Management of ICCT underlying Technologies used for Digital Service Innovation

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ABSTRACT

Information Communication and Computation Technology (ICCT) also called as Digital Technology and is considered as a general purpose universal technology due to its ability to solve many problems in the human society related to basic needs, advanced wants, and dreamy desires. In this chapter, initially, we have identified various quality attributes of Digital Service and some prominent published works in digital service innovation. The important underlying technologies of ICCT which are emerging as technologies of 21st century including Artificial intelligence& robotics, Big data & business analytics, Cloud computing& storage, Digital marketing, 3D printing, Internet of Things, Online ubiquitous education, Quantum computing, Information storage technology, and Virtual & Augmented Reality are considered for possible innovations in such industries. The applications of ICCT underlying technologies in some of the prominent service industry sectors are identified and the management of ICCT underlying technology usage strategies for digital service innovation in tertiary sector industries are analysed.

Keywords: ICCT, Digital technologies, Universal technology, Digital service innovation, Tertiary industry sector.

1. INTRODUCTION :

1.1 Business &Technology:

Doing anything with profit motivation is considered as business. Profit may be tangible or intangible based on some kind of resources which include, money, material, machine, men, information, or time. All business organizations are profit motivated and have the objective of earning long term sustainable profit. Business entities are divided into four types of industry sectors called the primary industry sector, secondary industry sector, tertiary industry sector, and quaternary industry sector. Primary industry sector consists of business entities which produce raw materials for secondary industry sectors like agricultural industry, mining industry, fisheries industry, etc. Secondary industry sector converts raw materials into finished tangible products called goods and is includes all manufacturing industries like food processing, automobiles, cement, steel, computer hardware, Electronic devices, etc. Tertiary industry sector consists of all services industries which provide intangible services to the customers like banking, insurance, tourism, education, healthcare, legal services, etc. Quaternary industry sector consists of supporting services to all other three types of industry sectors which include information technology services, research & development, business consulting, etc.Doing business in the society can be influenced by various things but adopting technology in business and managing it effectively increases the productivity, efficiency, and hence the profit from the business. Technology is an application of science in systematic way to solve many complicated challenges in the society to make human life comfortable and happy. Certain technologies have grown and expanded their branches to

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many areas and sectors of practice in such a way that they have been designated as General-Purpose Technologies. Such general purposetechnologies are identified and used in many industries to do business and to solve or simplify the problems of industries. General Purpose Technologies' (GPT) are characterized by pervasiveness where they have an inherent potential for technical improvements, and innovation complementarities, meaning that through innovative research and development the productivity of industry sectors can be increased [1].

A general-purpose technology or GPT is a term coined to describe a new method of producing and inventing that is important enough to have a protracted aggregate impact. Electricity and information technology (IT) probably are the two most important GPTs until the 20th century. A GPT can be a product, a process, technology or an organisational system. Whole eras of technical progress and growth appear to be driven by a few 'General Purpose Technologies' (GPT's), such as the steam engine, the electric motor, and semiconductors. GPT's are characterized by pervasiveness to many sectors, inherent potential for technical improvements, and innovation complementarities to many applications, giving rise to increasing scale of operation. Economist Richard Lipsey and Kenneth Carlaw [2] suggested that there have only been 24 technologies in history that have been identified as true GPTs. They define a transforming GPT follows four criteria which are listed below [3]:

(1) GPT is a single, recognizable generic technology.

(2) Initially, GPT has much scope for improvement but comes to be widely used across the economy.

(3) GPT has many different uses in many areas to solve problems or to provide comfortability.

(4) GPT creates many spill over effects to spread its base to many sectors.

General purpose technologies have the potential to reshape the economy of the world and boost productivity across all sectors and industries. Such transformations are far more than simple technical innovation, or a new discovery.

However, such technologies often require a wholesale remaking of infrastructure environments, of business models, and of cultural norms. There are three fundamental features of GPTs that differentiate them from other technologies which are (1) Pervasiveness – The GPT should spread to most sectors. (2) Improvement – The GPT should get better over time and, hence, should keep lowering the costs of its users. (3) Innovation spawning – The GPT should support to invent and produce new products or processes. Most technologies possess each of these characteristics to some degree, and thus a GPT cannot differ qualitatively from these other technologies [1].

