CYBER SECURITY, DATA PRIVACY & PROTECTION AND INFORMATION TECHNOLOGY LAWS

(Including Data Science, Artificial Intelligence & Other Developing Digital Technologies and their Applications in various areas)

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Mr. Rishabh Adukia is a young and dynamic Chartered Accountant with a wealth of experience in managing personal finance. His journey is a testament to his unwavering commitment to financial excellence and his passion for helping individuals navigate the complex world of money management.

Professional Expertise:

A Chartered Accountant by profession, he stands at the helm of his own consulting firm, specializing in managing wealth for HNIs and emerging millenials. With a repertoire that includes Company Secretaryship, Law, and a Masters in Business Finance, his qualifications speak volumes about his expertise. His credentials extend beyond traditional finance; he is a Certified Financial Planner, well-versed in the art of creating holistic financial strategies tailored to individual needs.

His expertise is not confined to boardrooms; he has actively engaged with regulatory bodies and law enforcement agencies. He has addressed esteemed gatherings at institutions like the Central Bureau of Investigation (CBI) Academy and the Serious Fraud Investigation Office (SFIO). His insights have been invaluable in helping individuals safeguard their financial interests in an increasingly complex world.

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By

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MENTOR TO ASSIST YOU IN ACHIEVING YOUR GOALS FROM GAINING EXPERTISE & CAREER GROWTH TO BECOMING GLOBAL PROFESSIONAL AND AUTHORING BOOKS

Dear reader

The road to progress and development doesn't just end with knowledge and experience gained. Knowledge continues to grow when it is shared among fellow aspirants.

I feel proud of the fact that I am amidst hardworking people who have made their way to the pinnacle of success, by overcoming obstacles and hurdles in their journey through professional life and achieving the most needed knowledge and expertise.

My unquenchable thirst for knowledge has been my constant inspiration to read more and gain more knowledge. It has also been the source of motivation to author books, which has enabled me to author 350 plus books on a wide range of subjects over a period of time.

I find it apt to remember English Historian and Geologist Charles Darwin's famous quote:

"In the long history of humankind those who learned to collaborate and improvise most effectively have prevailed."

In collaboration lies the spirit of greater achievements and carving a niche for ourselves by setting the most inspiring example for others to follow.

For students and debutant professionals, having a mentor can significantly help gain a comprehensive understanding of the career path ahead. Because of my experience, you can learn from my mistakes, become aware of potential pitfalls and circumvent them with ease. I want to mentor each reader to achieve their goals in life. Whether it is to pass an exam, advancement in career, balancing studies and job, supplementing methods of earning income, advise to start or advance your practice or overcoming any roadblock in professional and personal life – I want to welcome you to contact me and I will surely guide and assist you in the same.

I take this opportunity to invite both budding and established professionals/ entrepreneurs/academicians/readers to join me in sharing the knowledge and

expertise with our fellow professionals and aspirants by developing knowledge series in the form of books on a wide range of topics for example, business laws, various forms of audits, accounting standards, arbitration and mediation, self-help and self-development and management topics to name a few.

It will be my pleasure to co-author books with esteemed colleagues who will be interested in presenting an innovative approach with respect to any subject within the ambit of finance and its related fields.

You may feel free to contact me at rajkumar@cadrrajkumaradukia.com or reach me on my mobile phone 9820061049 by WhatsApp for further details and discussions in this regard.

Regards

CA (Dr.) Rajkumar S. Adukia

PREFACE

Pigeons gave way to Letters; Letters gave way to E-mails and E-mail gave way to WhatsApp. Fasten your seatbelts as you prepare to be transported into a jet age of technology – probably personal delivery by robots!! Typewriters became ancient artifacts and new innovations in computers are making news every minute. The time is not far away in the world and in India when Information Technology will be such that robots will replace maids, drivers, gardeners etc. in your house.

Intelligent is one who changes with the changing times. Information Technology is the only way forward and the language of today and future businesses. The professional must keep up with it so as to be successful in every arena. But this technological advancement has come at a price. Data is available at your service at the click of a button. Whether such data was created or circulated for public or private use has become difficult to ascertain. Too much Information available in the public domain and high-tech devices at our disposal can lead to intentional or unintentional manhandling of this information. Infamous data breaches and scandals shook many nations by storm.

So keeping abreast with recent developments in informational technology, data protection laws and cyber security is imperative. This book covers aspects of information technology with respect to data protection laws, cyber security and artificial intelligence & other developing digital technologies.

I hope this book will become an interesting source of information for you.

CA (Dr.) Rajkumar S. Adukia

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INTRODUCTION

Of all the significant advances made by mankind till date, probably one of the most important of them is the development of cyberspace. Cyberspace is an interconnected digital environment. It is a type of virtual world popularized with the rise of the Internet. The Internet is a global system of interconnected computer networks linked by a broad array of electronic, wireless, and optical networking technologies. A computer network is a group of interconnected computing devices that after establishing a network connection between themselves using cable or wireless media, exchange data and resources with each other. To communicate and exchange data and resources between the networked devices, communication protocols such as TCP/IP, Simple Mail Transfer Protocol and Hypertext Transfer Protocol are used.

With digitization of every activity, a gamut of detailed information is available in the public domain which could result in dire consequences if subjected to fraudulent mishandling. Infamous data breaches like the Cambridge Analytica (CA) scandal and the Marriott International data breach which resulted in access to personal information of millions of people without their consent, bought to the fore the issue of data privacy and the need for stricter access control measures to protect user data.

Stringent laws for digital governance and protection of data and privacy of citizens became the need of the hour for countries around the world. Various countries have taken steps towards different aspects of privacy and data protection and the European Union's General Data Protection Regulation (GDPR), a law on data protection and privacy for all individuals, was a trendsetter in this regard when it entered into application in 2018.

Thus, regulation of such cyberspace becomes imperative as Internet places in an individual's hands the immense and invaluable power of information and communication. In response to the complex and emerging legal issues relating to cyberspace, the laws regulating various aspects of such space came into being from time to time viz. Information Technology laws, Data Protection laws, Artificial Intelligence laws etc.

NEED FOR CYBER SECURITY

Cybersecurity is the practice of protecting inter-connected systems, networks, hardware, software, data and programs from digital attacks. Cyberattacks are becoming more complex and sophisticated, and are usually aimed at accessing, changing, or destroying sensitive information; extorting money from users via ransomware; or interrupting normal business processes. Cyber security solutions or measures consist of technological tools, processes and controls to mitigate cyber-attack risk.

In today's techno-savvy environment, the world is becoming more and more digitally sophisticated and so are the crimes. Internet was initially developed as a research and information sharing tool and was in an unregulated manner. As the time passed by it became more transactional with e-business, e-commerce, e-governance and e-procurement etc.

The enormous growth in electronic commerce (e-commerce) and online share trading has led to a phenomenal spurt in incidents of cyber-crime.

By nature, cyberspace is a complex place to regulate because it operates in a border-less jurisdiction which when subjected to a crime or fraud have ripple effects as the victims and culprits of the crime may be located in different regions and furthermore, the after-effects of the crime may have a bearing on different countries (other than the country of the victim or the culprit) at the same time. Hence, the need for dynamic cyber security laws.

CYBER CRIMES

Cyber-crimes are unlawful acts where the computer is used either as a tool or a target or both.

There is no international definition of cybercrime or cyberattacks. A common approach is to define it in two categories: cyber-dependent crimes and cyber-enabled crimes. These definitions are complicated by the fact that an act may be illegal in one nation but not in another.

According to United Nations Office on Drugs and Crime (UNODC), the, offences typically cluster around the following categories: :

- Offences against the confidentiality, integrity and availability of computer data and systems;
- Computer-related offences;
- Content-related offences;
- Offences related to infringements of copyright and related rights.

Examples of kinds of offences could generally be of the following kinds:

i. Unauthorized access

ii Damage to computer data or programs

iii Computer sabotage

iv Unauthorized interception of communications

v Computer espionage

At the Tenth United Nations Congress on the Prevention of Crime and Treatment of Offenders, 2000, in a workshop devoted to the issues of crimes

related to computer networks, cybercrime was broken into two categories and explained thus:

a. Cybercrime in a narrow sense (computer crime): Any illegal behavior directed by means of electronic operations that targets the security of computer systems and the data processed by them.

b. Cybercrime in a broader sense (computer-related crime): Any illegal behavior committed by means of, or in relation to, a computer system or network, including such crimes as illegal possession, offering or distributing information by means of a computer system or network.

Some examples of cyber crimes

- Cyber Attack
- Cyber Defamation
- Cyber Pornography
- Cyber Stalking
- Data diddling
- Denial of Service
- E-Mail bombing
- E-Mail spoofing
- Financial Claims
- Forgery
- Intellectual Property Crime
- Internet Time Theft
- Logic bombs
- Online gambling
- Phishing
- Salami attacks
- Sale of illegal articles
- Theft of information contained in electronic from
- Trojan attack
- Unauthorized access to computer system or network
- Virus/worm

INTERNATIONAL INITIATIVES FOR CYBER SECURITY

In today's era of information and communication technology (ICT), crime has now become related to cyberspace, the computer and the internet. As stated earlier, deciphering the jurisdiction of the crime is extremely difficult as the crime may be committed in one country and may threaten the security of another country, and may further, have an impact on a number of countries at the same time. Hence, combatting cybercrime is not only an internal matter of one state, but it takes on international proportions too. Therefore, many international conventions, initiatives and organizations have been established to address and resolve the problem of cyber security.

Council of Europe

https://www.coe.int/en/web/portal

The Council of Europe is an international organization with the goal of upholding human rights, democracy and the rule of law in Europe.

The International Criminal Police Organization (Interpol)

https://www.interpol.int/en

The Interpol is an international police cooperation mechanism to combat global crimes that cross national borders in general and cybercrime in particular. All 196 member countries are connected to each other and to the General Secretariat via a secure communications system called I-24/7.

United Nations

The United Nations (UN) is an intergovernmental organization whose stated purposes are to maintain international peace and security, develop friendly relations among nations, achieve international cooperation, and serve as a centre for harmonizing the actions of nations.

Internet Governance Forum (IGF)

https://www.intgovforum.org/en

The Internet Governance Forum (IGF) is convened by the United Nations Secretary-General. It is a global multi-stakeholder forum for dialogue on Internet governance issues and serves to bring people together from various stakeholder groups in discussions on digital public policy.

The Organization for Economic Co-operation and Development (OECD)

https://www.oecd.org/

The Organization for Economic Co-operation and Development (OECD) is an international forum with 38 member countries, founded to stimulate economic

progress and world trade. In the area of digital security, the OECD aims to develop and promote policies that strengthen trust without inhibiting the potential of information and communication technologies (ICTs) to support innovation, competitiveness and growth. Digital security refers to the economic and social aspects of cybersecurity, as opposed to purely technical aspects and those related to criminal law enforcement or national and international security.

INDIA INITIATIVES & ADMINISTRATIVE FRAMEWORK

In India, several legal, technical, and administrative policy measures have been undertaken for addressing Cyber Security challenges in the country viz. the National Cyber Security Policy (2013), framework for enhancing Cyber Security (2013), enactment of Information Technology (IT) Act, 2000 and setting-up of Indian Computer Emergency Response Team (CERT-In) for 24×7 cyber incident response, and National Critical Information Infrastructure Protection Centre (NCIIPC) for protection of Critical Information Infrastructure under the IT Act, 2000, Cyber Security Research & Development (R&D) and Capacity Building in Cyber Security.

MeitY

The Ministry of Electronics and Information Technology (MeitY) of the Government of India, is the nodal agency responsible for formulating policies related to the Information Technology (IT), cyber security and data privacy in India. It is responsible for formulation, implementation and review of national policies in the field of Information Technology, Electronics and Internet (all matters other than licensing of Internet Service Provider). The functions of the MeitY inter-alia include assistance to other departments in the promotion of E-Governance, E-Commerce, E-Medicine, E-Infrastructure, etc. and matters relating to Cyber Laws and administration of the Information Technology Act, 2000 and other IT related laws.

