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Innovation definition: Innovation is the process of turning new ideas into value, in the form of new products, services, or ways of doing things. It is deceptively complex, and goes beyond mere creativity and invention to include the practical steps necessary for facilitating adoption. New innovations tend to build on earlier versions, in a way that fuels the vast majority of the world's productivity and economic growth. It is now abundantly clear that truly innovative firms can significantly outperform their peers, if they are allowed to flourish.

Technological Innovations

Some innovation, like the development of new pharmaceuticals, has an obvious and direct link to novel scientific research; other types may result from using existing technology in a new way, or even from developments in unrelated fields. Many companies behind the sharing economy, for example, are essentially offshoots of existing internet and smartphone technologies. While emerging technologies like drones and 3D printing may create new markets and disrupt existing value networks, radical technical innovation in the form of so-called "general purpose" technologies has the potential to disrupt entire groups of industries; examples include the steam engine, the automobile, the computer, the internet and, potentially, artificial intelligence - all of which have had profound consequences for society. Technological innovation encompasses more than research and development. However, since research and development is key, many policy-makers have been keen to focus on ways in which it can be improved. Common areas of focus include national systems for research funding, systems for awarding and protecting patents (which are sometimes state-subsidized), the improvement of translating university research into value for the private sector; and tax incentives for innovative firms (such as R&D tax credits, or special tax regimes for revenue derived from intellectual property).

R&D tends to be heavily concentrated. The Organization for Economic Co-Operation and Development's Science, Technology and Industry Scoreboard 2017 reported that the 50 largest R&D performers account for 40% of all business R&D efforts in Canada and the US, and for more than half of such efforts in Germany and Japan. In addition, according to the report, the headquarters of the top 2,000 R&D corporations worldwide are concentrated mostly in the US, China, and Japan; about 70% of these

firms' total R&D spending is concentrated within just 200 firms. Organizations undertaking technical research may not have the expertise or the desire to bring new products to market, so innovation often entails transferring knowledge and technology from universities and research groups to other entities - often in conjunction with the licensing of intellectual property. An alternative route to market, which may be preferable where no suitable organization already exists or where there is an opportunity to capture more value, is to form a startup or spinoff. In order to facilitate technological innovation in specific industries, some countries have established intermediary institutions, like Germany's Fraunhofer Society institutes and the United Kingdom's Catapult Centres.

Biotechnology

Curation: Korea Advanced Institute of Science and Technology (KAIST)

Medical biotechnology is personalizing medicine by keying on our individual biology, industrial biotechnology is being used to develop more eco-friendly ways of building things, agricultural biotechnology can help feed an expanding global population, and synthetic biology is helping to sustainably produce essential chemicals and materials. Meanwhile environmental biotechnology may yet solve the vexing problem of plastic pollution. However, while recent biotechnology-related advances have opened up incredible new possibilities, they have also created significant ethical issues - as society grapples with concepts like gene-edited babies.

Subsets:Biotechnology: Environmental biotechnology, Agricultural Biotechnology, Industrial Biotechnology, Bio big data and machine learning, Synthetic Biotechnology, Gene and Genome Engineering, medical Biotechnology

Advanced Materials

Curation: ETH Zurich

From the Stone Age, to the Bronze Age, to the Iron Age, every major advancement for human civilization has been driven by a development in materials. In today's Silicon Age, semiconducting materials underpin the microelectronic devices and information technologies that enable much of modern living. Now, new materials are needed - to improve our collective quality of life, and to ensure greater environmental sustainability for the planet. Materials science and engineering research is constantly moving forward in an effort to help address these goals.

Materials for sustainable energy, sustainable polymers and soft materials, better battery materials for the future, Advanced materials for big data, Better

alloys for the future, Sustainable materials, Materials for medical micro and nanorobotics

Virtual and Augmented Reality

Curation: University of Southern California (USC)

Virtual reality was first imagined in science fiction, and emerged in real life via an immersive film-viewing cabinet created in the 1950s. Now, commercial applications for virtual and augmented reality are flourishing, and fundamentally altering the ways people interact with each other and their environments. While technological barriers and a lack of content have so far prevented mass adoption, virtual reality may become the next generation platform for communication - displacing our need for physical travel, and easing related energy consumption. New forms of immersive games, cinematic experiences, and news media are sure to emerge that place audiences in the middle of events.

new ways to make do and buy, Immersive media and Art, health benefits and risks, The Gamification of life, Immersive storytelling, technological Barriers, and Digital teleportation

Artificial Intelligence

Curation: Desautels Faculty of Management, McGill University

Artificial Intelligence is rife with contradictions. It is a powerful tool that is also surprisingly limited in terms of its current capabilities. And, while it has the potential to improve human existence, at the same time it threatens to deepen social divides and put millions of people out of work. While its inner workings are highly technical, the non-technical among us can and should understand the basic principles of how it works - and the concerns that it raises. As the influence and impact of AI spread, it will be critical to involve people and experts from the most diverse backgrounds possible in guiding this technology in ways that enhance human capabilities and lead to positive outcomes.