A new research method called Ideal System analysis is developed based on identifying the research gap by comparing present characteristics and ideal characteristics of a system [4]. Ideal system refers to the system which has ideal characteristics i.e., perfect in every way. It is what the mind pictures as being perfect. The characteristics of the present system can be improved towards the characteristics of the ideal system by doing research and innovation. Accordingly, the ideal business model is developed to specify the ideal characteristics of business under input characteristics, output characteristics, system requirement, market conditions, and are can be explained based on their effectiveness in improving the revenue and creating value to the stakeholders [5].Similarly, an ideal technology is defined as a system with ideal characteristics to solve all problems of human beings including both basic needs and advanced wants to support comfort living to realize their dreams. Based on various factors which decide the ideal technology system characteristics, a model consisting of input conditions, output conditions, environmental conditions, and system requirements are identified and analyzed [6].

1.2 Service as Intangible Product /Asset of Service Industries :

Companies in the service industry provideprofessional work called service performed in an expert manner by an individual or team for the benefit of its customers. The typical service businessprovides intangible

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products, such as accounting, banking, education, insurance, health treatment, transportation services, computer services, restaurants, tourism,etc.

The service industries can be innovative and quality and other related attributes of services can be improved to satisfy the service providers and end consumers by means of using a new business method or by means of new technology. Information Communication & Computation Technology (ICCT) is one kind of general purpose universal technology for the 21st

Century which can be used to innovate services of the service industry. ICCT is used as digital technology in the services industry sector to provide and enhance values of various services offered in business management in the society. The attributes of service like method, quality,accuracy, timeliness, efficiency, effectiveness of various services provided are affecting the business management of service industry organizations.

Table 1 : Various attributes used to evaluate service quality in the business field

S. No.	Attributes	Type	Explanation
1	Content	Intangible	Content of the service is the useful information contained in the service to the user.
2	Method	Intangible	Method of a service is the procedure to adopt the service by the user.
3	Quality	Intangible	Quality of service is a description or measurement of the overall performance of service.
4	Accuracy	Intangible	Accuracy of a service implies how close a measurement comes to its true value.
5	Timeliness	Intangible	Availability and accessibility of service in time to get the full benefit of the service by the customers.
6	Frequency	Intangible	Number of times the service is provided to the user during a given period of time.
7	Speed	Intangible	How quick the service is reachable to the end user.
8	Reliability	Intangible	Ability to perform expected objective for a given time period and to meet the expectation of the customers.

1.3 Digital Service :

Digital service is an automated service delivered using digital technologies via the internet, or an electronic communication network. Digital service is usually automated and its supply involves only minimal human intervention.The essential characteristics of digital service include [7-9] : (1) intangibility, (2) high technology, (3) invariance, and (4) scalability. The efficiency and the effectiveness of digital service are measured using many attributes in addition to attributes of a service. These quality attributes of digital service are determined using focus group method [10] and are listed in table 1, which include:Safe & Secure, Ubiquitous, Simple & Easy, Customizable, Flexibility, Adaptability, Reusability, and Innovability as shown in figure 1.

(1) Safe &Secure: Services which are developed using digital technology should be safe to use at development and usage stage for the provider and the consumer respectively so that fearless usage is expected. Further, the services developed using digital technology should protect the data and information, as well as the consequence benefits of the service, should be secured for considerably long time.

(2) Ubiquitous: Offering the service and availing the service anywhere globally, at any time throughout the day, and any amount of time continuously.

(3) Simple &Easy: Need simple and easy processes to communicate, offer, and use the service by everyone without implementation & understanding difficulty.

(4) Customizable: Ability to adapt to any system by making suitable changes, or ability to

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adapt to any customer for their variable environment and variable background.

(5) Flexibility: Digital service offered electronically can be stored and retrieved at any time and it can be used or processed online or periodically depending on the end users comfortability. Thus, the flexibility of digital services offers anytime, anywhere, and any amount of time usage opportunity. Further, such services are flexible in terms of processing further at any stage to add value.

