TECHNOLOGICAL REVOLUTION IN BUSINESS: CHALLENGES AND OPPORTUNITIES ABSTRACT

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Abstract

The world is changing at a breathtaking pace. Never before has innovation occurred in such a short period of time. There are several key trends acting together. They are inescapable and they are here now. Successful organisations will be the ones who can adapt to these trends and discover how to treat them as opportunities. Review these trends and consider how you will adapt and thrive. Innovation in business can lead to higher performance, but the process isn't automatic and it does not necessarily require above average levels of investment. Seventy percent of US CEOs are anticipating changes to their innovation capabilities. The definition of innovation *has widened to include not only R&D that underpins new technologies, products and services but also business processes and business models.*

The most successful companies combine an integrated process and a supportive culture to create a sustainable competitive advantage. Money simply cannot buy effective innovation. Patents generally don't drive profits. Less than 15% of companies are High-Leverage Innovators and distinguish themselves not by the money they spend, but in having a very good innovation in Business/Project management system.

This paper aims to unpin the challenges and opportunity faced in fourth industrial revolution with respect to three pillars; Environment, Economy, and Society. There are three reasons why today's transformations represent not merely a prolongation of the Third Industrial Revolution but rather the arrival of a Fourth and distinct one: velocity, scope, and global business impact. The speed of current breakthroughs has no historical precedent. When compared with previous industrial revolutions, the Fourth is evolving at an exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country. And the breadth and depth of these changes herald the transformation of entire systems of production, potential management, and governance rather manpower and human capital as well.

Keywords Technological Innovation, Digital Revolution, Fourth industrial revolution, Sustainable governance, Sustainable innovation.

Introduction

Innovation of technologies and the revolution for a knowledge-based economy have become "holy grails" of public policy worldwide. Innovation in business is not about moving from the present to the future in a single all-or-nothing leap. Rather, it is an alternative process of prototyping new models, including focused experimentation with new strategies for value creation, capture, and delivery that mitigate, manage, and when possible, capitalize on financial and related risks.

However, despite political rhetoric to the contrary, the policies and processes set up to facilitate or foster innovation remain more or less disconnected from sustainable development considerations. How can technological Innovation be governed in order to effectively line up international business and economic sustainability objectives? As per Innovation Network Survey fall 2013

- 75% said they had no metrics for their position
- 70% of them have innovation as part of their mission/job objectives
- 70% are allowed to work on "new" concepts for their company ("new" is not defined)
- 69% have no well defined innovation process within their company
- 60% have no working definition of innovation

Innovation can be ignited by business and technology integration .Technology can enable and drive innovation. But to truly capitalize on technology's potential and unleash an organization's creative energy, technology know-how must be combined with its business and marketing insights. Management graduates must act as man power solutions to global business scenario. Their dynamic ideas, analytical approach, consistent & disciplined complex dimensions integration are crucial to innovation. Entrepreneurial university and research and development consultancy in management institutes would be the step towards crucial and complex global business.

In the aftermath of nearly two years of severe economic turmoil, the most significant problem facing association boards, CEOs, and senior executives today, is the task of creating organizations/ industries / institutions business projects capable of thriving in the 21st century.

Businesses depend on service providers to handle confidential data, run essential business processes, and manage critical technology. This can leave businesses vulnerable to service provider breakdowns. Reaching this vital goal demands that associations embark on a comprehensive, dynamic, and ongoing process of reinvention, beginning with an intentional and imaginative effort to design, develop, and implement new business models that fully integrate the inextricably linked pursuits of purpose and profit.

Let's be clear from the outset: Tackling business-model innovation is not easy, and leaders should be under no illusions to the

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contrary. For a variety of reasons we have explored in this article, achieving genuine business-model innovation is a profoundly complex challenge—what we call a "wicked problem"—that defies ordinary solutions.

