*20 Technologies That Will Change Everything in 2021 and Beyond*

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By Lal Balkaran

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*"We are entering a fourth industrial revolution characterized by a range of new technologies that will fundamentally alter the way we live, work, and relate to one another in areas such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, and quantum computing – just to name a few – that could transform every industry in every country."*

*Klaus Schwab, Founder and Executive Chairman, World Economic Forum*

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We live in an era of rapid technological change that most of us do not stop to recognize or understand. Yet, such change underpins our very existence and the future of everything. With the dawn of a new decade, here are twenty such changes.

1. Digital Transformation

As computing power improves dramatically, more and more people around the world are participating in the digital economy. Technology's reach permeates almost everything we do from buying groceries online to finding a partner on a dating website. Innovations are powering the digital economy. For example, digital natives such as Uber, Airbnb, and Spotify, have successfully attacked the taxi, lodging, and music industries by meeting customer needs in new ways and leveraging technological innovations.

Digital transformation is recasting the relationships between stakeholders – employees, board members, regulators, customers, and suppliers.

2. Big Data

Big data embodies a revolution that will transform how we live, work, and think. The world today has access to more data than was conceivable even a decade ago. Brought about through the exponential growth of computing power, big data refers to the large complex data sets created by people, applications and smart machines. Businesses are accumulating new data faster than they can organize and make sense of it. Indeed, big data is perceived as the oil that is fueling the digital economy.

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3. Analytics

Analytics relates to the extensive use of data using sophisticated quantitative and statistical analysis and predictive modelling. It is supported by powerful computing power and information technology tools which drive decisions and actions. Leveraging analytics has been key to the rise of such behemoths as Facebook, Amazon, Apple, Netflix, and Google.

4. Cloud Computing

Cloud computing encompasses the provision of information technology (IT) services via the Internet from a remote or several remote locations.  It combines IT outsourcing, data centre, Web applications, network, and database. Cloud providers include IBM's Cloud, Amazon's Web Services; Microsoft's Azure; and Google Cloud Platform.

5. Drones

Traditionally, drones or unmanned aerial vehicles (UAV), were limited to military use due to high costs and technical sophistication. However, with falling prices, consumers can now purchase drones for as little as $60. The economic implications for commercial drone use are huge. For example, recent research suggests that between 2015 and 2025, UAV integration within national air space will account for $82.1 billion in job creation and economic growth.

6. Financial Technology (Fintech)

Fintech is not a single technology but a word coined to describe financial services technology.  Use of smartphones for mobile banking and investing services is increasing the public's accessibility to financial services. Fintech leverages technologies such as analytics, Blockchain currencies, digital cash, mobile wallets, and artificial intelligence to drive disruptive improvements in operations and customer engagement capabilities. As finance is the oil fueling the global economy, the financial services industry is embracing Fintech which will eventually become the mainstream of operations for the industry down the road.

7. Quantum Computing

Quantum computing is still a nascent technology but it is a new method of running computer programs potentially at higher speeds more powerful than today's digital computers. Current computers operate on bits of information designated by either 1s or 0s. Quantum computing runs on "qubits" that quantum physics allows to hold a mixture of 1s and 0s. Essentially, this quantum-mechanical phenomena permits representing much more data in a single position or qubit. Quantum computing will be able to break all encryption in use today. It can tamper with most Blockchain implementations, outperform any current computing hardware, and has many operational attributes of interest that improve centralized, cloud computing.

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8. Nanotechnology

Science of the small or nanotechnology is a broad-based, general purpose technology impacting almost every aspect of modern society. The unit of measurement used is a nanometer which is a billionth of a meter and incredibly small. For example, a human hair is 100,000 nanometers in diameter. Nano particles are already in use in a range of products, such as flat screen TVs, computer monitors, and cell phones. Experts on nanotechnology see a changing landscape in manufacturing, medicine, service providers, information technology and business processes operating simultaneously.

9. Robotics Process Automation (RPA)

Robotics Process Automation entails a bot or software application that can be programmed to perform basic human tasks that are typically rote or manual in nature, such as bank reconciliation. It is a configurable software laid on top of an existing IT system that can open spreadsheets and databases, copy data between programs, compare entries, perform algorithms, and prepare reports. Bots work around the clock, they don't make mistakes, and they can perform tasks that humans do at less than half the cost.

10. Virtual Reality (VR) and Augmented Reality (AR)

Virtual Reality is an artificial, computer-generated simulation of a real environment or situation. VR is delivered to a user through a headset. By stimulating vision and hearing, the user experiences the situation or environment firsthand.  Augmented Reality layers computer-generated enhancements on an existing reality to make it more meaningful through interaction. AR applications on mobile devices blend digital components into real world scenarios to enhance each other but can easily be distinguished.

VR and AR will eventually disrupt the digital workplace down the road. For example, AR can provide a new way to enhance how machines and humans work together. These technologies have great potential in the entertainment, science and medical industries.

11. 5G Networks

The fifth generation of wireless networks is being designed and deployed. It is deemed to be 100 times faster than the current 4G and will transform how we live and work. 5G is key as we move towards the Fourth Industrial. One study estimates that by 2035, 5G will enable $12.3 trillion in global economic output and support 22 million jobs around the globe. 5G can handle the vast amounts of data that the Internet will generate and will increase reliable broadband connectivity in rural and remote areas.