National Cyber Security Policy

National Cyber Security Policy was released in July 2013, to cater to the cyber security requirements of Government and non-Government entities as well as large, medium & small enterprises and home users. The policy aims at facilitating creation of secured computing environment and enabling adequate trust and confidence in electronic transactions and guiding stakeholders' actions for protection of cyber space. Currently, the Government has formulated the National Cyber Security Strategy (NCSS) 2021, which will enhance the objective and implementation of National Cyber Security Policy. The NCSS 2021 is under the process of approval.

Indian Computer Emergency Response Team (CERT-In)

It is a statutory organization of the MeitY and the agency responsible for responding to cybersecurity incidents in India. CERT-In operates 24/7 and offers a range of services, including incident response, vulnerability assessment and penetration testing, and security audit and compliance. It also collaborates with international organizations and governments to exchange information and best practices in the field of cybersecurity. CERT-In has been designated under Section 70B of the Information Technology Act, 2000 to serve as the national agency to perform the various functions in the area of cyber security:

Indian Cybercrime Coordination Centre

Indian Cybercrime Coordination Centre (I4C) is an initiative of the Ministry of Home Affairs, Government of India to deal with cybercrime in the country in a coordinated and comprehensive manner. I4C focuses on tackling all the issues related to Cybercrime for the citizens, which includes improving coordination between various Law Enforcement Agencies and the stakeholders, driving change in India's overall capability to tackle Cybercrime and to improve citizen satisfaction levels.

Controller of Certifying Authorities (CCA)

CCA is a statutory Organization of the MeitY. The Controller of Certifying Authorities (CCA) has been appointed by the Central Government under section 17 of the Information Technology Act for purposes as defined in the Act. The Office of the CCA came into existence on 1st November, 2000. It aims at promoting the growth of E-Commerce and E- Governance through the wide use of digital signatures. The Controller of Certifying Authorities (CCA) licenses and regulates the working of Certifying Authorities (CAs).

National Informatics Centre (NIC)

National Informatics Centre (NIC) under MeitY is the technology partner of the Government of India. NIC was established in the year 1976 with the objective to provide technology-driven solutions to Central and State Governments. NIC-CERT Division is the nodal arm of National Informatics Centre (NIC) for managing the cyber security incidents. NIC-CERT acts as a single point of contact and co-ordinate with concerned stakeholders for cyber security incidents targeted at NIC Infrastructure.

Standardization Testing and Quality Certification (STQC) Directorate

The STQC is an attached office of the Ministry of Electronics and Information Technology, Government of India, provides quality assurance services in the area of Electronics and IT through countrywide network of laboratories and centers. In the area of IT & e-Governance, STQC provides Software Products/ Systems and Process Assurance Services by conducting Testing, Training, Audit and Certifications.

National Critical Information Infrastructure Protection Centre (NCIIPC)

National Critical Information Infrastructure Protection Centre is an organization of the Government of India created under Section 70A of the Information Technology Act, 2000, through a gazette notification on 16 January 2014. It is designated as the National Nodal Agency for all measures to protect the nation's 'Critical Information Infrastructure'. 'Critical Information Infrastructure' is defined in Explanation to Section 70(1) of the IT Act 2000, to mean the computer resource, the incapacitation or destruction of which, shall have debilitating impact on national security, economy, public health or safety.

Sectoral Regulators

Guidelines on Cyber Security and Information Technology by sectoral regulators like Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Insurance Regulatory and Development Authority of India (IRDAI) and Telecom Regulatory Authority of India (TRAI) have to be complied with. Department of Telecommunications of the Ministry of Communications also issues directions from time to time which have to be complied with.

REGULATORY LANDSCAPE

India does not have any exclusive unitary cybersecurity law. The Information Technology (IT) Act, 2000, is the primary law governing the IT industry in India. It covers various aspects of electronic commerce, including digital signatures, cybersecurity, and data protection. India uses the IT Act 2000, a few provisions of the Indian Penal Code 1860 and the Indian Evidence Act 1872 and multiple other sector-specific regulations to promote cyber security standards. The Government also enacted the Digital Personal Data Protection Act, 2023 on 11th August 2023 but it is yet to be notified.

Legislations having a bearing on Cyber Security and Information Technology:

- The Information Technology (IT) Act, 2000 and the Rules and Regulations thereunder. More specifically the following Rules are important w.re.to cyber security and data privacy and protection:
    - Information Technology (Procedure and Safeguards for Blocking for Access of Information by Public) Rules, 2009
    - The Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data or Information) Rules, 2011
    - The Information Technology (Security Practices & Procedures for Protected Systems) Rules 2018 (U/s 70 of the IT Act 2000)
    - The Information Technology (Intermediary Guidelines & Digital Media Ethics Code) Rules 2021

- The Digital Personal Data Protection Act, 2023 which was enacted on 11th August 2023, but is yet to be notified
- The Telecommunications Act 2023 which was enacted on 24th December 2023, but is yet to be notified
- The Payment and Settlement Systems Act, 2007
- The Indian Penal Code 1860
- The Indian Evidence Act 1872
- The Consumer Protection Act 2019 and Rules made thereunder
- The Companies Act 2013
- MeitY Order regarding online CSAM - An inter-ministerial committee was constituted by Ministry of Electronics and Information Technology(MeitY) to discuss the issues related to online child sexual abuse materials (CSAM) and its blocking in India. Based on the recommendation of the committee and the approval of Hon'ble Minister of Electronics and Information Technology, MeitY has issued an order dated. 18.04.2017 to Internet Service Providers(ISPs) to adopt and implement Internet Watch Foundation(IWF) resources on or before 31.07.2017 to prevent the distribution and transmission of Online CSAM into India.
- MeitY - Key Roles and Responsibilities of Chief Information Security Officers (CISOs) in Ministries/Departments and Organizations managing ICT operations dated 11.4.2018
- MeitY - Public Procurement (preference to Make in India) Order 2019 for Cyber Security Products dated 6.12.2019 - The Government has issued Public Procurement (Preference to Make in India) Order 2017 vide the Department for Promotion of Industry and Internal Trade (DPIIT) erstwhile Department of Policy Industrial and Promotion (DIPP) Notification No. P-45021/2/2017B.E.-II dated 15.06.2017 and partially modified order no No.P-4502112/2017-PP(BE-II) was issued on 28.05.2018 to encourage 'Make in India'. In furtherance to the Public Procurement (Preference to Make in India) Order 2017 notified vide reference cited above, Ministry of Electronics and Information Technology (MeitY) notified Public Procurement (Preference to Make in India) Order No 1(10)/2017CLES dated 02.07.2018 for cyber security products. Ministry of Electronics and Information Technology (MeitY) issued revised Public Procurement (Preference to Make in India) Order 2019 for cyber security products.
- India Computer Emergency Response Team (CERT-In) Guidelines
    - o Directions under sub-section (6) of section 70B of the Information Technology Act, 2000 relating to information security practices,

procedure, prevention, response and reporting of cyber incidents for Safe & Trusted Internet - No. 20(3)/2022-CERT-In dated 28th April 2022

- Key Roles and Responsibilities of Chief Information Security Officers (CISOs) in Ministries/Departments and Organizations managing ICT operations dated 14.3.2017
- Guidelines on Information Security Practices for Government Entities

- The Reserve Bank of India (RBI) Notifications, Guidelines & Directions:
  - Reserve Bank of India (Information Technology Governance, Risk, Controls and Assurance Practices) Directions, 2023 - RBI/2023-24/107 DoS.CO.CSITEG/ SEC.7/ 31.01.015/2023-24 dated 7th November, 2023 – Applicable to banks and certain financial institutions, the guidelines aim to ensure the confidentiality, integrity, and availability of information.
  - RBI Guidelines on Regulation of Payment Aggregators and Payment Gateways - RBI/DPSS/2019-20/174 DPSS.CO.PD. No.1810/02.14.008/2019-20 dated 17th March 2020
  - RBI cyber security framework in banks – RBI/2015-16/418 DBS. CO/CSITE/ BC.11/33.01.001/2015-16 dated 2.6.2016
  - Comprehensive Cyber Security Framework for Primary (Urban) Cooperative Banks (UCBs) – A Graded Approach - RBI/2019-20/129DoS.CO/ CSITE/ BC.4083/31.01.052/2019-20 dated 31.12.2019
  - RBI Master Directions on Digital Payment Security Controls 2021 - RBI/2020-21/74 DoS.CO.CSITE.SEC.No.1852/31.01.015/2020-21 dated 18th February, 2021
  - RBI Digital Lending Guidelines 2022 - RBI/2022-23/111 DOR. CRE.REC.66/ 21.07.001/2022-23 dated 2nd September 2022
- Securities and Exchange Board of India (SEBI) Guidelines
  - SEBI has issued guidelines to strengthen the existing cyber security and cyber resilience framework for stock exchanges and other market infrastructure institutions
  - Guidelines for MIIs regarding Cyber security and Cyber resilience - SEBI/HO/MRD/TPD/P/CIR/2023/146 dated 29th August 2023
  - MIIs, whose systems have been identified as Critical Information Infrastructure (CII) by National Critical Information Infrastructure Protection Centre (NCIIPC), are mandated to send regular updates/closure status of the vulnerabilities found in their respective “protected systems” to NCIIPC.

- Cyber Security and Cyber Resilience framework for Mutual Funds/Asset Management Companies (AMCs) - SEBI/HO/IMD/DF2/CIR/P/2019/12 dated 10th January, 2019
- Cyber Security and Cyber Resilience framework for Stock Exchanges, Clearing Corporations, and Depositories. - SEBI/CIR/MRD/DP/13/2015 dated 6th July, 2015
- Cyber Security and Cyber Resilience framework for KYC Registration Agencies (KRAs) - SEBI/HO/MIRSD/DOP/CIR/P/2019/111 dated 15th October, 2019
- Cyber Security and Cyber Resilience framework for Stock Brokers/Depository Participants vide circular SEBI/HO/MIRSD/CIR/PB/2018/147 dated 3rd December, 2018
- Cyber Security and Cyber Resilience for Qualified Registrars to an Issue and Share Transfer Agents ("QRTAs") - SEBI/HO/MIRSD/CIR/P/2017/100 dated 8th September, 2017

• Department of Telecommunications (DoT), Ministry of Communications

- Telecom Regulatory Authority of India (TRAI) is a statutory body under DoT
- There are license conditions imposed by DoT for grant of license, which lay down requirement of implementation of measures
- DoT mainly issues the directions from time to time with respect to cyber security
- DoT has issued 'Best Practices – Cyber Security' dated 8th July 2020
- DoT has issued 'Unsafe Practices to be avoided at Workplace' dated 9th September 2020
- The Telecommunications Act 2023 which was enacted on 24th December, 2023 but is yet to be notified provides Measures for protection of users under section 28(2) of the Act:
- *"(2) The Central Government may by rules provide for measures for protection of users, in consonance with any regulations notified by the Telecom Regulatory Authority of India from time to time, including measures such as—*

  (a) the prior consent of users for receiving certain specified messages or class of specified messages;

  (b) the preparation and maintenance of one or more registers, to be called as "Do Not Disturb" register, to ensure that users do not receive specified messages or class of specified messages without prior consent; or

(c) the mechanism to enable users to report any malware or specified messages received in contravention of this section.

Under section 28(3) of the Act - An authorized entity providing telecommunication services shall establish an online mechanism to enable users to register any grievance pertaining to the telecommunication service, and redressal of such grievances, in such manner as may be prescribed.

- Insurance Regulatory and Development Authority of India (IRDAI)
  - IRDAI has released the "Information and Cyber Security Guidelines, 2023" – Ref No. IRDAI/GA&HR/GDL/MISC/88/04/2023 dated 24th April 2023
  - Applicability of guidelines - All insurers including Foreign Re-Insurance Branches (FRBs), Insurance intermediaries regulated by the IRDAI viz. covering Brokers, Corporate Agents, Web Aggregators, TPAs, IMFs, Insurance Repositories, ISNP, Corporate Surveyors, MISPs, CSCs and Insurance Information Bureau of India (IIB) shall adhere to the guidelines.
  - Mission of the guidelines - Ensuring the security of all Organization's information assets through implementation of up-to-date security mechanisms for prevention and monitoring of threats; governance of information security related activities and awareness of all employees
  - Insurance companies have to appoint a Chief Information Security Officer (CISO), who will be responsible inter alia for providing advice and for setting out the Information and Cyber Security Policy (ICSP)
- Pension Fund Regulatory and Development Authority (PFRDA)
  - PFRDA Circular PFRDA/2022/14/I&CS/02 dated 15.6.2022 - Re: Cyber Security Directions & FAQs issued by CERT-In
- General Data Protection Regulation (GDPR): The General Data Protection Regulation (GDPR) is a regulation introduced by the European Union (EU) to protect the privacy and personal data of its citizens. It applies to all organizations that process personal data of EU citizens, irrespective of their location.