(6) Adaptability: It is the ability of digital service to withstand, to sustain, and to respond to the demands and changes of the moment. When the applications change, the servicewith

the strength of Adaptability easily adapts and changes like flexibility.

(7) Reusability: Digital services are reusable platforms typically contains extra functionality that could be reused in future requirements. This encourages digital services due to their extra capabilities built around possible future service usage scenarios.

(8) Innovability: Innovability is an ability of a service to adopt innovation either through (i) improvements in the processes of the service leading to new service model or (ii) improvements in technology adopted in the service & its delivery leading to a radical change in the quality of the service.
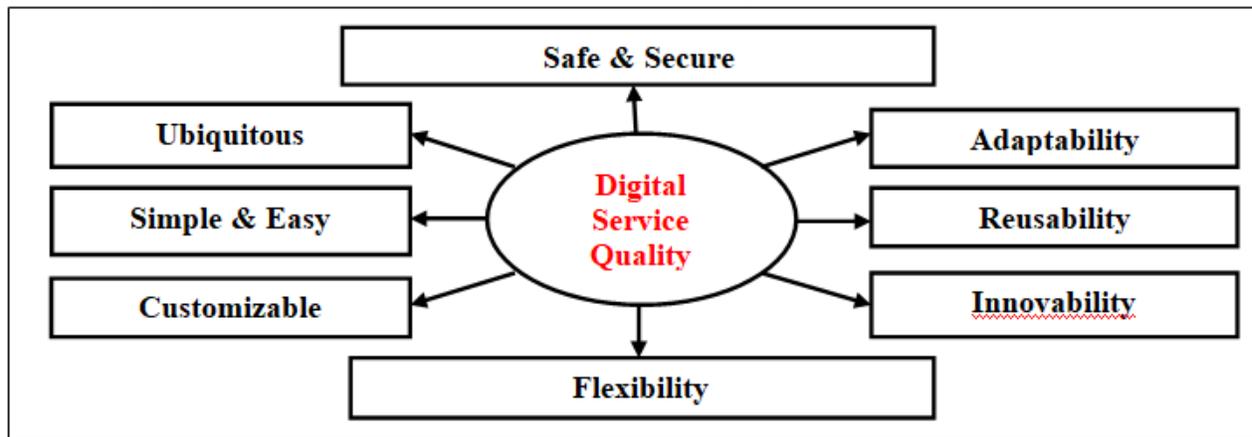
Fig. 1 : Block diagram representing the various quality attributes of Digital Service.

1.4 Digital Service Innovation :
A digital service innovation benefits for both the service providersand service receivers called customers and it improves the competitive edge of the service provider. Digital service innovation is an effort of adding novelty in the existing process of a service product or service process that is based on usage of some digital technology systematically for the enhanced comfortability of the customers and business providers. Innovation is a culture of

adding value to an existing system by means of creative thinking and it leads to adding further economic and social value in terms of its users and by doing so, it generates new or improved products, services, or processes. Many researchers working on various aspects of digital service innovation and some of the important scholarly publications are reviewed and listed in table 2.

Table 2 : Some of the related works in digital service innovation

S. No.	Issues on Digital Service Innovation	Focus	Reference
1	Service innovation in the digital age	key contributions and future directions	Barrett, M., (2015) [11]
2	Digital innovation strategy	A framework for diagnosing and	Nylén, D., (2015)

