementation of Industry 4.0.”

In her final statement, she pointed out that today's joint event at WSIS is a small but important step for both organizations. Through platforms like these, the discussion can be advanced and open up dialogue on how countries can prepare for Industry 4.0, the opportunities it brings but also the challenges involved, and the crucial role that international organizations, such as UNIDO and ITU, play in harnessing the power of Industry 4.0 can be opened up.



## PANEL DISCUSSION

Prof. Sami Haddadin

**Through your experience working with government, academia and the private sector, what should the knowledge-base and government actors be mindful of in terms of supporting the adoption and implementation of Industry 4.0? Looking at it from the perspective of changing the competitiveness landscape, how could they be preparing the private sector for this inevitable transition?**

- ▶ Be proactive and supportive of this tremendous technology change acting at the right level of responsibility and realism.
- ▶ There is a need to prepare markets for the upcoming change and government has to take the lead on this.
- ▶ Actively inform industrial decision makers about technological step changes and near-future roadmaps, i.e. create awareness and continuous overview of technologies, remember Industry 4.0 is not a technology, it is a paradigm. This new paradigm means template solutions and increased connectedness.
- ▶ Bring together all local stakeholders (technology providers, integrators, customers etc.) to find the right combination of low hanging fruit suitable for their own market as every market is different and may require other concrete solutions.
- ▶ Create well-organized education centres for small and medium enterprises, so that they may become experts and early adopters in the field.
- ▶ Showcase and share successful transformations “from classical industry technology providers to Industry 4.0 technology providers”
- ▶ Support and shape international standardization as an enabler for making heterogeneous technology Industry 4.0 compatible.
- ▶ Support entrepreneurship with all viable means, as it not only creates novel enterprises with possibly unforeseen business models and opportunities, but is also an important way to keep talent from leaving.



Ms. Ratika Jain

**Is it important to have a coherent strategy for Industry 4.0, in particular, there needs to be a longitudinal dimension and understanding that all sectors may not adopt it in the same way?**

- ▶ If we look at manufacturing sectorally, in the Indian context, we see that certain sectors are more mature technologically than others. We also observe that these sectors are also the early adopters of smart industry 4.0 principles.
- ▶ Additionally, it is important for market forces to drive / provide a compelling reason for companies to invest in smart solutions to stay competitive and hence all sectors may or may not adopt Industry 4.0 in the same way or adopt the same solution.
- ▶ There is the need to bring in shared dimensions and coherence; there is the need for skills development, in particular the need to develop an adaptive workforce.
- ▶ Yet, if we look at some of the enablers of smart manufacturing such as sensors, robots, software programs, simulation, big data analytics, etc., we see there is a huge opportunity for India to be a global supplier of these technologies and solutions in the near future.

**“Industry 4.0 means different things to different people”**





Prof. Sami Haddadin

**From the perspective of an innovator, what factors make an environment conducive for the adoption and implementation of industry 4.0? What are the necessary preconditions?**

- ▶ Experts and talent in various technological and business domains relevant for the era of digital automation are essential. If they are not yet available, a clear strategy on how to create a critical mass of expertise has to be developed and rolled out quickly.
- ▶ Financial resources that allow the development of breakthrough technologies and leave the classical industrial path. There is the need for access to venture capital in order to boost ideation to market.
- ▶ Education and research have to be supported with strategic long-term funding agendas, ranging from basic research to application-oriented development in tight collaboration with industry. There needs to be a drive to increase linkages between and integrate research, education and industry.
- ▶ It is therefore important to have a coherent strategy for Industry 4.0 that focuses not only on helping companies adopt 4.0 technologies, but also to create an eco-system that enables the creation of technologies that power the next industrial revolution.
- ▶ Another dimension we must look at is that of jobs. With about a million people joining the workforce every month and with increased automation and use of robotics, job creation is and will be an important social imperative for a country like India.
- ▶ A related aspect is therefore how we ensure that the workforce has the requisite skills to cater to the economy's needs. All of the above will only be possible if we chart out a coherent action plan for technology-enabled industrialization.

**“Industry 4.0 is not a technology, it’s a paradigm.”**



Mr. Sebastián Díaz

### **What impact will the emergence of the 4th Industrial Revolution (Industry 4.0) have on technology start-ups? What should start-ups be increasingly mindful of?**

- ▶ If we understand that a start-up is a technology based SMB, we could say that start-ups are part of this 4.0 revolution. Start-ups are taking the lead on this. Big corporations are looking at start-ups to see how they solve problems, because start-ups were born developing business on new industries, such as IoT, Ecommerce, SaaS, etc. It's like a dad asking his child to teach him how to use LinkedIn. If you don't learn now, you probably won't exist for many companies if you are looking for a job. So now we are seeing that start-ups are more prepared for this revolution than big companies.
- ▶ Start-ups need to be mindful about the huge opportunity that they have, to lead all the industries towards this major change. Start-ups are coming to Chile with a B-2-B model for working and this is having an impact of business culture with start-ups offering solutions. Every year we see more companies looking to solve problems through entrepreneurs, because they are the key to adapting to the next revolution. As a result, we need to better understand how to integrate start-ups into the ecosystem.