INFORMATION TECHNOLOGY LAW IN INDIA

The Information Technology Act, 2000 received Presidential Assent on 9th June, 2009 and was notified on October 17th, 2000.

The United Nations General Assembly by resolution A/RES/51/162, dated the 30 January 1997 has adopted the Model Law on Electronic Commerce adopted by the United Nations Commission on International Trade Law. This is referred to as the UNCITRAL Model Law on E-Commerce. The said resolution recommended inter alia that all States give favorable consideration to the said Model Law when they enact or revise their laws, in view of the need for uniformity of the law applicable to alternatives to paper-based methods of communication and storage of information. The Ministry of Commerce Government of India created the first draft of the legislation following the UN termed as "E Commerce Act 1998". After the formation of a separate ministry of Information Technology, the draft was taken over by the new ministry which re-drafted the legislation as "Information Technology Bill 1999". This draft was placed in the Parliament in December 1999 and passed in May 2000. After the assent of the President on June 9, 2000, the act was finally notified with effect from October 17, 2000 vide notification number G.S.R 788(E).

The comprehensive legal framework of the IT Act, 2000 and its amendment (The IT Act was last amended in the year 2008) provides for:

i. Enabling regime for legal recognition of – E-Commerce, E-Governance, Electronic Records & transactions, E-Signature

ii. Controller of Certifying Authority (CCA)

iii. Adjudication and Appellate mechanism for cyber contraventions

iv. Cyber Crimes with criminal punishment/ penalties provided (vis-à-vis physical crimes under IPC). These include- effective deterrence provisions (Sections 43, 43A, 65, 66, 66B, 66C, 66D, 66E, 66F, 67, 67A, 67B, 70, 72 & 72A) in terms of compensation/ penalty and punishment to deal with cybercrimes.

v. Internet-enabled businesses ('intermediaries') including Social media platforms and mobile applications

vi. Cyber Security through institutional framework of CERT-In, NCIIPC. It covers- Collection and sharing of information related to cyber incidents (Sections 69B & 70B) for effective proactive/reactive actions by CERT-In and investigative actions by law enforcement agencies; Protection of critical information infrastructure (Section 70A)

vii. Blocking of information from public access under section 69A and the rules thereunder in specific conditions, only in the interest of (i) sovereignty and integrity of India, (ii) defence of India, (iii) security of the State, (iv) friendly relations with foreign States or (v) public order or (vi) for preventing incitement to the commission of any cognizable offence relating to above.

viii. Privacy & security of data related issues (section 43A) (limited to Sensitive Personal Information) and Breach of lawful contract (section 72A)

ix. Takedown / removal of any information appearing on intermediary platforms which are violative of any law for the time being in force by the appropriate Government or its agency under section 79(3)(b).

Structure of the Act

The IT Act, 2000 consists of thirteen Chapters divided into 90 sections [Sections 91, 92, 93 and 94 of the principal Act were omitted by the Information Technology (Amendment) Act 2008 and has 2 schedules. [Schedule III and IV of the Principal Act were omitted by the Information Technology (Amendment) Act 2008].

Some Important Rules and Regulations under the Information Technology Act 2000 are:

- The Information Technology (Certifying Authority) Regulations 2001
- Information Technology (Certifying Authorities) Rules, 2000.
- Information Technology (Procedures and Safeguards for Interception, Monitoring or Decryption of Information) Rules, 2009.
- Information Technology (Procedure and Safeguards for Blocking for Access of Information by Public) Rules, 2009
- Cyber Appellate Tribunal (Salary, Allowances and Other Terms and Conditions of Service of Chairperson and Members) Rules, 2009
- Cyber Appellate Tribunal (Procedure for Investigation of Misbehavior or Incapacity of Chairperson and Members) Rules, 2009
- Information Technology (Procedure and Safeguards for Monitoring and Collecting Traffic Data or Information) Rules, 2009
- Information Technology (Guidelines for Cyber Cafe Rules) Rules, 2011
- The Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data or Information) Rules, 2011.
- The Information Technology (Electronic Service Delivery) Rules, 2011.
- Information Technology (National Critical Information Infrastructure Protection Centre and Manner of Performing Functions and Duties) Rules, 2013
- Cyber Appellate Tribunal (Powers and Functions of the Chairperson) Rules, 2016.
- The Information Security Practices and Procedures for Protected System Rules, 2018
- Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021.

PRIVACY AND DATA PROTECTION

Data is information. The information may be raw, in organized or in unorganized form – whatever form it may be in, the information needs to be protected. With the advent of high-tech instruments and software, data is collected, worked upon and distributed which makes it subject to exchanging hands through various channels. Legal and political issues make it imperative for the data to be securely protected. Privacy concerns exist wherever personally identifiable information or other sensitive information is collected, stored, used, and finally destroyed or deleted – in digital form or otherwise. Improper or non-existent disclosure control can be the root cause for privacy issues.

Major sources of information which are compromised and are most prone to breaches are:

- Healthcare records
- Criminal justice investigations and proceedings
- Financial institutions and transactions
- Biological traits, such as genetic material
- Residence and geographic records
- Social media profiles and information
- Location-based services
- Web surfing behavior or user preferences using persistent cookies

The challenge for regulators is to frame mechanisms wherein it is possible to utilize data while simultaneously protecting an individual's privacy preferences and their personally identifiable information. Hence, the laws and regulations related to Privacy and Data Protection are constantly changing, as lawmakers endeavor strict and diligent compliance with data privacy and security regulations.

Regulatory Mechanism for Data Protection

Data protection has emerged as an important reaction to the development of information technology. On August 11th 2023, the Indian Government enacted the Digital Personal Data Protection Act, 2023 (DPDP Act) by publishing it in the Official Gazette. The DPDP Act, when effective (as per dates to be notified), will govern the personal data processing activities of a broad range of organizations that operate in the Indian market.

The DPDP Act will replace the current data protection laws encapsulated under the Information Technology Act (IT Act) 2000 and the Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data or Information) Rules 2011 ("SPDI Rules").

Highlights of the Digital Personal Data Protection Act 2023

Receiving Presidential assent on 11th August 2013 and being published in the Official Gazette of India on 12th August 2023, India's data protection law viz. The Digital Personal Data Protection Act 2023, came into force. Different dates may be appointed for the enforcement of the different provisions of this Act, thus notification of sections of the Act for implementation is awaited.

The following are some of the main highlights of the Act:

- The Act has been laid down to provide for the processing of digital personal data
- It will apply to the processing of digital personal data within India where such personal data is collected in digital form, or in non-digital form and digitized subsequently. It will also apply to processing of digital personal data outside India, if such processing is in connection with offering goods or services within India.
- It will not apply to personal data processed by individuals for any personal or domestic purpose and personal data that is publicly available
- The Act allows transfer of personal data outside India, except to countries restricted by the central government through notification.
- The Act introduces terms like Data Fiduciary, Data Principal, Data Processor, Data Protection Officer and defines the same.
- Data Fiduciaries, being persons who process data, have been mandated certain obligations w.re.to digital personal data in the Act and may process data in accordance with the provisions of the Act and that too for lawful purpose.
- Processing of personal data is permissible only for a lawful purpose and that too only after obtaining consent of the Data Principal or processing may be done for legitimate purposes.
- Data Principal, that is, the person to whom the personal data relates has certain rights and duties as laid down in the Act
- Data Protection Board of India will be established as the regulatory body to adjudicate on non-compliance with the provisions of the Act.
- Substantial financial penalties extending up to Rs.250 crores have been prescribed for breaches of provisions of this Act

The Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data and Information) Rules, 2011 ("SPDI Rules")

The rules provide guidelines for the collection, use and storage of sensitive personal data or information by body corporate. Section 43A of the IT Act 2000 provides for the right of individual regarding protection of sensitive personal data or information and also compensation to be paid to the affected

users in case of unauthorized access of information and leakage of sensitive personal information. Section 72A of the IT Act 2000 provides for punishment for disclosure of information in breach of the lawful contract.

ARTIFICIAL INTELLIGENCE & OTHER DEVELOPING DIGITAL TECHNOLOGIES AND THEIR APPLICATIONS IN VARIOUS AREAS

Getting tagged by Algorithms; Face recognition; Smart cars; Marketing chatbots; Digital assistants; Navigation; Social Media monitoring; Manufacturing Robots…the list is endless.

Welcome to the artificially intelligent world, which is not only here to stay, but, will also keep getting bigger and bigger. The world of AI is growing at lightning speed as each day brings with it something new in AI.

Artificial intelligence (AI) and other digital technologies are changing the world we live in. Whatever the area – be it life or work, AI has already permeated it, and you need to understand it and keep up with it. A lot is happening around the digital world and it is happening at lightning speed. However, though AI is changing the rules of business and society at large, a new problem of responsible use of AI and ethical challenges in use of AI has come to the fore. In the last few days, harmful cybersecurity attacks and digitally forged images and videos (commonly known as deepfakes) have caused a stir and governments are mulling over the challenge of the insufficient regulatory landscape to tackle ethical issues with respect to AI. As AI and human life become more and more intertwined, given below is a brief outline of the AI universe.

Introduction – The 4th Industrial Revolution (IR 4.0)

- Fourth Industrial Revolution or “IR 4.0” is a buzzword describing rapid technological advancement in the 21st century.
- The term was popularized in 2016 by Klaus Schwab, the World Economic Forum founder and executive chairman
- The First Industrial Revolution (1765 - started at the end of the 18th century to the beginning of the 19th) - was marked by a transition from hand production methods to mechanized production through the use of steam power and water power.
- The Second Industrial Revolution (1870 - started at the end of the 19th century) was marked with massive mass production in industries through the emergence and use electric power i.e. new source of energy—electricity, gas, and oil.

- The Third Industrial Revolution (1969 - in the second half of the 20th century) – was marked with automation of production through the rise of electronics, information technology and computers.
- The Fourth Industrial Revolution also called IR 4.0 (started at the beginning of the third millennium) – is building on the third revolution and is marked with focus on electronics & automation, and is characterized by rapid technological development, smart & emerging Technologies and integration of the physical, digital, and biological worlds.
- The Fifth Industrial Revolution – It seems that the impact of the IR 4.0 technologies will lead us towards a new industrial revolution - We are on the edge of the dawn of the Fifth revolution where the key focus will be on production through the collaboration of humans and technology not for maximization of profit but, to achieve well-being of all stakeholders.

Simplified Understanding of Computers

- A Computer is a programmable machine. The two principal characteristics of a computer are; It responds to a specific set of instructions in a well-defined manner & It can execute a prerecorded list of instructions. The actual machinery of the computer – monitor, keyboard, wires, transistors, circuits etc. -- is called hardware; the instructions and data are called software.
- Who invented the computer?" is not a question with a simple answer. The real answer is that many inventors contributed to the history of computers and that a computer is a complex piece of machinery made up of many parts, each of which can be considered a separate invention.
- The development of computer systems has evolved significantly over the years, and the history of computers is often divided into generations based on the technology used.
- First Generation (1940s-1950s): Vacuum Tubes - The first computers used vacuum tubes for processing and magnetic drums for storage.
- Second Generation (1950s-1960s): Transistors - The second generation of computers replaced vacuum tubes with transistors. They used magnetic core memory which was faster and better than magnetic drums.
- Third Generation (1960s-1970s): Integrated Circuits - The third generation of computers used integrated circuits. They also introduced magnetic disk storage.
- Fourth Generation (1970s-1980s): Microprocessors - The fourth generation of computers saw the introduction of microprocessors. They

had semiconductor memory (such as Random Access Memory (RAM), Read Only Memory (ROM), etc.).

- Fifth Generation (1980s-Present): Artificial Intelligence - The fifth generation of computers is still ongoing, and is focused on artificial intelligence and parallel processing.