Lessons learned from case study of entrepreneurial universities and Technical & Management institutions world-wide where sustainable innovations of industrial processes and products have been or are on-going. The ultimate aim is to develop relevant insights from these case studies to enhance our understanding of innovation systems and to inform policymakers and other actors in world, concerning how they can promote and advance innovation governance, and in particular what mechanisms are needed to ensure that innovation policy is coherent with broader sustainable development aspirations. Hence, the study is focussed on environmental sustainability as its normative objective "function" but will through the research design pay considerable attention to social and economic sustainability as well. The economics of innovation and the politics of policymaking both imply a necessity for balancing these dimensions.

Rationale/Literature Review

Economic development has many dimensions, but the major determinant as well as the most outstanding source of structural change is arguably technological change (Schumpeter, 1934). In the North, the quest for economic growth has more and more become a quest for cutting-edge technology and knowledge (Blomström et al., 2002, Pierre, 2004). In the developing world, it has been found that technology change can help to combat poverty and raise life expectancy and quality dramatically (UNDP, 2001). The European Union's Lisbon Agenda gives testimony to the importance attached to innovation in modern society. The Lisbon Agenda aims at "stepping up reform for competitiveness and innovation" towards "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion" (European Commission, 2002).

Innovation is not only at the forefront of the mainstream economic policy discourse but also emerging as an increasingly salient issue in relation to achieving a more sustainable development. Achieving sustainable development depends on technological and social innovations coupled with organizational and institutional change geared towards environmental sustainability (Norberg-Bohn, 1999, Pearson et al., 2004). One salient example is the climate policy arena, in particular in relation to "post 2012" discussions, where in light of global difficulties in reaching political agreement, technology is nowadays widely considered the key solution out of the dilemma of getting national governments to agree to ambitious carbon reductions while at the same time safeguarding economic development and welfare (Nilsson and Nilsson, 2005). Sustainable innovation will be critical in the search for renewable resources and steering away from the fossil fuel economy. Great hopes are attached to the promise of sustainable technology innovation also in other fields of resource use and environmental impact, such as, for instance, non-renewable and renewable resource use, energy conversion, and chemicals. Indeed, some of that promise has also been delivered in certain domains.

However, the policy and research domains of innovation systems and technology are to a large extent disconnected from those dealing with sustainable development (Kivimaa and Mickwitz, 2006). There is an emerging literature on sustainable innovation and a number of research networks are on-going (Moors and Mulder, 2002, Foxon et al., 2004, Smith et al., 2005). However, the dominant rationale for innovation systems still seems to be in terms of socio-economic effects such as growth, employment and competitiveness of countries and regions. By exploring the sustainability aspects of innovation systems, this proposal will make an original contribution to the field of innovation systems studies, in particular in view of the relative lack of empirically grounded analysis. With a strongly empirically grounded approach the researcher will be able to draw out both context-specific and more generic lessons relating to sustainable innovations.

In innovation processes, governmental policy actors have an important role to device policies and institutional arrangements to create incentives and mechanisms to promote and facilitate innovation as well as steer it in sustainable directions (Moors and Mulder, 2002, Foxon et al., 2004). However, conventional R&D policies have often proven ineffective in supporting innovation, and as a result most analysts today reject a focus on R&D support for innovation as an out-dated "linear-hierarchical" model (OECD, 2005a). Recent literature emphasizes that governments can, and should, take a leadership role in managing innovation, but argue that its role is different from the traditional one, concerned with both process and substance, and covering much broader domains than R&D, entailing, e.g. public investment in down-stream adoption and learning, public-private partnerships, supporting arenas for niches to develop and grow, and sustained political support over long time periods (Kok et al., 2002).

Literature has made several propositions about governance for innovation. For instance, an emerging literature on strategic niche management is concerned with nurturing "socio-technical" experiments for learning about innovations, and creating networks between producers, users and governing body (Schot et al., 2002, Weber et al., 1999). It has been suggested that the governance role will be changing from step to step in the innovation process. Following a technology "learning curve", in the take-off phase, there is a need for actor mobilisation. In the acceleration phase, governance can stimulate learning by forming agendas and visions. In the stabilisation phase, their role shifts to one of controller and consolidator (Neij et al., 2003).