**“Start-ups are a part of the Industry 4.0 revolution”**



Ms. Ratika Jain

**Is there a risk that Industry 4.0 implies the development of a dual economy with ever-increasing income and wealth inequalities, perhaps especially in the case of a vast country such as India where the regional discrepancy between infrastructure development (e.g. compare Bangalore and ITC with Orissa and Bihar) and industrial advancement may be huge (e.g. Industry 1.0 and Industry 4.0)?**

- ▶ Inequality as such is something that India has been working to address for a long time and it is important that we do not view technology as a villain but as a facilitator of a larger developmental objective.
- ▶ Technology, can, in fact be a great leveller of income/wealth inequalities as opposed to a divider and we have seen this happen most significantly in the context of the mobile revolution in India. Telephone density went from a marginal 2% in the late 1990s to 60% in a decade, creating a host of economic opportunities for the so-called bottom of the pyramid. In the Indian context technology is the catalyst for leapfrogging opportunities.
- ▶ With respect to Industry 4.0, the government is committed to creating public digital infrastructure and an eco-system that will potentially help industry leapfrog. As we speak, the government is working on revamping the industrial policy of the country to make India 'future-ready' for the inevitable transformation that will ensue with technology absorption.
- ▶ Having said that, the general view is that India is likely to see the co-existence of 1.0, 2.0, 3.0 and 4.0 technologies, with economic factors deciding when one embarks on this journey.
- ▶ Geographically, we are seeing a new evolution in the industrial map of India and there are very clear industrial magnets being created along the industrial corridors, alongside the multi-modal logistics grid and the industrial clusters.
- ▶ I do believe that the laws of economics will create balance in this emerging tapestry. At industry level, I am hopeful that as larger companies look to deploy smart solutions they will also have to handhold their tier I, II, III and IV suppliers to upgrade their facilities and that this domino effect will help percolate advanced technologies across the supply chain.
- ▶ Industry 4.0 brings with it mass customization which should be made more available to SMEs. Furthermore, trends like servitization, which are more location-agnostic, will serve to bridge economic divides.

- ▶ The fundamental challenge in my mind, therefore, is how to make India embrace the technological changes that are inevitable and foster new opportunities for growth.





Mr. Sebastián Díaz

**Global knowledge networks are a crucial part of the innovation process, and regardless of the industry or the size of the business and organization, everyone can benefit from more agile, more efficient and more innovative methods of organization and collaboration. With this in mind, how will Industry 4.0 impact them, for example with the reversal of FDI?**

**“Collaboration is key”**

- ▶ We believe that collaboration is fundamental in the 4th Industrial Revolution. At Start-Up Chile, we currently have start-ups from more than 80 countries in our portfolio and more than 500 partnerships with organizations from all over the globe. Our entire system is based on collaboration, as there was very little financial input into the Start-up Chile model. We share knowledge, best practices, commercial agreements, etc.
- ▶ We understand that if our entrepreneurs grow with the help of our partners, Chile will benefit. The same will happen with this revolution. If countries help each other, the faster they will grow; there is a huge opportunity for developed countries if they help developing countries.
- ▶ There is a great need for industry-workforce-knowledge-based institution connectivity. The private sector needs to join forces with governments to collaborate with other companies in other countries; this will bring better relations, more confidence, major stability and better business.





Prof. Sami Haddadin

**What is being done by developed countries to facilitate a conducive environment and what lessons and best practices can be shared to economies in transitional or developing countries?**

- ▶ There is the clear need to share knowledge, technology and know-how.
- ▶ Strategic R&D agenda based financing (e.g. EU H2020, Germany Industry 4.0 programme) and basic research in parallel (do not decide for just one or the other) can be implemented.
- ▶ Continuous R&D programmes open for tight research and SME cooperation, such as risk sharing.
- ▶ Support industrial entrepreneurship with business incubators, start-up programmes, professional networks etc.
- ▶ Attract venture capital and making it accessible.
- ▶ Connect start-ups with established industrial leaders to get both worlds together at an early stage, use-case oriented progress.
- ▶ First coordinated education programmes: starting in schools- via university- to professionals.
- ▶ Focus on the upcoming robotics revolution as a central element for Industry 4.0. The 4th industrial revolution is characterized by the tight entanglement and fusion of digitalization and automation in order to make machines smart, intelligent, interactive, and easy to use for humans. We tend to think of automation as classically rigid, costing hundreds of millions of dollars, but we are moving towards small-scale, modular networks of connected machines that can respond to dynamic changes in requirements and therefore present entirely new possibilities of making use of automation for SMEs in Europe and in developing countries. Therefore, a core technology is robotics, intelligent robotic systems at an affordable price.