History of Artificial Intelligence

- The beginning of AI cannot be categorized with a date and year as there have been many advances in various aspects of AI viz. search algorithms, machine learning algorithms, deep learning etc. and transformation is happening continuously.
- The idea of Artificial Intelligence goes back many years, however, following are the events related to how the term was coined and brought unto popular usage
- Alan Turing, a British mathematician while working at the University of Manchester, published a Paper in 1950, titled "Computer Machinery and Intelligence" which proposed a test of a machine's ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human, called 'The Imitation Game'
- 'The Imitation Game' was more famously referred to as 'The Turing test', after its inventor, and referred to the test of a machine's ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human.
- Around 1952, Arthur Lee Samuel, made the Samuel Checkers-Playing Program, a program that played championship level checkers, and was known for his research in machine learning and artificial intelligence research
- In 1955, Allen Newell, Herbert A. Simon and John Clifford Shaw, developed a program 'The Logic Theorist', designed to mimic the problem solving skills of a human and presented it at the Dartmouth Summer Research Project on Artificial Intelligence (DSRPAI), a summer workshop at Dartmouth College, hosted by John McCarthy and Marvin Minsky in 1956.
- The Dartmouth Workshop in 1956 can be said to be the birth of AI and the term artificial intelligence could be attributed to be first coined by John McCarthy in 1956 when he organized this first academic workshop on the subject.
- The significance of this event cannot be undermined as it catalyzed the next era of AI research.

Artificial Intelligence & Generative AI

- As defined by Wikipedia, at the most basic level, Artificial intelligence (AI) is the intelligence of machines or software, as opposed to the intelligence of humans or animals.
- It is a method of using computer systems & software to think and problem-solve like the humans and perform tasks that would classically require human intelligence.
- Examples of AI are now all around us with diverse applications across a range of sectors and industries and in personal life too. E.g. - AI powered robots being used in manufacturing, commercial and consumer markets, smart assistants, virtual assistants, voice assistants, recommendation engines, search algorithms, assist healthcare professionals and diagnostics, personalize education sector, driverless vehicles & robot taxis, individual preferences & algorithms in social media etc.
- Traditional AI as opposed to Generative AI is artificial intelligence that performs specific tasks based on predefined rules and patterns.
- Generative AI (Gen AI) is a branch of artificial intelligence that generates new data (text, images, audio, video, code, artificially manufactured data) that resembles human-created content in response to some kind of input or prompt. E.g. of Gen AI Tools - Applications such as ChatGPT, Dall E-2, GitHub Copilot etc.
- A famous early example of Generative AI tool can be traced to 1966, when a Massachusetts Institute of Technology (MIT) professor named Joseph Weizenbaum created the first chatbot a mechanical psychiatrist named ELIZA.
- In recent times, in November 2022, the release of Open AI's ChatGPT, an easy-to-use GenAI tool was made widely available to the public and set in motion many more versions in the field
- Gen AI tools may be text generative AI (e.g. Chat GPT), image generative AI (e.g. Dall-E), code generative AI (e.g. GitHub Copilot), audio generative AI, design generative AI (e.g. Autodesk) etc.
- Generative AI technologies use techniques like deep learning algorithms and artificial neural networks (ANNs) etc. to identify patterns and generate new content
- An ANN is based on a collection of connected units or nodes called artificial neurons, which loosely model the neurons in a biological brain.
- Two most widely used generative AI models are Generative Adversarial Networks (GANs) (to create images/multimedia output from both images/text input data) and Transformer-based models (to create text output from text input, like Generative Pre-Trained Transformer (GPT))

- To understand the working of Generative AI, one needs to know the AI technologies of machine learning, deep learning and natural language processing,

Machine Learning & Deep Learning

- Generative AI uses machine learning and deep learning models to work.
- Machine learning and deep learning are both types of AI; Deep learning is a subset of machine learning, and machine learning is a subset of artificial intelligence
- Arthur Samuel, a pioneer in the field of artificial intelligence and computer gaming, coined the term “Machine Learning”. He defined machine learning as - a “Field of study that gives computers the capability to learn without being explicitly programmed”.
- Machine Learning(ML) is a branch of artificial intelligence that can automate and automatically adapt with minimal human assistance. It uses statistical algorithms that can perform tasks without explicit instructions.
- Deep learning is a subset of machine learning that uses artificial neural networks (based on a collection of connected units or nodes called artificial neurons, which model the neurons in a biological brain) to imitate the learning process of the human brain.
- Deep learning uses multi-layers of algorithms to process data and thus improve the outcomes through repetition, without human intervention.
- Deepfake – Deepfakes are fake images, audio or video created using Artificial Intelligence (Deep learning) technology, hence the name ‘Deepfake’.

Natural Language Processing

- Natural language processing – understanding humans – is key to AI being able to justify its claim to intelligence.
- Natural language processing (NLP) is a component of artificial intelligence that enables computers to interpret, manipulate, and comprehend human language – spoken or written.
- Natural language processing uses technology to process human language in the form of text or voice data and respond. E.g. virtual assistants like Siri or Alexa. Other examples of use of NLP technology includes spam detection, automatic translation of text or speech, text summarization, virtual chatbots, grammar/spell checking etc.
- NLP tasks include machine translation, summarization, ticket classification, spell check, writing entire articles etc.

- There are sub-branches of NLP which are generally used synonymously with NLP.
- Natural-language understanding (NLU) or natural-language interpretation is a subtopic of natural-language processing in artificial intelligence that deals with machine reading comprehension. Natural-language understanding is considered an AI-hard problem (In the field of artificial intelligence, the most difficult problems are informally known as AI-complete or AI-hard).
- Natural language generation (NLG) is a sub-branch of natural-language processing in artificial intelligence software process that produces natural language output.
- NLP is a key foundation of AI as it is a branch of artificial intelligence that focuses on helping computers to understand the way that humans write and speak.
- Some popular NLP tools are Natural Language Toolkit (NLTK), spaCy, OpenNLP, Amazon Comprehend etc.

Transformer Based Models & Generative Adversarial Networks (GANs)

- Just as in Physics, a transformer transform voltage from one value to another, in Artificial Intelligence, a transformer transforms one type of input into another type of output
- 'Transformer', proposed in 2017 by a team of Google researchers in their paper 'Attention is All You Need', is a deep learning architecture, based on artificial neural networks, that uses self-attention technique to track relationships in a sequence.
- It has also led to the development of pre-trained systems, such as generative pre-trained transformers (GPTs) and BERT (Bidirectional Encoder Representations from Transformers).
- Large language models (LLMs), based on the transformer architecture, composed of multiple neural network layers, are AI algorithms (using deep learning techniques) that can perform a variety of natural language processing (NLP) tasks like recognize, summarize, translate, predict, and generate content using extremely huge datasets.
- One type of LLM used by text generative AI for natural language processing tasks is known as a Generative Pre-trained Transformer, or GPT. ChatGPT, which stands for Chat Generative Pre-trained Transformer, is a large language model-based chatbot developed by OpenAI and launched on November 30, 2022, which has the ability to interpret and utilize natural language for use in various types of applications. Open AI's ChatGPT is built on GPT models, the most recent upgrades in 2023 being GPT-4 turbo and GPT 3.5 turbo.
- Currently, some text generative AI that are available for use are:

- ChatGPT (https://chat.openai.com)
- Bard - (https://bard.google.com)
- Microsoft Bing (https://www.microsoft.com/enus/bing?ep=140&es=31&form=MA13FV)
- Jasper - (https://www.jasper.ai)
- Chatsonic - (https://writesonic.com/chat)
- Claude - (https://claude.ai)
- Llama – (https://ai.facebook.com/blog/large-language-model-llama-meta-ai)
- YouChat – (https://you.com)
- Perplexity – (https://www.perplexity.ai)
- Elicit - (https://elicit.org)

- Generative Adversarial Network (GAN), developed by Ian Goodfellow and his colleagues in 2014, is a machine learning (ML) architechture which consists of two conflicting neural networks called 'generator' (generates synthetic data) and 'discriminator' (distinguishes between synthetic and real data), that compete with each other by using deep learning methods, to produce realistic output.
- GANs play an important role in image, voice and video generative AI
- Currently, some image, audio & video generative AI that are available for use are:
  - DALL•E (https://openai.com/dall-e-2) (https://openai.com/dall-e-3)
  - Stable Diffusion (https://stablediffusionweb.com/)
  - Midjourney (https://www.midjourney.com/home
  - Elai (https://elai.io)
  - GliaCloud (https://www.gliacloud.com)
  - Pictory (https://pictory.ai)
  - Runway (https://runwayml.com)
- GANsformer - An amalgamation of GAN and Transformer – integrates transformer's self-attention mechanism with the GAN's generator and discriminator neural networks.

Big Data & Analytics

- Big data primarily refers to data sets that is too large or complex to be dealt with by traditional data-processing application software.

- The term big data has been in use since the 1990s, and largely John Mashey, an American computer scientist, director and entrepreneur is credited for popularizing the term
- It is vast amount of data which is collected, stored and studied and analyzed for patterns and trends. Information technology is used to derive value from that data.
- Big data can be used by almost any entity to gain valuable insights and make decisions about their operations. Big Data and Analytics is the strategy of analyzing large volumes of data gathered from a wide variety of sources.
- Analysts use a variety of tools and methods to analyze the data viz Predictive analytics, Real-time analytics, data-mining, artificial intelligence, machine learning, deep learning, use of various softwares etc.

Cloud Computing

- Cloud computing is the on-demand availability of information technology resources as services over the internet.
- Computing services which can be accessed over the cloud include servers, storage, databases, networking, software, analytics, etc.
- The use of the “cloud” metaphor denotes virtualized services
- Instead of buying, owning, and maintaining physical data centers and servers, technology services, such as computing power, storage and databases can be accessed on an as-needed basis from a cloud provider
- Storage of data on a cloud which can be accessed on demand, creates large storage space and is an efficient off-site data back-up solution.
- Cloud computing lowers operating cost and provides economies of scale

Distributed Ledger Technology & Blockchain

- A ledger is a record of activity and distributed ledger - a common record of activity that is shared across computers in different locations.
- Distributed ledger technology (DLT) is a network that uses ledgers stored on separate, connected devices (called nodes) and allows information to be stored using cryptography. In contrast to a centralized database, a distributed ledger does not have a central administrator and is less prone to cybercrime.
- It ensures data accuracy and security, as once the information is stored on it, it cannot be changed unless it is programmed to be changeable.

- DLT is the technology blockchains are created from. All blockchains are distributed ledgers, but not all distributed ledgers are blockchains.
- Blockchain is a distributed digital public ledger database that is used to record transactions across many computers. A Distributed database is a database that is spread over multiple computers or over a network of computers. The record cannot be altered retroactively without the alteration of all subsequent blocks and network consensus. Blockchain stores data in blocks linked together to form a chain. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data.
- As explained by Wikipedia, "Blockchain was invented by Satoshi Nakamoto"—the pseudonym of an unknown person or persons in 2008.
- The four key concepts behind blockchain are: Shared ledger, Permissions, Smart contracts and Consensus.

Robotics & Robotic Process Automation

- The term robotics is an extension of the word robot.
- A robot in human form is called an android.
- The word 'robot' is defined by the online Merriam-Webster dictionary as 'a machine that resembles a living creature in being capable of moving independently (as by walking or rolling on wheels) and performing complex actions (such as grasping and moving objects)'.
- Robotics is a branch of engineering and computer science that involves the design, construction, operation, and use of robots.
- The field of robotics develops machines that can automate tasks and do various jobs that a human might not be able to do.
- Robotic process automation (RPA) is a form of business process automation that is based on software robots or artificial intelligence agents and is sometimes referred to as software robotics, as humans interact with software to perform repetitive tasks that generally require no insights. RPA can be used to automate various repetitive tasks like filling online forms etc.
- In RPA, routine work is carried out by combining Application Programming Interface (API) and user interface (UI) interactions to integrate and perform repetitive tasks.
- Robotics includes designing, building, and programming robots, whereas AI involves programming and is not restricted to physical robots.