Objectives

The study addresses two overarching questions:

- How technological (Digital) revolutions be sustainable (Economy, Environmental, social) innovations.
- How can they be influenced by governing body i.e. Technical institutions, government policies and other actors?

The above broad evaluation aims in-depth objectives as follows

1. To provide conceptual and empirical insight into the emerging interface field of technology innovation policy and sustainability,
2. To study the relation between governance and sustainable innovation, and other actors could strive to make these fields more coherent.
3. To learn empirical lessons about the potential and limitations of governance arrangements in stimulating sustainable innovation,
4. Analytical focus is on the *institutional structures and procedures* that shape the potential for sustainable technological innovation.
5. Role of World Technical institutions and govt. organization(AICTE, CII, World Bank, Global Engineering Dean's Council, Indo –US collaboration of Engineering Education and government policy in having sustainable innovation.
6. To evaluate case studies : Global Engineering & Management Universities

Research Design: Conceptual Framework

This study refers to three reasons why today's transformations represent not

merely a prolongation of the Third Industrial Revolution but rather the arrival of a Fourth and distinct one: velocity, scope, and systems impact. The speed of current breakthroughs has no historical precedent. When compared with previous industrial revolutions, the Fourth is evolving at an exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country. And the breadth and depth of these changes herald the transformation of entire systems of production, management, and governance. Therefore, it was imperative to conduct exploratory study under the innovation policy to find out the importance of technological revolution as a sustainable innovation. The study is based on survey on Global technical education institutions their Governing bodies and government policies.

Research Hypothesis

To realise the above mentioned objectives, for the sake of present study following null hypothesis were tested with the help of statistical treatment and empirical data collected

1. H_0: Technological Enablers: Future Networks Internet for everything Cloud, web scale has no significant role in sustainable innovation.
2. H_0: Major technological drivers (Digitization) do not play significant role in sustainable innovation and governance.
3. H_0: Technological revolution and Sustainability have no significant relationship in Governance.
4. H_0: There is no significant difference between factors of third & fourth technological revolution and that of sustainable governance.
5. H_0: Technical institutions and Govt. organizations do not see difference in factors of third & fourth technological revolution and sustainable innovation

Research Methodology

The present investigation was carried out by the 2nd author with the above mentioned objectives. Research used primary data collected with the help of a research questionnaire and the secondary data to identify the affective technological revolutionary measures (Third and fourth Industrial Revolution for sustainable governance (Economic Environmental & Social) by Governing body i.e. technical and management institution government Policy. Data was analyzed by using SPSS and different statistical tools such as Freidman Chi-Square Test, Independent Sample t-test, and the Descriptive Statistics. Freidman Chi-Square test has been used to find whether there is any significant relationship between the means of both variables i.e. technological revolution and sustainable innovation; and independent sample t-test used was for comparison of means of both the verticals i.e. Technological Revolution and the sustainable governance by Technical & Management Institutes.

Measurement of Instrument

A research questionnaire was drafted to evaluate the major areas of sustainable innovation based on five identified variables i.e. Environment, Economic, Social, Legal & Political. A five-point Liker scale was used to capture the sample responses to measure these variables. The technological revolution i.e. Digitization, Velocity, Exponential pace, and System impacts were used to evaluate Sustainable innovation & governance. The reliability of the research instrument was established at (Cronbach's Alpha .996).

Sampling

In this research paper, the entire population comprising CEO& Directors of World Technical & management institutions undergoing not merely prolongation of Third industrial revolution (Simply Digitization) but also arrival of Fourth Industrial Revolution (Velocity ,scope ,system impacts) and governing bodies to regulate sustainable innovation and governance by the potential Engineering & B-School graduates in their final semester and the major corporate. Sample respondents comprised 111 Directors & CEO's selected from Governing bodies for sustainable innovation i.e. Global Technical Institutions (**AICTE, CII, World Bank, Infosys, Global Engineering Deans Council, IUCEE**), and the 50 future potential graduates from engineering and management institutes for sustainable Technological **(Digital)** revolutions . Moreover, to find out the compatibility between Innovation & technological Revolution of potential respondents companies from Engineering & Management Education sector has been undertaken.