Mr. Sebastián Díaz

**How are Latin American countries, and in particular Chile, planning for the adoption and implementation of Industry 4.0? For instance, does Chile have a strategy for how to support the private sector, as well as mitigate increased competition from abroad?**

- ▶ Yes! Chile is taking this revolution very seriously. Take Start-Up Chile as an example, a public accelerator looking to bring talented people to create the know-how for the next generations. Entrepreneurship is one of the many ways to prepare for this revolution- start-ups now, big corporations tomorrow. Also, a few months ago, we launched the Visa Tech, a visa that will allow big companies to bring talented people to Chile. This allows them to get a working visa in a couple of days, which is huge, taking the global context into consideration. We are one of the few countries investing in foreign knowledge.
- ▶ Chile is one of the countries with more Free Trade Agreements in the world. We can't compete with industrial/developed countries and that's why we are investing in knowledge. Big companies in the private sector realized that if they don't change then they will lose, not only in our local market, but also globally.
- ▶ Universities have a huge responsibility in this too. They need to encourage young people to study careers oriented towards this new revolution. For example, in Chile we have a lot of start-ups in our entrepreneurial ecosystem, but they have a hard time trying to find the right people to work with them in their tech businesses. Mobility of skilled labour is needed as we don't have enough programmers, engineers, etc. and we will need them sooner or later.
- ▶ There is a need to understand the triple helix of government, industry and the knowledge-base. The government is encouraging the private sector to work with entrepreneurs, to take their processes to the next level. This will allow them to compete with foreign companies that are better prepared. For example, our government just launched an innovation voucher for companies and start-ups. To start working together we need to take a few cultural barriers down. Most of the time, at least in Latin America, traditional individuals/companies think that tech entrepreneurs are just playing and not taking their business seriously. So, often, start-ups can't work with corporations because they see that investing time/money in them as a waste. Now the private sector has the opportunity to see how they work and how entrepreneurs will improve their companies with money from the public sector. Once companies realize the potential of this partnership, it will only be a matter of time before the rest of the big corporations join this revolution.

**“A change in culture and mindset is a crucial step forwards to adopting change”**



Ms. Ratika Jain

**What are the challenges and policy issues related to the adoption and implementation of Industry 4.0, and how is India dealing with them?**



- ▶ There is significant reform activity that has been initiated over the past few years by the Indian Government. Most of these reforms are targeted at creating requisite infrastructure and an eco-system for economic growth.
- ▶ Especially in India, as industries are at various maturity levels (of Industry 4.0), significant efforts are required to create awareness on Industry 4.0 and its benefits.
- ▶ Other challenges include access to capital, cyber security laws, IPR protection, availability of infrastructure, such as a digital eco-system – lack of availability of network, internet infrastructure, standards and regulations, high prices of sensors, robotics, solutions etc.
- ▶ Specifically for Industry 4.0 at policy level, the Indian Government is now working on a new industrial policy that will subsume all the various sectoral and state level policies and will bring out government’s focus on building an eco-system for technology enabled industrialization. This will entail developing the requisite standards and infrastructure addressing digital, human resource development, physical, institutional and technological needs.
- ▶ Awareness building is a basic but crucial step .The government is working in parallel to create awareness on Industry 4.0 through various regional and national workshops and other outreach programmes.
- ▶ Industry 4.0 means different things to different people and people need to know what the true potential is for them. It is important to understand what technologies mean and what their scope is. Companies must understand what the next milestone is and what needs to be done.
- ▶ There is a need for reorientation and CII tries to play a role in addressing some of these challenges. We work hand in hand with the government to tackle these problems. We are helping them align most of the initiatives, such as Make in India, Digital India, Smart Cities, Atal Incubation Labs and several others, move towards the common objective of building a technology base.

**“Institutions could figure this out themselves by trial and error, however given the pace of technological change there is no luxury for this”**

# QUESTIONS FROM THE AUDIENCE

## What role can multilateral organizations play in the arrival of Industry 4.0, both from a developed and developing country perspective?