Internet of Things (IoT)

- The internet of things, or IoT, is a network of interrelated devices that connect and exchange data with other IoT devices and the cloud. The cloud refers to servers that are accessed over the Internet, and the software and databases that run on those servers.
- It is a system of interrelated computing devices, mechanical and digital machines, physical objects that have ability to exchange data and perform a variety of tasks without requiring human-to-human or human-to-computer interaction.
- The Internet of Things (IoT) refers to a network of interconnected digital and physical devices that are embedded with sensors, software and network connectivity that allows them to collect and share data. E.g. - smart thermostats, smartwatches, radio-frequency identification (RFID)-enabled clothing, transportation systems etc. The future is envisioned as entire "smart cities" based on IoT technologies.
- IoT enables these smart devices to communicate with each other and with other internet-enabled devices creating a vast network of interconnected devices.

Augmented Reality/Virtual Reality & Metaverse

- Virtual reality (VR) is an artificial computer generated environment that uses technology to give the user an immersive feel of a virtual world. Applications of virtual reality include video games, business virtual meetings etc. It immerses the user into a virtual environment different from the real one.
- Augmented reality (AR) is an interactive experience that combines the real world and computer-generated content. It is achieved by using technology to enhance the version of the real physical world by using digital visual elements, sound, or other sensory stimuli. It enhances the real environment through new information. Applications include product visualization etc.
- Metaverse - The word itself is a combo of the Greek word "meta," which means after or beyond, and the word universe.
- The term metaverse was coined in 1992 by author Neal Stephenson in his sci-fi novel Snow Crash, whereas history of augmented and virtual reality dates back to 1980's when one of the first virtual reality headsets were developed.
- "Metaverse" became a household word when Facebook rebranded its corporate identity to "Meta" in October 2021.
- In science fiction, the metaverse is a hypothetical restatement of the Internet as a single, universal, and immersive virtual world that is facilitated by the use of virtual reality (VR) and augmented reality (AR)

headsets. Metaverse is referred to as a virtual-reality space in which users can interact with a computer-generated environment and other users.

- Futurists argue that while it is early days for the metaverse and fundamental technical barriers still exist, the metaverse will happen.

Drone Technology

- An unmanned aerial vehicle is commonly known as a drone, and it can be automated or be remotely controlled.
- Although the reason for origination of the word drone to describe an unmanned aerial vehicle is not clear, it can probably be because of the similarity of the vehicle with the literal meaning of the word i.e. 'a male honey bee' is known as a drone and drone also implies 'a continuous buzzing sound'.
- Although history of unmanned aerial vehicles can be traced back to hot air balloons, however, the history of more modern drones could be said to commence at the time of the first world war. During World War I, the Ruston Proctor Aerial Target of 1916 was the first pilotless aircraft built using radio control techniques.
- Not only military use, but drones nowadays are used for personal and commercial use as well – photography, delivery of goods etc.
- Drone has a number of software and hardware components viz. body, power source, sensors, speed controller, camera, navigation system, control stations etc.
- They are mostly customized as per requirement, but according to their wing-type, drones can be classified as fixed wing drones and rotor drones (single rotor or multi-rotor) viz. single-rotor helicopter, multi-rotor, fixed-wing and fixed-wing hybrid VTOL (Vertical take-off and landing). VTOL describes drones that are able to take off, hover and land vertically, like a helicopter.
- As drone usage is increasing in commercial and personal use, safety and security is becoming a point of concern, and many countries have imposed laws and regulations to counter this.

5G Technology

- 5G refers to the fifth generation wireless technology. It is designed to increase speed, reduce latency, and improve flexibility of wireless services
- 1G (used analog technology)), 2G (used Global System for Mobile Communication (GSM)), 3G (used Universal Mobile Telecommunication Systems (UMTS) technology), 4G (used Long Term Evolution (LTE) technology) and 5G (uses New Radio (NR) technology) – these are

the five generations of wireless cellular technology. G stands for Generation, and the number denotes the generation number. 5G is the latest generation.

- Wireless technology provides the ability to communicate between two or more entities over distances without the use of wires or cables of any sort. The birth of wireless technology started with the discovery of electromagnetic waves.
- A wireless network allows connection between various equipment/ locations without the use of cables e.g. mobile/cellular phone networks, wireless local area networks, satellite communication networks etc.
- 5G is 20 times faster than the previous 4G and is designed to give more connectivity than ever given before. It has hugely impacted the world especially when working with areas of virtual reality, the Internet of Things and artificial intelligence.

3D Printing

- 3D printing is an additive manufacturing technique in which material is typically added together to create an object. Other examples of additive manufacturing techniques are material jetting, binder jetting etc. On the other hand, subtractive manufacturing techniques are those that remove raw material to create the final product e.g. drilling, cutting, welding etc.
- 3D printing manufactures 3D objects by adding materials gradually in layers to form the desired shape.
- The history of 3D printing, also known as 'Rapid prototyping technology', can be traced back to 1981 in Japan, when Hideo Kodama invented an early additive manufacturing technology i.e. a device that used UV light to harden photo reactive polymers.
- 3D printer technology is computer controlled and uses computer aided design to convert raw material like plastic, thermoplastic filaments, metal powders etc. into a new object. Fused deposition modeling (FDM), Stereolithography (SLA) and Selective laser sintering (SLS) are some common 3D printing technologies.
- Examples of common applications of 3D printing in industries and across various sectors – Rapid prototyping in research & development, prosthetics & implants in medical industry, construction & architecture, aerospace industry etc.

Other Important concepts

- Biotechnology involves integration of biology and engineering and refers to using biological systems to develop new products and solutions.
- There are diverse applications of Biotechnology and they have been used in industry, agriculture, environment and medicine. Genetic

engineering, an application of bio-technology, involves modification of genes of organisms to achieve desired outcomes. In Tissue Culture, fragments of tissue of organism are cultured grown outside the organism in a lab, and it has helped to produce a variety of products apart from use in research & medicine.

- Nanotechnology combines fields of science and engineering to manipulate the structure of matter and produce new structures. It has contributed in advancement in various sectors like medicine, consumer products, manufacturing etc. American physicist Richard Feynman is considered the father of nanotechnology. He introduced the concept of 'nanotechnology' when in 1959 he presented a lecture "There's Plenty of Room at the Bottom" at the California Institute of Technology.
- Artificial Intelligence is being used in fields of biotechnology and nanotechnology and will give innovative solutions

Applications of AI in various areas

- AI is making its presence felt everywhere. The pandemic has sped up the adoption of digital technologies by businesses and has quickened the AI adoption by companies
- Global AI Adoption Index 2022 (New research commissioned by IBM in partnership with Morning Consult) has in its 'Key findings' stated that AI adoption is growing steadily and that 35% of companies reported using AI in their business, and an additional 42% reported they are exploring AI.
- Some applications of AI in various areas (the list is not exhaustive) are as follows:

Agriculture

- Weather forecasting
- Determining soil & crop health
- Enabling faster harvesting of crops
- Intelligent irrigation
- Protection from weeds
- Detect diseases & suggest effective solutions

Automobile industry

- Manufacturing
- Supply chain
- Quality control
- Insurance

- Customization with consumer preferences
- Technology for self-driving vehicles.

Cyber Security

- Mapping & preventing unexpected threats
- Identifying faulty data
- Identifying illegal access
- Detecting vulnerabilities, virus and malware and taking preventive & corrective action
- Development of biometric authentication systems – like facial, voice, iris recognition
- Surveillance

Ecommerce

- Finding target audience
- Customized suggestions & recommendation based on customer preferences
- Real-time engagement with consumers, AI bots for customer interaction
- Round-the-clock customer support
- Performing routine tasks
- Detecting fake reviews
- Pattern recognition
- Optimize marketing
- Preventing credit card frauds

Education

- Routine tasks
- Enrolment and document verification
- Digitization of content
- Customization for students with respect to learning ability
- Learning solutions for differently abled students
- Student progress analysis

Financial services

- Fraud detection
- Data security

- Analysis of historical and real-time data
- Wealth management & financial advice
- Loan approvals
- Cloud computing services
- Robotic process automation for routine tasks like data entry, document processing, report generation etc.
- Software solutions
- Regulatory technology (RegTech)

Gaming

- Integral part of video games
- Generate responsive, adaptive and intelligent human-like behaviors primarily in non-player characters (NCP)
- Game design & testing
- Assist in real-world simulation
- Creating elements of the game environment
- Create game levels
- Adjusting the difficulty in a video game in real-time based on the player's ability
- Pathfinding & grid-based pathfinding algorithms
- Understand user behavior through data mining i.e. analyzing large data sets to identify patterns and relationships
- Generate new content

Healthcare

- Diagnostics
- Accurate diagnosis
- Detection of diseases
- Medical solutions
- Assistance in surgery
- Remote patient monitoring
- Customized Treatment plans
- Personalized workout & meditation

Personal & General Use

- Edits & effects for photos, videos etc.
- Lear new languages & improve language proficiency
- Create articles, emails, scripts, essays, code etc.
- Recording & transcription
- Voice assistance
- Virtual assistance
- Smart devices
- Filtering out spam e-mails
- Social media
- Personalized content recommendations on streaming platforms

Robotics

- Use of sensors, high-definition cameras, voice recognition devices etc.
- Recognize and decipher information through computer vision technology
- Use of AI algorithms & techniques
- Help to imitate the human mind and thus perform decision-making, action etc.
- Enable navigation, recognition, grasping of objects etc.
- Helps to perform tasks faster
- Assist in Manufacturing process
- AI powered robots are assisting the Aerospace industry
- Improving productivity and efficiency

Transport, Travel & Logistics

- Geospatial solutions, Geographic Information System (GIS)
- Use of Navigation, Global Positioning System (GPS)
- Positioning & planning
- Monitor flow of traffic and predict future traffic conditions
- Suggest fastest route to destination thus improve operational efficiency and optimize route
- Detecting fraud, route planning & tracking, ride matching etc. in Ride-sharing platforms.

Sunrise Industry in AI

Insurance Underwriting

- AI-assisted underwriting is a key emerging area of insurance innovation
- It offers solutions such as speedy and secure processing of large insurance data volumes, precise risk evaluation, and fair policy pricing
- Insurance companies use AI to assess risks using massive data sets
- Involves automated processing of insurance applications. Applications are prioritized for processing based on their expected profitability, urgency, and estimated time-to-quote.
- Involves fast and precise quantification of client-specific risks to help underwriters properly price insurance and speed up policy issuance.
- Involves instantly matching the data provided by customers to the data available in relevant public sources.

Fraud Detection in Banking

- AI can detect and flag anomalies in real-time banking transactions, app usage, payment methods, and other financial activities.
- AI machine learning algorithms, are leveraged to quickly and accurately analyse large volumes of data to identify suspicious transactions and patterns that may indicate fraudulent activity.
- Involves detecting bank fraud that involves multiple accounts, devices, and locations, or fraud that is spread across different channels such as online and in-person transactions.
- Involves preventing fraud by enabling better fraud risk management, identifying high-risk customers or transactions and alerting financial institutions to potential fraudulent activity before it occurs.

Medical Diagnostics

- AI-powered diagnostics utilize advanced algorithms and machine learning techniques to analyze vast amounts of medical data, assist in disease diagnosis and make accurate predictions about a patient's health.
- Medical data including electronic health records, lab results, imaging scans, genetic information, and even lifestyle factors is input into the system
- Large datasets and complex algorithms are used to identify patterns and trends that may go undetected by traditional diagnostic methods.
- AI-powered diagnostics has the ability to continuously learn and improve its accuracy over time. The algorithm can refine its predictions based on new insights, based on availability of data

- Uses image recognition technology for faster identification and diagnosis and early disease detection and prevention

Network Optimization

- AI-powered network optimization is overcoming telecommunications industry's challenges in managing intricate, data-heavy networks.
- Network optimization is a process focused on maximizing network performance and efficiency.
- Use of network optimization techniques like traffic shaping, load balancing, and protocol to improve network performance
- Provides high-quality user experience and reduces the cost of network infrastructure by optimizing its usage.
- Enables improvement in telecommunication companies' networks in real time based on changing conditions and demand.
- Prevents downtimes and outages and reduces latency and network congestion.
- Informed decisions based on network analytics leads to improved service delivery

Energy Storage Technologies

- An energy storage system, is a device or group of devices assembled together, capable of storing energy in order to supply electrical energy at a later time. AI is transforming how energy storage systems are managed and utilized.
- AI-powered energy storage technologies enable real-time monitoring, intelligent optimization, and predictive analytics.
- The AI algorithms optimize energy consumption, storage, and distribution, leading to reduced costs, increased energy efficiency, resource savings and minimized environmental impact.
- The systems can enhance the integration of renewable energy sources, mitigating the challenges posed by their inherent unpredictability
- Energy storage facilities can dynamically adapt their operations to varying demand patterns, grid conditions, and renewable energy availability.
- AI-driven energy storage solutions enable the creation of virtual power plants, aggregating distributed energy resources for grid stabilization and enabling demand response programs.