Data Collection

Primary source

The researcher collected the primary data through self-administered research questionnaire (Google Form)

Secondary source

The researcher collected the secondary data through published and printed sources such as research papers, articles, newspaper, magazines, websites etc.

Factors contributing to Technological revolution: Independent Variable

- Third Industrial Revolution i.e. Digital revolution or simple digitization
- Fourth Industrial Revolution i.e. Velocity Pace &System impact i.e. Environmental Economic and Social.

Factors contributing to Sustainable innovation: Dependent Variables

- **Environment**
  - improving forecasts of natural events or disasters
  - optimizing global agricultural production and food supply
  - anticipating traffic congestion and managing low emission zones
  - Limiting energy production up to the precise needs of consumers
  - Discovering defects in, or imminent failure of specific product components,
  - Allowing preventative maintenance that avoids failure and more costly repair / replacement
- **Economic**
  - They attract consumers who are motivated by environmental concerns: Encourage Subsidies, Customer expectations, Product enhancement, Collaborative innovation,
  - Organizational forms
  - they limit the "bottom-line" impact of the rising of energy price and environmental taxes
  - Penalise Levies & Taxes
- **Social**
  - New economic model
  - Economic Sharing
  - Crowd funding
  - Mobility

Sample Description/Sampling Technique

Sample of World technical institutions and governing bodies comprised 66% technical institutions and 34% Government Organizations. As regards sustainability category of respondents, there were directors from Environment (36%); Economic (33%), Social (20%), Legal (6%) and Political (5%). In terms of Technological Revolutions those with Digitization and Velocity, Scope and System impacts were 40%, 33%, 20% and 7%.

Lists of Technical institutions for sustainable governance were obtained from global sustainable Education leader's websites. Research used stratified random sampling technique and the population was categorized on the basis of Global education academia leaders for sustainable innovation & governance. The list of Engineering/Management sector service companies was obtained from the list of major innovation governance drivers.

Analysis and Findings

Hypothesis1: Major areas for Sustainable Governance Expected by Technological Revolution

Sl. No.	Variables	Number	Mean	Std. Deviation
(1)	(2)	(3)	(4)	(5)
1.	Natural Resource, Water, Clean Energy, Bio Diversity &climate Change (Environment)	50	4.1714	3.86858
2.	Encouraged Subsidies, Penalized Levies &Taxation(Economy)	50	4.1429	3.91781
3.	Economic Sharing ,Crowd Funding, (Social)	50	4.1518	3.84198
4.	Strategy &Policies Laws(Legal)	50	4.0595	3.80064
5.	Ruling Govt.(Political)	50	4.0714	3.86858

Table-1

The Table 1 reveals that the highest mean score of 4.1718 for Natural Resource &Clean Energy Bio diversity (Environment) is the highest. Encouraged Subsidies (Economic) which has a mean score of 4.1429 is very close to Environment similarly Economic Sharing (Society). This implies that Technological revolution has rated sustainable innovation highest in these three areas with higher emphasis on Environment economy and society Reasons for the same could be that technological revolution has major economization of environmental /social sustainability.

Hypothesis 2. Testing of Digitization for sustainable Innovation & Governance Variables

H0: There is no significant relationship between Digitization for sustainable innovation &Governance Variables

H1: There is a significant relationship between Digitization and sustainable innovation &Governance Variables.