AI for what purpose, bias and fairness in AI algorithm, AI and Covid 19, Ai and future of jobs, can AI overcome its limitations, the Geopolitical impact of A.I, Operationalizing responsible AI, and AI, diversity and inclusion

3D Printing

Curation: Ecole Polytechnique Fédérale de Lausanne (EPFL)

3D printing has already revolutionized the ways that parts are designed and manufactured. Other applications of the technology - bioprinting human organs, printing affordable housing, and the on-demand production of potential future habitats on the Moon and Mars - were until only recently the stuff of science fiction. Now, breakthroughs are being achieved in all of

these areas, and 3D printing is showing promise as a means to solve many of mankind's most pressing issues.

3D Printing and intellectual property, design for additive manufacturing, Bio Printing, Flexible manufacturing, 3D Printing in space, and 3D Printing for construction

Internet of Things

Curation: Michigan State University

The Internet of Things, or "IoT," surrounds us with networks of smart, web-connected devices and services capable of sensing, interconnecting, inferring, and acting. It is enabling the development of new products and business models, while creating ways for governments to deliver more useful services and better engage with the public. Some of the most important issues related to IoT include technology architecture and standardization, safety and security risks, threats to privacy and trust, potentially missed opportunities for broad social benefits - and a need for responsible governance.

making the rules for beneficial IOT, IOT value creation and business models, Safety security and the IOT, Architecture and Standards, and Privacy and the trust in IOT

Future of Computing

Curation: University of Innsbruck

In the not-too-distant past, computing was limited to a few large machines installed at a handful of universities. Now, fully-fledged information and entertainment systems are sitting in just about everyone's pocket. New approaches like quantum computing and artificial neurons promise to push performance and efficiency even further. However, technological progress has raised significant concerns related to our ability to protect both sensitive data and the environment - which can only be addressed with regulation designed to keep pace with innovation.

Subsets: Wide spread applications, a broader computing reach, New computing governance rules, Unlocking big data, Cyber security evolution, Environmental effect of computing, and Overcoming technological limitations

Blockchain

Curation: Korea Advanced Institute of Science and Technology (KAIST)

Blockchain can enable greater trust and transparency through decentralization, cryptography, and the creation of new incentives. Best-known as the digital underpinning of Bitcoin, it has evolved into a foundational technology with promise in many areas. While the financial sector is investigating it as a means to replace expensive and inefficient payment systems, it could also reshape supply chains - particularly in combination with the Internet of Things and artificial intelligence - while boosting the practical, day-to-day use of smart contracts and digital identities. However, many questions remain about the best use of the technology, its environmental impact, and its governance.

Subsets: Blockchain and Leveraging Data, Blockchain and Crypto-currency climate change, Smart contracts and automation, Blockchain and digital identity, Decentralized Governance and new models, Tokenization and digital assets, Blockchain security and interoperability, and Blockchain Policy, regulation and Law

Digital Communications

Curation: Nanyang Technological University (NTU)

The digital communications industry is facilitating unprecedented levels of global internet use, online social interaction, and financial inclusion. As the industry is transformed, effective policy and regulation that support businesses could boost productivity. At the same time, the industry must be open to new models of collaboration and governance, in order to better address challenges like data privacy and growing demands on infrastructure.

Subsets: An expanding IOT, Policy uncertainty, secure data transmission, Sustainable communication infrastructure, future communication systems, and connectivity and coverage

Entrepreneurship

Curation: ETH Zurich

It is a fundamental driver of economic value and job creation, whether it manifests in the form of a new startup or as a regenerating force within an established company - entrepreneurship is about acting under conditions of uncertainty, and in the absence of calculable risk. As they discover or exploit opportunities, and mobilize the resources necessary to act on them, entrepreneurs unleash the forces of creative destruction in ways that transform existing industries and create entirely new ones. Entrepreneurs can also serve as arbitragers, capable of bringing markets back into competitive equilibrium.

Subsets: social entrepreneurship, Corporate Entrepreneurship, Entrepreneurship education, Entrepreneurial Ecosystem,

Fourth Industrial Revolution

The Fourth Industrial Revolution represents a fundamental change in the ways that we live and work. It is a new chapter in human development, enabled by advances that are commensurate with those of the first, second and third industrial revolutions - merging the physical, digital, and biological worlds and fusing technologies in ways that create both promise and peril. The speed, breadth, and depth of this revolution has forced us to rethink how countries should develop, how organizations create value, and how people from all walks of life can benefit from innovation. Now, as the world grapples with COVID-19, there is an opportunity to further embrace this revolution in ways that create a more inclusive, human-centred global economy.

Subsets: Agile Technology Governance, Agency and Trust, Technology Innovation, Ethics and Identity, technology Access and Inclusion, frontier Technologies, disrupting jobs and demanding new skills