Aviation Maintenance

- AI-powered aviation reduces maintenance costs, minimizes aircraft downtime, proactively addresses potential issues and improves operational efficiency.

- The AI algorithms can analyze vast amounts of data from aircraft systems, sensors, and historical maintenance records to predict equipment failures or maintenance requirements.
- Identifies real-time performance operational data and improves fleet management thereby reducing chances of cancellations, minimizing flight disruptions and reducing turnaround time, resulting in higher revenue.
- Enables automated visual inspections of aircraft components thus streamlining the inspection process and enhancing accuracy.
- AI algorithms, extensive database and in-depth analysis and reporting can help aviation industry to improve safety, efficiency, and overall operations.
- Makes aviation maintenance safer, efficient, and cost-effective.

United Nations & AI

- The UN System Chief Executives Board for Coordination (CEB) is the highest-level coordination forum of the United Nations system and its work is supported by two high-level committees: The High-Level Committee on Programmes (HLCP) and the High-Level Committee on Management (HLCM) (https://unsceb.org/)
- The International Telecommunication Union (ITU) is the United Nations specialized agency for information and communication technologies. (https://www.itu.int/en/about/Pages/default.aspx)
- The United Nations Educational, Scientific and Cultural Organization (UNESCO) is a specialized agency of the United Nations (https://www.unesco.org/en)
- UNESCO's 'Recommendation on the Ethics of AI' was adopted by UN member states in 2021 and advocates that the use of AI keeping in mind the promotion and protection of human rights, human dignity, and environmental sustainability.
- In 2020, the UN System CEB and its HLCP established the interagency working group on AI (IAWGAI), co-led by ITU and UNESCO, to bring together UN system expertise on AI in support of the CEB and HLCP work streams
- United Nations Inter-Agency Working Group on Artificial Intelligence (IAWG-AI) (https://unsceb.org/inter-agency-working-group-artificial-intelligence)
- UN system expertise on ethics of AI is led by UNESCO and the strategic approach and road map for supporting capacity development is led by ITU

- AI for Good is the United Nations (ITU's) year-round digital platform on AI. (https://aiforgood.itu.int/). Recently, AI for Good has launched the Neural Network: an AI-powered community networking and content platform
- The ITU, since 2018, also compiles an 'UN Activities on AI Report', an annual up-to-date directory of all the AI-related projects, initiatives, events and processes that are being carried out within the UN system
- UN activities on AI - 40 UN sister agencies and their 281 projects related to AI can be viewed at https://aiforgood.itu.int/about-ai-for-good/un-ai-actions/
- High-Level Advisory Body on Artificial Intelligence (HLAB on AI) - The UN Secretary-General is convening a multi-stakeholder HLAB on AI to undertake analysis and advance recommendations for the international governance of AI. (https://www.un.org/techenvoy/ai-advisory-body)
- AIM-Global - United Nations Industrial Development Organization's (UNIDO) Global Alliance on Artificial Intelligence for Industry and Manufacturing (AIM-Global), a collaboration platform, was launched on 6 July 2023, at the World AI Conference (WAIC) held in Shanghai, China.

The Organization for Economic Cooperation and Development (OECD) & AI

- The Organization for Economic Co-operation and Development's (OECD) is an international forum for economic collaboration with 38 member countries
- The OECD's Committee on Digital Economy Policy (CDEP) has a Working Party on Artificial Intelligence Governance. The Working Party on Artificial Intelligence Governance oversees the OECD's work on AI policy. The OECD.AI Network of Experts provides policy, technical and business expert input.
- The OECD Principles on AI were adopted in May 2019 by OECD member countries, a set of five complementary values-based principles which include recommendations for public policy and strategy.
- The Principles included a definition of Artificial Intelligence. However, on 8th November 2023, the OECD Council adopted a new definition of AI i.e. *"An AI system is a machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that [can] influence physical or virtual environments. Different AI systems vary in autonomy and adaptiveness after deployment".*
- 'The OECD Framework for the Classification of AI Systems: a tool for effective AI policies', is a user-friendly tool to evaluate AI systems from a policy perspective.

- The OECD AI Policy Observatory (OECD.AI), is a repository of AI policy initiatives in over 60 countries and territories. (https://oecd.ai/en/)

The Global Partnership for AI (GPAI) & AI

- The Global Partnership on Artificial Intelligence (GPAI), is an international and multi-stakeholder initiative to guide the responsible development and use of AI in a manner that respects human rights and the shared democratic values of its members.
- Established in June 2020, the GPAI has 15 founding members (14 member countries and the European Union) including India. Currently it is a congregation of 28 Member Countries and the European Union.
- The GPAI's experts are collaborating across four Working Group themes: 1) Responsible AI (including a subgroup on AI and Pandemic Response); 2) Data Governance; 3) Future of Work; and 4) Innovation & Commercialization.
- The OECD hosts a dedicated secretariat to support GPAI's governing bodies and activities
- India will serve as the Lead Council Chair in 2023, and host the GPAI Summit in India in December, 2023.

Global Regulations governing AI

- Australia –
    - Currently there is no mandatory AI specific regulation in Australia.
    - The Department of Industry, Science & Resources of the Australian Government had put out a Discussion paper 'Supporting Responsible AI' on 1st June 2023 (closed on 4th August 2023) for public consultation on how to mitigate any potential risks of AI and support safe and responsible AI practices.
    - The Government has published The Artificial Intelligence (AI) Ethics Framework in 2019 which contains 8 principles which guides businesses and governments to responsibly design, develop and implement AI.
- Canada –
    - Currently there is no regulatory AI specific regulation in Canada
    - In September 2023, the Minister of Innovation, Science and Industry announced the Voluntary Code of Conduct on the Responsible Development and Management of Advanced Generative AI Systems.

- In June 2022, Canada has proposed the Digital Charter Implementation Act (Bill C-27), which proposes three acts that have been described as a holistic package of legislation for trust and privacy: The Consumer Privacy Protection Act, The Personal Information and Data Protection Tribunal Act, and The Artificial Intelligence & Data Act (AIDA).
- Launched in 2017, Canada's national AI strategy, the Pan-Canadian Artificial Intelligence Strategy, was one of the first in the world

• China –

- China has in place some of the world's first binding national regulations on artificial intelligence (AI) and the regulations target different aspects of AI:

a. Provisions on the Management of Algorithmic Recommendations in Internet Information Services (came into effect on 1.3.2022)

b. Provisions on the Administration of Deep Synthesis Internet Information Services (came into effect on 10.1.2023)

c. Measures for the Management of Generative Artificial Intelligence Services (came into effect on 15.8.2023)

- Additionally, there are various laws and regulations that impact AI development in China viz. Cybersecurity Law of the PRC, the PRC Data Security Law, the Personal Information Protection Law of the PRC etc.

• European Union –

- Most European Union (EU) countries have their own national strategies towards regulating AI, but these are largely convergent.
- The European Commission (EC) in 2018 had established the EU High-Level Expert Group on Artificial Intelligence (HLEG-AI).
- In April 2021, the European Commission (EU) proposed the first EU Artificial Intelligence Act. On 14 June 2023, Members of the European Parliament (MEPs) adopted Parliaments negotiating position on the AI Act.
- On 8th December, 2023, the European Union (EU) and the European Parliament reached a provisional agreement for the world's first Artificial Intelligence Act – The EU Artificial Intelligence Act.
- The Act would govern the use of artificial intelligence including governments' use of AI in biometric surveillance and how to regulate AI systems such as ChatGPT.

- The Act would regulate the use of AI systems in the EU. It applies to providers, manufacturers, importers, distributors and deployers of AI systems. It would apply w.re.to where output is intended to be used in EU even if those companies are based outside EU.
- The EU AI Act will not be enforced until 2025, allowing companies to adjust and prepare. Before then, companies will be urged to follow the rules in 2024 voluntarily.

- Singapore –
  - The Personal Data Protection Commission (PDPC) of Singapore in July 2023 had released a public consultation paper for 'Proposed Advisory Guidelines on Use of Personal Data in AI Recommendation and Decision Systems'
  - Singapore's PDPC published the Model AI Governance Framework, first edition of which was released in 2019 and second edition in 2020, contains ethical principles which organizations should implement when deploying AI.
  - The Advisory Council on the Ethical Use of AI and Data was established in 2018 to understand and address the challenges of AI. On its recommendation, Singapore's first National Artificial Intelligence Strategy was published in 2019
  - The Infocomm Media Development Authority (IMDA), a statutory board under the Singapore Ministry of Communications and Information, open-sourced AI Verify, an AI governance testing framework and toolkit to demonstrate responsible deployment of AI.
- United Arab Emirates (UAE) –
  - No specific AI regulation but sector-specific regulations and non-binding guidelines
  - In October 2017, the UAE Government announced the vision of the National Strategy i.e. UAE Artificial Intelligence Strategy 2031
  - It is the first country to have set up a separate Office for AI viz. 'Minister of State for Artificial Intelligence, Digital Economy & Remote Work Applications Office
  - The UAE Cabinet formed the UAE Council for Artificial Intelligence (AI) that oversees AI integration in government departments and the education sector.
- United Kingdom -
  - In March 2023, The Department for Science, Innovation and Technology released a Policy paper on 'AI regulation: a

pro-innovation approach', to seek views through supporting consultation, which was last updated in August 2023. The Government is analyzing the responses and will eventually implement a regulatory framework for AI

- The Alan Turing Institute, UK's national institute for data science and artificial intelligence, will pilot a new UK government initiative in support with others, to lead in shaping global technical standards for Artificial Intelligence.
- The Centre for Data Ethics and Innovation (CDEI) leads the UK government's work on trustworthy innovation in data and AI
- The UK National AI Strategy was published in September 2021, a ten-year plan, setting out the UK's strategic intent to guide action over the next ten years
- UK Government's official Public Sector Guidance on AI Ethics and Safety, were published in 2019 for public sector organizations

- United States of America –
  - There is no comprehensive federal legislation regulating the use of AI in the United States of America (USA).
  - In USA, there are numerous independent regulatory bodies, and there is lack of clarity on regulatory authority regarding AI
  - According to the National Conference of State Legislatures, In the 2023 legislative session, at least 25 states introduced artificial intelligence bills and 15 states adopted resolutions or enacted legislation.
  - In June 2023, the US lawmakers introduced a bill, the National AI Commission Act, to create a blue-ribbon commission that will review the United States' current approach to AI regulation, make recommendations on any new office or governmental structure that may be necessary, and develop a risk-based framework for AI regulation.
- World's first Artificial Intelligence Safety Summit – On 1st Nov 2023, 28 countries and the European Union have signed the Bletchley Declaration (named after the venue of the summit at Bletchley Park in the UK) to establish a shared understanding of both the capabilities and risks of frontier AI.