Independent Samples Test					
Levene's Test for Equality of Variances				**t-test for Equality of Means**	
Variables		**F**	**Sig.**	**T**	**dDf**
1		**2**	**3**	**4**	**5**
1. Natural Resource, Water, Clean Energy, Bio Diversity &climate Change(Environment)	a. Equal variances assumed	0.076	0.383	0.623	110 Null Hypothesis Rejected
	b. Equal variances not assumed	-	-	0.326	76.959
2.Encouraged Subsidies, Penalised Levies &Taxation(Economy)	a. Equal variances assumed	1.77	0.186	1.197	110 Null Hypothesis Rejected
	b. Equal variances not assumed	-	-	1.251	84.334
3.Economic Sharing ,Crowd Funding, (Social)	a. Equal variances assumed	2.356	0.128	0.575	110 Null Hypothesis Rejected
	b. Equal variances not assumed	-	-	0.632	96.003
4.Strategy &Policies Laws(Legal Aspects)	a. Equal variances assumed	0.04	0.242	0.363	110 Null Hypothesis Rejected
	b. Equal variances not assumed	-	-	0.262	74.211
5. Ruling Govt(Political)	a. Equal variances assumed	0.656	0.42	1.258	110 Null Hypothesis Rejected
	b. Equal variances not assumed	-	-	-1.324	85.909

Table.2: Analysis of Digitization and Sustainable innovation Variables **Source**: Calculations are based on primary data

Table.2. Reveals that there is significant relationship between the respondents over digitization and sustainable innovation Variables. The value of t is .623 and the Sig t value is .783. As the t value is more than sig value, null hypothesis is rejected and therefore there is relationship between the digitization and sustainable innovation. The value of t is 1.197 and the Sig value is .186; as t value is more than sig value, null hypothesis is rejected. It is therefore safe to conclude that there is relationship between the Natural resources (Environment) and their sustainable innovation, i.e. there is variation between natural resources, energy in Engineering &Management institutions. On similar basis, other variables subsidies &taxation (Economic), Crowd Funding (Social) and policies (Legal Aspects) are also scoring on the similar pattern; hence there is significant relationship between revolutionary factors and sustainable innovations.

Hypothesis 3: Testing for Technical revolution Velocity, Scope & Sustainable Governance.
H0: There is no significant relationship between Velocity Scope & Sustainable Governance.
H1: There is a significant relationship between Velocity Scope & Sustainable Governance.

Variables		Sum of Squares	Df	Mean Square	F	Sig.
1		2	3	4	5	6
1. Natural Resource, Water, Clean Energy, Bio Diversity &climate Change(Environment)	a. Between Groups	1.738	4	0.434	1.403	0.238
	b. Within Groups	33.142	107	0.31	-	Null Hypothesis Rejected
	Total	34.88	111			
2.Encouraged Subsidies, Penalized Levies &Taxation(Economy)	a. Between Groups	1.025	4	0.256	1.84	0.503
	b. Within Groups	32.654	107			Null Hypothesis Rejected
	Total	33.679	111			
3.Economic Sharing ,Crowd Funding, (Social)	a. Between Groups	1.526	4	0.382	0.994	0.414
	b. Within groups	41.092	107	0.384		Null Hypothesis Rejected
	Total	42.618	111			
4.Strategy &Policies Laws(Legal)	a. Between Groups	2.758	4	0.689	1.974	0.104
	b. Within Groups	37.365	107	0.349		Null Hypothesis Rejected
	Total	40.123	111			
5.Ruling Govt(Political)	a. Between Groups	1.795	4	0.449	0.495	0.739
	b. Within Groups	96.919	107	0.906		Null Hypothesis Accepted
	Total	98.714	111			

Table 3: Anova (Analysis of Velocity & Scope of revolution) **Source**: calculations based on primary data
The above Table 3.states that f value 1.403 is more than the significant f value i.e. .238, we reject the null hypothesis and accept the alternative hypothesis i.e. there is a significant relationship between Velocity &Scope of technological revolution and Natural Resources (Environment) . The above table states that f value is more than the significant f value for the variables Subsidies &Taxation (Economy), economic sharing (Social), and ruling Party or govt. (Political) we reject the null hypothesis and accept the alternative hypothesis i.e. there is a significant relationship between Revolution and governance.

Hypothesis 4.Testing Revolutionary System Impacts and Sustainability
H0: There is no significant relationship between Revolutionary System Impacts and Sustainability.
H1: There is a significant relationship between Revolutionary System Impacts and Sustainability.