Mr. Sebastián Díaz

- ▶ Multilateral organizations are everywhere. They can be placed in a developing or developed country. They need to be the connectors between different markets and cultures.
- ▶ A developing country can benefit from this with all the knowledge that they can get. This will allow them, in time, to be more prepared; a better country for its people, one that takes advantage of all sectors, industries, companies, etc.
- ▶ A developed country can help a small country. If a developing country gets better, corporations from developed countries can “sell” more and get better deals and collaborators.

Prof. Sami Haddadin

- ▶ The first premise has to be the education and training of people. Current technology, MOOCs and the arrival of affordable automation technology make it possible to give people access to knowhow, education and technology.
- ▶ Knowledge and technology transfer are vital. Specific and well-designed workshops and guest lectures are needed to better understand the key essence of Industry 4.0 and the core technologies that are available, affordable, transferrable, and also make sense for the respective markets.
- ▶ Automation should be evaluated from a societal, environmental and ethical aspect.
- ▶ The transfer of knowledge and technology, facilitate the distribution of knowledge. At the same time, local industry needs the right information and lessons learned. What exactly makes sense to be transferred and what does such a process look like?

Ms. Ratika Jain

- ▶ There is an important role of international organizations with respect to preparedness of Industry 4.0, specifically UNIDO as it helps create an informed understanding and an interface for organizations like ILO to respond effectively to emerging challenges, particularly within the context of the future of work.
- ▶ Multi-lateral organizations can play a definitive role by:
  - ▶ Providing international expertise, sharing of best practices and providing tools that industry can leverage.
  - ▶ Facilitating technology partnerships.
- ▶ UNIDO, through its mandate can provide an understanding of a new industrial blueprint. Working towards building an inclusive and sustainable industrial platform. Labour policy should be reactive to these inputs.



## QUESTIONS FROM THE AUDIENCE

**Not all revolutions are of technology but of mind-sets, how are you facilitating this in your county?**

Ms. Jain responded that mind-set and education are related, different stakeholders understand Industry 4.0 is here to stay and this is a reality that needs to be accepted. The bigger question is how do you react to this change? In the Indian context it's a cultural phenomenon – how do you make the most of the situation.

**“Technology is the catalyst which has created leapfrog opportunities”**

Ms. Ratika Jain





**Are we reforming the education sector in order to adapt to the advent of Industry 4.0? Is anyone working in this area?**

Mr. Díaz indicated that investment in knowledge is necessary and that this starts at the level of education.

In addition, Ms. Jain highlighted that tinkering labs in schools changes the way in which students look at and accept technology.

**With respect to financing technological change, what models could be used by developing countries to deal with the change?**

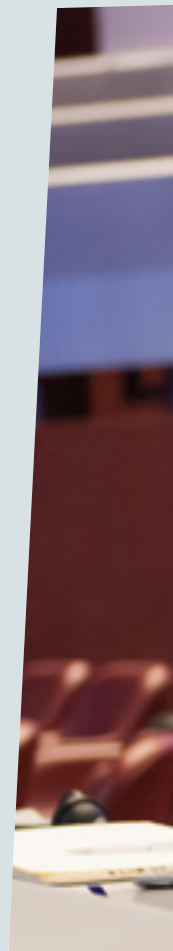
Ms. Jain underscored that economics will always be the biggest driver as there is a competitive business rationale. Economic cycles will shift, perhaps with a lag but it will come across.

Mr. Haddadin replied that there is the need for an ecosystem to develop, in which it is important to find the right business cases with a value chain approach, case by case.

## MAIN TAKEAWAYS

The important take home messages from the discussion are as follows:

- ▶ It is important to have a coherent strategy for Industry 4.0. The strategy should not only focus on companies but also on creating an eco-system to support creation of technologies.
- ▶ We will see coexistence of Industry 1.0, 2.0, 3.0 and 4.0 in many developing countries.
- ▶ Implementation of Industry 4.0 requires eco-system and infrastructure; cyber security laws, IPR protection and access to capital; also standards and infrastructure addressing digital, human resource development, physical, institutional and technological needs.
- ▶ Government has many roles, for example, bringing together all stakeholders, supporting entrepreneurs, creating education centres and much more.
- ▶ Innovators in particular need financial resources, education and research as well as experts and talent.
- ▶ Start-ups are a crucial part of Industry 4.0. Even big corporations are seeking solutions to problems from start-ups.
- ▶ The private sector-government link is important and collaboration is fundamental for successful adoption of Industry 4.0. For instance, there is a need to share best practice, knowledge, commercial agreements, etc.
- ▶ International organizations have an important role to play, for example, the provision of knowledge and technologies, connecting actors in different markets and cultures, education and training, and must consider not only the implementation of Industry 4.0 but also its social and ethical implications, i.e. creating an inclusive and sustainable industrial platform.







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