AI in India

- The Ministry of Electronics and Information Technology (MeiTY), NITI Aayog, The Ministry of Commerce and Industry and the Department of Telecommunications (DoT), are the government bodies actively involved in this space. However, missions and developments have been

collaborative and have taken place at both central and state level in India and in various sectors

- The AI & Emerging Technologies Division of the MeiTY is supporting work for policy / strategy papers in the emerging areas like AI, AR/VR, IOT, Blockchain, Robotics, Computer Vision, Drones, etc.
- The Government has launched INDIAai (The National AI Portal of India) as an AI content repository (https://indiaai.gov.in/)
- The MeiTY recently published the Draft 'National Strategy on Robotics' which aims to position India as a global leader in robotics by 2030. It invited public comments on the same, the deadline for submission of which was 31st October 2023.
- The National Association of Software and Service Companies (NASSCOM) is an Indian non-governmental trade association and advocacy group. Nasscom AI is the voice of the AI ecosystem in India. NASSCOM's Responsible AI Resource Kit comprises of tools and guidance to enable businesses to leverage AI to grow
- NITI Aayog, the apex public policy think-tank of the Government of India, released the National Strategy on Artificial Intelligence "AI for All" in 2018, that inter alia wanted to ensure the safe and responsible use of AI.
- A Drone Mission for India has been instituted in NITI Aayog to inter alia promote the drone ecosystem in India
- In 2018, Ministry of Electronics & Information Technology (MeitY), India had constituted four committees to promote AI initiatives in India and develop an AI policy framework.
- In 2017, Ministry of Commerce and Industry, India had constituted an 18-member Task Force on Artificial Intelligence (AI) for India's Economic Transformation.
- The Indian Council of Medical Research (ICMR) in March 2023 released the Ethical Guidelines for Application of AI in Biomedical Research and Healthcare

Data Protection and Privacy, Cyber Security & AI

- Technological advancement and globalization has made Data exchange the backbone of existence. It entails data protection amidst the monumental risk of data abuse and fraudulent mishandling. Infamous data breaches affecting millions of users are far too common and have many a times shook many nations by storm.
- With the advent of high-tech instruments and software, data is collected, worked upon and distributed which makes it subject to exchanging hands through various channels, thus making it imperative to be protected

- As per United Nations Conference on Trade and Development (UNCTAD), 137 out of 194 countries had put in place legislation to secure the protection of data and privacy, as of December 2021. The number is now much higher.
- Globally, a giant step in the personal data protection regime first took place in 2018 when the European Union (EU) enforced General Data Protection Regulation (GDPR), a legal framework that requires businesses to protect the personal data.
- Data privacy and protection laws in some countries:
  - Australia – The Privacy Act 1988
  - China – The Personal Information Protection Law (November 2021) and the Data Security Law (September 2021)
  - Canada – The Personal Information Protection and Electronic Documents Act (PIPEDA) (Came into effect in January 2001). A new bill, namely Bill C-27 for the Digital Charter Implementation Act 2022 divided into three parts viz. the Consumer Privacy Protection Act, the Personal Information and Data Protection Tribunal Act, and the Artificial Intelligence and Data Act, was proposed in June 2022 and is under consideration in Canada's Parliament.
  - Singapore – Personal Data Protection Act 2012 (Key amendments in February 2021)
  - Philippines – Data Privacy Act 2012 and National Privacy Commission established in 2016
  - UK – The Data Protection Act 2018 and the UK General Data Protection Regulation (Regulation (EU) 2016/679)
  - USA – No federal law regulating privacy.
- India's data protection law viz. The Digital Personal Data Protection Act 2023, came into force on 11th August 2023.
- Cyber security refers to the methods of protecting and preventing, not only data but also networks, software, hardware and devices from illegal access and criminal use.
- Data privacy, cyber security and AI are all interwoven with each other. Preserving data privacy in the age of AI is a cause of concern. AI techniques are augmenting cyber security to prevent security breaches and cyber threats.
- AI can analyze large volume of data and identify patterns and predict potential threats or vulnerabilities, thus preventing cyberattacks

DATA SCIENCE

Data, being the new 'oil', can be seen as the smallest units of factual information that can be used as a basis for calculation, reasoning, or discussion. Data science is the study of data to extract meaningful insights for business. It is an interdisciplinary academic field that uses statistics, mathematics, artificial intelligence and computer engineering to extract knowledge and draw conclusions from large amounts of data. These insights can be used to guide decision making and strategic planning.

Cloud computing is very important for data science. Cloud computing enables businesses to access various computing services such as databases, data analytics, artificial intelligence, software, servers, and so on over the internet, referred to as the cloud. Companies can use the cloud to host their data and they don't need to worry about servers anymore. Data Science with Cloud Computing has popularized the concept of Data as a Service (DaaS). DaaS is provided by data vendors that use cloud computing to provide data storage, data processing, data integration, and data analytics services to companies using a network connection. Hence, Data as a Service can be used by companies to better understand their target audience using data, automate some of their production, create better products according to market demand, etc. All of these things in return increase the profitability of a company which in turn gives them an edge over their competitors.

Specialty Areas:

Data science is the process of gathering and analyzing data to better make decisions and understand situations. The Data Science lifecycle involves various roles, tools, and processes, which enables analysts to glean actionable insights viz. data collection, data storage & processing, data analysis etc.

Thus, Data scientists can specialize in many areas, such as:

- Business intelligence - Business intelligence(BI) is a set of technologies, applications, and processes that are used by enterprises for business data analysis. It is used for the conversion of raw data into meaningful information which is thus used for business decision-making and profitable actions. It supports decision-making based on facts rather than assumption-based decision-making.
- Statistical Analysis - Statistical analysis is the process of collecting and analyzing large volumes of data in order to identify trends and develop valuable insights. There are two main types of statistical analysis: descriptive and inferential. Descriptive statistics summarizes the information within a data set without drawing conclusions about its contents. Inferential statistics takes the results of descriptive statistics one step further by drawing conclusions from the data and then making recommendations.

- Data Warehousing - A data warehouse is a central data repository used for reporting and data analysis. It can connect to and integrate multiple data sources to provide a common area to generate business insights. A data warehouse is a type of data management system that is designed to enable and support Business Intelligence activities, especially analytics. Data warehouses are solely intended to perform queries and analysis and often contain large amounts of historical data. The data within a data warehouse is usually derived from a wide range of sources. A data warehouse centralizes and consolidates large amounts of data from multiple sources. Its analytical capabilities allow organizations to derive valuable business insights from their data to improve decision-making.
- Data Visualization - Data visualization is the representation of information and data using charts, graphs, maps, and other visual tools. These visualizations allow us to easily understand any patterns, trends, or outliers in a data set. Data visualization also presents data to the general public or specific audiences without technical knowledge in an accessible manner. Data visualization can be used in many contexts in nearly every field, like public policy, finance, marketing, retail, education, sports, history, and more.
- Data Mining - Data mining uncovers patterns in data, while data science involves a broader range of data-related activities, including data mining. Data mining is a subset of data science that refers to the process of discovering patterns and other key information from massive data sets, ultimately analyzing data to discover useful information. It is concerned with extracting valuable patterns, trends, and information from unstructured data. It involves the partitioning of data and calculating the probability of future events. Data mining is used by retail companies and financial organizations to identify trends to increase customer base, predict the fluctuation in stock prices and customer demand, etc.
- Data Analytics - is the practice of examining raw data to identify trends, draw conclusions, and extract meaningful information. Data analytics focuses on processing and performing statistical analysis of existing datasets. Analysts concentrate on creating methods to capture, process, and organize data to uncover actionable insights for current problems, and establishing the best way to present this data. Data science is an umbrella term for a group of fields that are used to mine large datasets. Data analytics software is a more focused version of this and can even be considered part of the larger process. Analytics is devoted to realizing actionable insights that can be applied immediately based on existing queries.
- Data Forensics – Data forensics, also known as computer forensics, refers to the study or investigation of digital data and how it is created and used. It is the investigation of digital data and encompasses

identifying, preserving, recovering, analyzing, and presenting attributes of digital information. It may focus on mobile devices, computers, servers and other storage devices, and it typically involves the tracking and analysis of data passing through a network. Data forensics can also be used in instances involving the tracking of phone calls, texts, or emails traveling through a network. Digital forensics professionals may use decryption, reverse engineering, advanced system searches, and other high-level analysis in their data forensics process.

Data scientists need to have the following skills:

- Knowledge of Programming languages (e.g. Python, R, SQL, and Java) which are used for data manipulation, analysis, and visualization. These can be learned informally through online courses, books, or tutorials, or else one can join a formal degree or diploma course for the same.
- Require computer science and pure science skills beyond those of a typical business analyst or data analyst. The data scientist must understand the specifics of the business, such as automobile manufacturing, e-commerce, or healthcare.
- Statistical and mathematical knowledge, such as probability, linear algebra, calculus, and optimization, which are used for building and testing predictive models and algorithms. This will help to apply statistics and computer science, along with business acumen, to data analysis.
- Use a wide range of tools and techniques for preparing and extracting data—everything from databases and SQL to data mining to data integration methods.
- Extract insights from big data using predictive analytics and artificial intelligence (AI), including machine learning models, natural language processing, and deep learning.
- Collaboration skills to work with other data science team members, such as data and business analysts, IT architects, data engineers, and application developers.

Data science experts are in high demand, as they extract insights from data, convey the meaning of results to decision-makers & stakeholders and explain how the results can be used to solve business problems. Real world applications of data science are many, for e.g. in Advertising & marketing, healthcare, E-commerce, Transportation etc.

HOW TO BECOME GLOBAL PRACTITIONER IN TRADITIONAL, NON-TRADITIONAL AREAS (WITHIN THE STATE, NATION AND GLOBE), AND EXPLORE NEW OPPORTUNITIES

The profile of a Chartered Accountant has catapulted to a professional with a high-level of managerial skill with multi-disciplinary talent. He/ She is now looked upon as a complete business provider. Improved information technology is enabling accountants to automate the more mundane tasks, allowing them time to develop their skills and further their knowledge in all areas of business. The CA professional is a complete business advisor wherein he performs many roles - Setting up companies, improving management processes, increasing opportunities of trade, initiating new lines of diversification, CEO's, MD's, CFO's, Finance controllers, portfolio managers, treasury managers, fund managers, financial directors etc.

Global Professional opportunities:

Traditional Areas – Accounting; Auditing; Direct Taxes; Indirect Taxes

A. Non- traditional State Areas-Part 1

1. Real Estate- RERA
2. Charitable Laws
3. Cooperative Societies
4. Labor laws
5. Chit funds State laws
6. Stamp Duty
7. Subsidies schemes of states

B. Non-traditional National areas – part 2

8. Presentation before Tribunals - tribunal practice
9. MSME sector
10. Company law- Oppression and mismanagement, Liquidation etc.
11. Virtual legal counsel / CFO / Virtual Entrepreneur
12. Disciplinary consultancy to ICAI, ICSI, CMA, Bar Council, Ministries, Government departments- police administration
13. Non-Banking Financial Institutions- NBFCS, Nidhi company, Money lenders
14. Succession Laws, Hindu laws, family laws

C. Global Non- traditional practice areas –part 3

15. Sustainability, ESG reporting, CSR, Social audit, SSE,17 SDG Climate change mitigation - carbon credit
16. Social Media consultancy services- designing, creation of accounts, posting, tagging, sharing
17. Corporate Governance & Independent Director
18. Marketing consultancy-domestic and International
19. Enterprise Risk management
20. Start-ups and E-commerce
21. Global funding
22. International trade - Global import –export services- Marketing
23. Coach- Hard skills and soft skills-time management, emotion management, personality development
24. Intellectual Property Rights Advisory services
25. Cyber security, Digital economy and data protection services
26. Industry specific specialisation – Business growth in that industry
27. Human Resource Management
28. Drafting of business and legal documents
29. Finance for non-finance executives
30. Consumer and Competition laws
31. Recovery mechanism guidance - Insolvency and Bankruptcy, SARFAESI, Criminal Actions, TORT etc.
32. Outsourcing - accounting - drafting – knowledge
33. Opportunities under financial crimes and laws like PMLA, Benami transactions, Black money, Fugitive Offenders Act
34. Mergers and Amalgamation
35. Valuation services
36. Internal Control measures
37. ADR –Arbitration, Mediation
38. Agriculture and rural development
39. IFRS and country specific GAAPs , IPSAS
40. Forensic services
41. SEBI and capital areas

PROFILE

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ICAI Central Council Member 1998-2016 and 2022 onwards
Chairman of Board of Studies, ICAI
Vice-Chairman, Research Committee, ICAI
Convener – ICAI VISION Document 2049
Chairman of SAFA Committee on Education, Training and CPD
IFAC Technical Advisor