Variables		Sum of Squares	do	Mean Square	F	Sig.	Status of Hypothesis
1		2	3	4	5	6	7
1.Natural Resource, Water, Clean Energy, Bio Diversity &climate Change(Environment)	a. Between Groups	0.621	3	0.207	0.653	0.583	Null Hypothesis Rejected
	b. Within Groups	34.259	108	0.317			
	Total	34.88	111				
2.Encouraged Subsidies, Penalised Levies &Taxation(Economy)	a. Between Groups	0.607	3	0.236	0.644	0.525	Null
	b. Within Groups	33.271	108	0.308			Hypothesis
	Total	33.679	111				Rejected
3.Economic Sharing ,Crowd Funding, (Social)	a. Between Groups	1.429	3	0.476	1.249	0.296	Null Hypothesis
	b. Within Groups	41.189	108	0.381			Rejected
	Total	42.618	111				
4.Strategy &Policies Laws(Legal Aspects)	a. Between Groups	2.587	3	0.862	2.481	0.065	Null Hypothesis
	b. Within Groups	37.536	108	0.348			Accepted
	Total	40.123	111				
5.Ruling Govt.(Political)	a. Between Group	0.93	3	0.31	0.342	0.725	Null Hypothesis
	b. Within Groups	97.784	108	0.905			Accepted
	Total	98.714	111				

Table 4. Anova (Analysis of System Impact) **Source**: calculations based on primary data

The above table 4 states that f value is .653 is more than the significant f value i.e.583, we reject the null hypothesis and accept the alternative hypothesis i.e. there is a significant relationship between Natural Resources (Environment), Subsidies Taxation(Economic), Economic Sharing(Social) and Revolutionary System Impact .The above table states that f value is .342 is less than the significant f value i.e. .725, we accept the null hypothesis there is no significant relationship between Ruling Govt. and System Impact also there is no significant relationship between Revolutionary System impact &Laws(Legal Aspects).

Annexure I

Sl. No.	**Sampled Population of Technical institutions & Govt. Organization for Sustainable Innovation Potentials**				
	Global	**Technical Institutions**	**Govt. Organization**	**Total Population**	**Sample size**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
1	USA	20	46	66	30
2	UK	15	20	45	25
3	India	30	15	45	20
4	China	30	50	80	35

Table 4.

Sampled Population of sustainable innovation Potentials

Sl. No.	Global	**Management Institutes**	Engineering Institutes	**Total Population**	**Sample Size**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
1	USA	50	50	100	20
2	UK	25	10	35	10
3	India	20	15	35	10
4	China	20	10	30	10

Table 5.

Hypothesis 5: Testing Sustainable innovation Potentials for Technological revolution variables.

A Freidman Chi Square Test conducted on technological revolution to study impacts on various sustainable innovations. Governing body and Potential management from world technical institutions and govt. Organization play major role in governance. Digital revolution after third industrial revolution speeded exponentially in its fourth revolution which lead to biodiversity ,climate change (environmental innovation) encouraged subsidies for the organization that supported sustainable behaviour and penalized the non sustainable with levies and taxation. The study reveals that sustainable innovation and technological revolution have equal importance with respect to independent and dependent variables and vice versa.

Research Findings & Recommendation

The study and the statistical analysis of primary data collected from the world technical institutions concludes