12. Data Mining

The internet and exponential growth in computing power have combined to produce vast amounts of data that humans simply cannot analyze. Data mining, although not new, embodies an array of subsets to leverage and analyze such data. It

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refers to the discovery of information without a previously formulated hypothesis where relationships, patterns, and trends hidden in large data sets are uncovered. Data mining techniques include deep learning, machine learning, predictive modelling, link analysis, data segmentation, deviation detection, text mining, and social network analysis.

13. Artificial Intelligence (AI)

Artificial intelligence refers to technologies that make machines 'smart' by enabling a machine to be programmed to explore vast amounts of data in order to find insights about causality, correlations, and other complex relationships that can be expressed as an algorithm. Humans can interpret the findings and determine what action to take. For example, it can mine voice, data, and images from social media, the Internet and determine potential risks for an organization. Subsets of AI include, Deep Learning, Machine Learning, Image Recognition, Natural Language Processing, Cognitive Computing, Intelligence Amplification, Cognitive Augmentation, Machine Augmented Intelligence, and Augmented Intelligence. Examples of AI applications include, Fraud investigation, Monitoring financial statements, Portfolio management, Executing stock trades and Screening job applicants.

14. Natural Language Processing (NLP)

Also known as free text interpretation, NLP's focus is to understand the contents of human communication. As a data mining activity, NLP allows the identification of critical data contained within large, unstructured text sources; for example, using the Internet searching for sites or documents that contain the key words entered. Computer programs analyze text, speech, and images to understand us, answer questions, and even tell us what to do. One example is a program to analyze customer accounts, read emails and instruct bots to automate customer complaints and refunds which is far cheaper than having humans perform this task.

15. Machine Learning (ML)

A subset of Artificial Intelligence, machine learning entails computers teaching themselves as they course correct and try new strategies when obstacles are encountered, learning iteratively from outcomes or modelling and programming themselves to improve performance. With ML, a computer is given data or inputs, activities and outcomes, then it is told to analyze it to 'learn' how to improve outcomes. Common examples of ML are found on e-mail spam filters, credit monitoring software, and news feed and targeted advertising functions. ML has the potential of disrupting every industry.

16. Deep Learning (DL)

Deep Learning is a branch of Artificial Intelligence that can be trained to recognize patterns in the vast amounts of big data that would be impossible for humans to do. DL essentially combines machine learning with natural language processing whereby computers are allowed to classify and replicate human thinking. These

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machine learning methods can learn more abstract concepts, primarily in the areas of image recognition and text processing.

IBM's Watson deep learning-powered systems are used by some firms to analyze vast amounts of bank credit files for commercial loan portfolios.

### 17. Intelligent Automation (IA)

IA refers to software robots that run with a pre-defined goal and serve internal system needs such as initiating, validating, monitoring and terminating or altering other software applications or processes. These robots can even execute parts of digital back-end processes in production to eliminate tedious repetitive tasks. This is the emerging reality where digital labour is the new low cost alternative to manual labour. Intelligent software can easily handle most manual tasks with a surprising degree of sophistication.

### 18. Blockchain

Blockchain made its debut in 2008 as the core technology behind Bitcoin. Essentially, it is an Internet-based distributed ledger that digitally records the full history of a transaction stored in 'blocks' of data that are linked, or 'chained', together. Participants' computers act as nodes to authenticate each new transaction or 'block' as it is added to the chain. Encryption, digital signatures and protocols provide security. Each new block is unique, date stamped and encrypted. Blockchain is expected to change everything in the world of business and commerce. Security is tight in Blockchain with no point of weakness for hackers to target.

### 19. Internet of Things (IoT)

IoT is an environment in which anything from electrical systems to domestic appliances, streets, buildings, people, even items of clothing with smart computer chips are connected to the internet with the ability to transfer data over a network. Coined in 1999, IoT arose as a result of marketplace forces such as increasingly available broadband Internet, reduced costs of technology, expanded use of cloud computing, and an explosion in the number of devices with smart computer chips and Wi-Fi capability.

One study by Cisco showed that by 2020, the number of devices connected to the Internet globally would be over 50 billion. IDC projects a revenue stream of over $1.7 trillion for the IoT ecosystem this year.

### 20. Cybersecurity

Cybersecurity refers to the technologies, processes, and practices designed to prevent unauthorized access to an organization's information assets. It is considered a top risk in many surveys (World Economic Forum, Professional Associations, the Big Four, McKinsey, and others). Witness the many hacks done recently into organization websites where private customer information has been hacked. In 2018, businesses invested over $80 billion in hiring security professionals, privacy protection, and avoiding ransomware attacks.

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## Conclusion

Humanity is in the midst of a technological revolution. Yet, most of us are unaware and so disoriented by the rapid pace of technological and cultural change that we find it difficult to really understand the impact of such changes on how we work, live, and even think. These changes, for better or for worse, are transforming the world we live in and even who we really are. Can you think of life today without email, the Internet, your smartphone, and social media? Technological giants like Amazon, Facebook, Netflix, Google, and Apple govern our everyday life, know where we are, who we are talking to, what sites we visit, what we buy and wear, all at an instant. Indeed, they have a stranglehold on how we live. The above well-chosen twenty technologies should therefore be explored, understood, and be embraced to survive in a world of ever-changing technology.

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## About the Author

Lal Balkaran, MBA, FCMA, FCPA, FCGA, CGMA, CIA is an award-winning internal auditor who has been widely published across the globe. He is an independent consultant and the founder of IIA-Guyana which celebrates 20 years a year ago. Lal can be reached at lalbalkaran@rogers.com and at 416-451-6075.

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