Contribution to the Profession & Economy

1. Served on almost all committees of ICAI:
    - Founder Convenor of Kalbadevi Study Circle. Actively contributed and participated in Kalbadevi Study circle and workshops conducted by WIRC (1984-1991)
    - Hon Sec.- WIRC (1991)
    - Chairman of WIRC (WIRC was adjudged best out of 5 regions) (1997-1998)
    - Chairman of Public Relations Committee (1998)
    - Chairman of Board of Studies and Bombay Computer Centre (1999)
    - Chairman of University and Higher Secondary Board Liaison committee (2000)
    - Chairman of Committee for Members in Industry (2001)
    - Chairman of Research committee (2002)
    - Chairman of Research committee (2003)
    - Chairman of Corporate & Allied Laws Committee & Chairman of the Committee of Electoral Reforms (2004)
    - Chairman of Insurance & Pension Committee (2005)
    - Chairman of Peer Review Board & Chairman of Committee on Trade law & WTO (2006)
    - Member of Executive Committee, Vice- Chairman of Auditing and Assurance Standards Board (2007)
    - Chairman of Professional Development Committee and Committee for Economic and Commercial Laws (2008)

- Member of Examination Committee, Vice Chairman – Internal Audit Standards Board & Vice Chairman- Committee for Small and Medium Practitioners (2009)
- Chairman - Internal Audit Standards Board & Committee for Economic and Commercial Laws (2010)
- Chairman - Internal Audit Standards Board & Member of XBRL India, Accounting Research foundation (2011)
- Chairman - Committee for Members in Industry & Internal Audit Standards Board & Member of XBRL India, Accounting Research foundation, South Asian Federation of Accountants (PAIB) (2012)

2. International Member of Professional Accountants in Business Committee (PAIB) of International Federation of Accountants (IFAC) from 2001 to 2004
3. Member of Inspection Panel of Reserve Bank of India
4. Member of J.J. Irani Committee (which drafted Companies Bill 2008)
5. Member of Secretarial Standards Board of ICSI
6. Member of Working Group of Competition Commission of India, National Housing Bank, NABARD, RBI, CBI etc.
7. Independent Director of Mutual Fund Company and Asset Management Company.
8. Worked closely with the Ministry of Corporate Affairs on the drafting of various enactments.
9. Served as Independent Director of SBI Funds Management Private limited and Bank of India Asset Management Co. Ltd.
10. Served as Independent director at ICAI Accounting Research Foundation - Section 8 company
11. Actively involved with ICAI as a Central Council Member during the period when the convergence to IFRS was conceptualized in India and has been instrumental in materializing the idea.
12. Group Leader at several Study Circles organized by Professional associations at Mumbai and many places in India. Some of the Study Circles were organized by: i) Study Circle of Western India Regional Council of ICAI at various places; ii) Bombay Chartered Accountants Society; iii) Chamber of Income-tax Consultants and iv) Sales Tax Practitioners' Association of Maharashtra

Contribution to Education & Training

1. Address to Insolvency and Bankruptcy Board of India
2. Address to Institute of Chartered Accountants of India
3. Address to Institute of Company Secretaries of India
4. Address to Institute of Cost Accountants of India
5. Address to Chamber of Indian Micro Small & Medium Enterprises
6. Speaker in IIA's 2013 International Conference in Orlando on Green Audit.
7. Faculty at Indian Institute of Corporate Affairs for courses on Insolvency Laws and Corporate laws.

8. Faculty Speaker in Workshop on Risk Management for Bankers organized by CAFRAL (Centre for advanced Financial Research and Learning)
9. Faculty at National Institute of Securities Management (NISM) and Indian Institute of Corporate Affairs (IICA.)
10. Addressed the Program for Principal Inspecting Officers & Inspecting Officers by Reserve Bank of India- Department of Non-Banking Supervision.
11. Addressed the National apex Chamber of Commerce and State apex Chamber of Commerce including his address to ASSOCHAM, Confederation of Indian Industry (CII), Federation of Indian Chamber of Commerce and Industry (FICCI), and All India Manufacturers Organization(AIMO).
12. Addressed the CBI officers, officers of Serious Fraud Investigation Office (SFIO), and various State Police Academies.
13. Addressed the SCOPE- Standing Conference of Public Enterprises which is an apex professional organization representing the Central Government Public Enterprises. It has also some State Enterprises, Banks and other Institutions as its members.
14. Addressed the National Academy of Audit and Accounts (NAAA)
15. Addressed Congress of Fiji Institute of Chartered Accountants

My contribution to Government and Global level

1. Member of International Federation of Accountants – professional accountants in business committee - 2001-2004
2. Addressed twice international annual seminar of Institute of Internal auditors
3. Addressed international seminar of association of certified fraud examiners
4. Addressed international seminar of ISACA
5. Gave training to official of Comptroller and Auditor General, Central Bureau of Investigations, officials of various ministries
6. Addressed to almost all training forums of Government of India
7. Visited 90% branches of ICAI and addressed students and members
8. Member of IFRS foundation - small and medium enterprises implementation group - 2018 to 2020
9. On board of SBI mutual fund, BOI Mutual fund
10. Member of Standards board of ICAI, ICSI & ICMAI
11. Addressed Reserve Bank of India officials and officers of many private and public sector banks

Positions held in Past

1. INSOL India National Committee for Regional Affairs
2. International Financial Reporting Standards (IFRS) Foundation SME Group
3. CAG Advisory Committee
4. Quality Review Board, Government of India

5. International Member of Professional Accountants in Business Committee (PAIB) of International Federation of Accountants (IFAC)from 2001 to 2004
6. Member of Inspection Panel of Reserve Bank of India
7. Member of J.J. Irani committee (which drafted Companies Bill 2008)
8. Member of Working Group of Competition Commission of India, National Housing Bank, NABARD, RBI, CBI etc.
9. President - Association of Indian Investors (A Section 8 Company)
10. Visiting Lecturer at S.P. Jain Institute of Management, Intensive Coaching Classes for Inter & Final CA organized by WIRC of ICAI.
11. Hon. Consultant to Bombay Industries Association and many trade bodies.
12. Faculty member for Entrepreneurship Development Programme of Ministry of Industrial Development, Government of India
13. Lecturer at Intensive Coaching Classes conducted by Institute of Chartered Accountants of India for Intermediate & Final C.A. students.
14. Faculty at Direct Taxes Regional Training Institute of CBDT, SFO, CBI and many regulators and banking institutions
15. Hon. Sec. of Western India Regional Council of Institute of Chartered Accountants of India in 1991-92 and Chairman of WIRC in 1997-98.
16. Hon. Sec. of All-India Importers & Exporters Association.
17. President of Rotary Club of Bombay Sea Pearl.
18. Hon. Sec. of All India Manufacturers' Organisation.
19. Hon. Sec. of Western India Chamber of Commerce

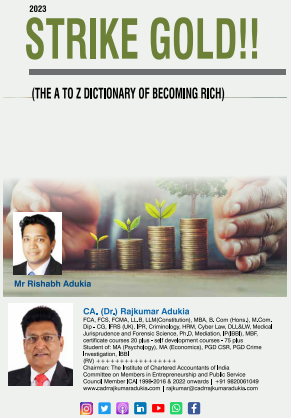
Academic Achievements

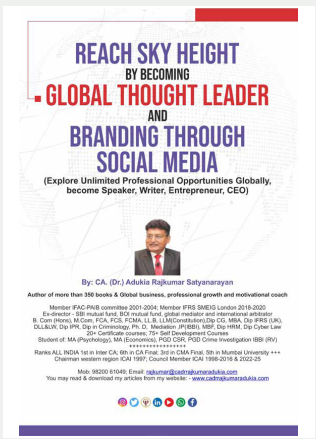
1. Graduated from Sydenham College of Commerce & Economics & was adjudged Best Student of College, winner of many Scholarships including most coveted award of the college 'Jeejeebhoy Cup for Proficiency & Character'
2. Secured Fifth Rank in Bombay University in April, 1980.
3. Received Gold Medal for highest marks in Accountancy & Auditing in B.Com. Examination.
4. Secured First Rank in Inter CA in November, 1981.
5. Received G. P. Kapadia prize for the best student of the year 1981.
6. Secured Sixth Rank in Final CA in May, 1983.
7. Secured Third Rank in Final I.C.W.A in December, 1983.

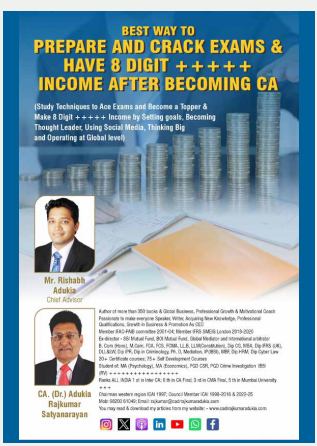
Awards and Accolades

1. Recipient of Samajratna Award by Government of Rajasthan.
2. "Rajasthan Shree" by Rajasthan Udgosh, a noted Social Organization of Rajasthan
3. Winner of Rifacimento International award for Asia's Who's Who of Men and Women of achievement. My bio data is published in Reference Asia.
4. State Trainer by the Indian Junior Chamber
5. Winner of National Book Honors Award, 2018

Some Other Publications Authored by CA (Dr.) Rajkumar Adukia







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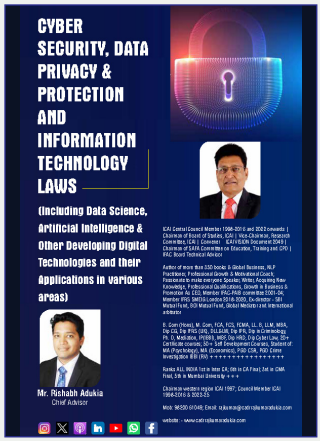

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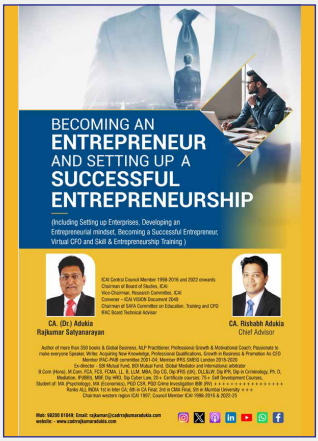

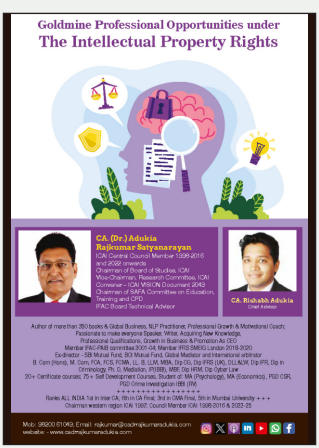

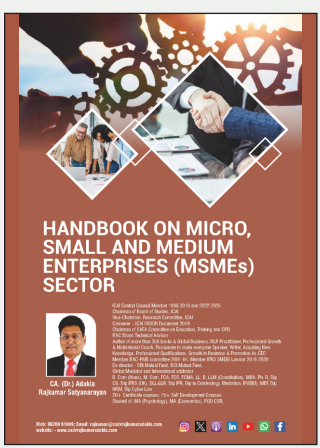

Author's Profile

CA (Dr.) Rajkumar S Adukia

Author of more than 350 books & Global business, Professional Growth and Motivational Coach, NLP Master Practitioner, Thought Leader

Passionate to make anyone Global Speaker, Writer, Entrepreneur, Global Practitioner, Acquiring New Knowledge, Professional Qualifications, Growth in Business & Promotion As CEO.

My Profile:

Educational Qualification

❶ Educational Qualification - B. Com (Hons), M. Com, FCA, FCS, FCMA, LL. B, LLM, Ph. D, MBA, Dip CG, Dip IFRS (UK), DLL&LW, Dip IPR, Dip in Criminology, Mediation, IP(IBBI), MBF, Dip HRD, Dip Cyber Law

❷ All India Ranks - AIR 1st Rank in CA-Inter; AIR 6th Rank in CA-Final; AIR 3rd Rank in CMA-Final, AIR 5th Rank in Mumbai University

❸ 20+ Certificate courses; 75+ Self Development Courses

❹ Ex-director - SBI Mutual Fund, BOI Mutual Fund

❺ ICAI Central Council Member 1998-2016 and 2022-2025

CA (Dr.) Adukia left no stone unturned during his career spanning more than 40 years. He is ever enthusiastic and passionate to mentor, guide and assist in matters of professional growth, self-development and goal fulfillment. He is renowned for his competency in identifying new professional opportunities and accelerating professional growth. His education, skill-set, experience, networking aptitude and a positive go-getter mindset make him a sought after professional. Having addressed more than 100 International Conferences, he has shared his vast experience through training, workshops & professional services with banks, financial institutions, corporate, Government departments and Regulators.