1. Government organization and the technological revolution must establish the gap between the competencies self assessed by technological drivers.
2. "Cloud" approach and Green IT techniques like virtualization, efficient hardware components, free air cooled data centres, etc. will help ensure minimal impact.
3. According to Govt. Organizations self assessment, Economic Environment and Social innovation scores maximum and states that sustainable governance is required in these major areas for sustainable innovation.
4. It is evident that arrival of Fourth revolution (Velocity Scope and system impacts also has significant impact on Environment, (Natural Resources, clean energy & water) Economy (Financial and intellectual capital) and Society or people.
5. Study concludes conversing with CEO's and chairpersons that the acceleration of innovation and the velocity of disruption are hard to comprehend or anticipate and that these drivers constitute a source of constant surprise, even for the best connected and most well informed.
6. Significant relationship between third revolution (Simply digitization) fourth (Velocity scope & impact) and sustainable innovation.
7. Equal importance of Revolution and sustainability Potentials with respect to independent and dependent variables and vice versa.
8. Study states that Digitization has the capability to significantly change the game in each sector of sustainable innovation by three pillars of sustainability - Environment, Economy & Social.
9. Fourth industrial revolution have already seen a huge volume of data created by both social networks and Internet of objects (in fact it is predicted that every year we will create as much data as we have during the whole period since writing was invented). By 2018, we anticipate 4.5 Ban smartphones,25Bn connected objects and more than 1.5 Bn of us engaged in on-line Social Networks.
10. Smartphone applications, social networks and sensors will generate data which can be used to present additional value add services to users through using localization and context. With the consent of users, this data can be used by business partners to offer personalized and contextualized services back to the users. The associated business models are such that in many cases suppliers are willing to subsidize the required communication infrastructures and offer services free or at very low cost to the user.
11. This gives rise to the Economy of Data: a nascent discipline based upon the theory of Multisided Market which will further fuel the Digitization of the society – provided that users trust the Platform vendors and are willing to share data about themselves.
12. Industry 4.0 is certainly a major breakthrough in delivering environmental benefits to industry and its supply chain. It will be also a major step towards the "reinvention of work" as work becomes more collaborative, flexible and agile. The workplace will adapt to specific and changing needs with work increasingly becoming a thing we do rather than a place we go.

Finally, the digital revolution is also an opportunity for emerging countries to leapfrog the constraints that are all too common in the "legacy burdened" old world. But there is an underlying question: "how do we make sure they avoid similar mistakes to those made by the lead nations in the first industrial revolution?"

Challenges and Opportunities

Like the revolutions that preceded it, **Opportunities** can be categorised as follows

- The Fourth Industrial Revolution has the potential to raise global income levels and
- Improve the quality of life for populations around the world.
- To date, those who have gained the most from it have been consumers able to afford and access the digital world; technology has made possible new products and services that increase the efficiency and pleasure of our personal lives.
- Ordering a cab, booking a flight, buying a product, making a payment, listening to music, watching a film, or playing a game—any of these can now be done remotely.
- In the future, technological innovation will also lead to a supply-side miracle, with long-term gains in efficiency and productivity.
- Transportation and communication costs will drop, logistics and global supply chains will become more effective, and the cost of trade will diminish, all of which will open new markets and drive economic growth.
- Discontent can also be fuelled by the pervasiveness of digital technologies and the dynamics of information sharing typified by social media.
- More than 30 percent of the global population now uses social media platforms to connect, learn, and share information. In an ideal world, these interactions would provide an opportunity for cross-cultural understanding and cohesion.

Challenges: ON the other side of same COIN

- At the same time, as the economists Erik Brynjolfsson and Andrew McAfee have pointed out, the revolution could yield greater inequality,
- Particularly in its potential to disrupt labour markets.
- As automation substitutes for labour across the entire economy,
- This will give rise to a job market increasingly segregated into "low-skill/low-pay" and "high-skill/high-pay" segments, which in turn will lead to an increase in social tensions.
- In addition to being a key economic concern, inequality represents the greatest societal concern associated with the Fourth Industrial Revolution. The largest beneficiaries of innovation tend to be the providers of intellectual and physical capital—the innovators, shareholders, and investors—which explain the rising gap in wealth between those dependent on capital versus labour.
- Technology is therefore one of the main reasons why incomes have stagnated, or even decreased, for a majority of the population in high-income countries: the demand for highly skilled workers has increased while the demand for workers with less education and lower skills has decreased.
- The result is a job market with a strong demand at the high and low ends, but a hollowing out of the middle.
- A winner takes-all economy that offers only limited access to the middle class is a recipe for democratic malaise and dereliction.

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