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		improving digital product and service innovation.	[12]
3	Information technology and product/service innovation	A brief assessment and some suggestions for future research	Nambisan, S. (2013) [13]
4	Exploring digital service innovation process	Innovation process through value creation	Häikiö, J. (2016) [14]
5	Service innovation	Disruptive digital innovation	Agarwal, R. et al.(2015). [15]
6	Service sector innovation	Understanding service sector innovation	Sheehan, J. (2006) [16]
7	IT-related service innovation	Signs and practices as resources	Löbler, H., et al.(2014) [17]
8	Product–service innovation and performance	The role of collaborative partnerships and R&D intensity	Bustinza, O. F. et al.[2019][18]
9	Digital public service innovation	Framework proposal	Bertot, J. C., et al.(2016) [19]
10	Disruptive innovation in health care delivery	A framework for business-model innovation	Hwang, J., et al.(2008) [20]
11	Flexible generification	ICT standardization strategies and service innovation	Hanseth, O., (2015). [21]
12	Service chain management	Technology innovation for the service business	Voudouris, C., (2007). [22]
13	Incremental and radical innovation	Design research vs. technology and meaning change	Norman, D. A., (2014). [23]
14	Digital business innovation	Trends and challenges in digital business innovation	Morabito, V. (2014). [24]
15	ICT based service innovation	A challenge for project management	Bygstad, B., (2009). [25]
16	Innovation as the core competency of a service organisation	The role of technology, knowledge and networks	Kandampully, J. (2002). [26]
17	Key service innovation drivers in the tourism sector	Empirical evidence and managerial implications	Jiménez-Zarco, et al (2011). [27]
18	How big data analytics enables service innovation	materiality, affordance, and the individualization of service	Lehrer, C., et al. (2018). [28]
19	Service innovation	Using the Internet of things	Xu, X. (2012). [29]
20	Shaping, organizing and rethinking service innovation	A multidimensional framework	Rubalcaba, L.,et al. (2012). [30]
21	Innovation and regulation in the digital age	A call for new perspectives	Benghozi, P. J., (2009). [31]

It is observed that service innovation is possible in major two ways which include service model based innovation and technology based innovation. Service model innovation includes providing new model using new processes to offer a service from an organization or service provider to end customers. Technology based service innovation uses digital signal based Information Communication and Computation Technology (ICCT) which is also called digital technologies. In this paper, we discussed the progress in digital technologies and how they can contribute to the digital services innovation and add value to them from both service

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provider and service receiver points of view.

2. OBJECTIVES OF THE CHAPTER :

The chapter discusses the concept of using various prominent ICCT underlying technologies in the innovation of digital products of various sectors of the service industry. Being explorative research in nature, the chapter focuses on the following objectives :

(1) To identify various attributes used to evaluate service quality in the business models

(2) To identify quality attributes of digital service using the focus group method.

(3) To identify important underlying technologies of ICCT which are emerging as technologies of the 21st century and to be used for digital services innovation.

(4) To discuss the applications of ICCT underlying technologies in some of the prominent service industry sectors.

(5) To discuss and analyse the management of ICCT underlying technology usage strategies for digital service innovation in tertiary sector industries.

3. ICCT UNDERLYING TECHNOLOGIES & THEIR IMPORTANCE :

In history, many killer applications technologies were invented which were found to be initially less productive and costly but eventually grown as General Purpose Technologies (GPTs). There are many GPTs identified which include the wheel, steam engine, railroad, electricity, semiconductor electronics, automobile, computer, Internet, mobile phones, Information Communication and Computation Technology (ICCT),

Nanotechnology (NT), etc. Recently, based on the analysis, it is found that two general purpose technologies viz. ICCT & NT are capable solve many problems of the society especially related to problems of basic needs, problems of advance wants, and problems on dreamy desires of a human being in the society and renamed as Universal Technologies [3]. ICCT, being a digital signal based technology, is responsible for information generation, communication, processing, storing, and retrieval and represents a single unified technology called Information Communication and Computation Technology (ICCT). ICCT is a combined version of Information Communication Technology (ICT) and Computer Technology (CT).In the 21st century, ICCT is grown and spread its roots from primary to tertiary sectors due to its pervasiveness, growth, and innovation opportunity properties [3]. The Improvement and Innovation spawning properties of ICCT is capable to innovate many services offered by service industries and hence capable & qualified to be called as universal technology. As time progress, during the 21st century, ICCT has created many underlying technologies which were further developed as independent technologies under the umbrella of ICCT as universal technology. The important ICCT underlying technologies which offer general purpose technology characteristics including pervasiveness, growth oriented, and innovation opportunity and hence have potential to make digital service innovations to a high extent are listed in table 3.

Table 3 : ICCT underlying technologies, their objectives, and ultimate goal [32], [33]

S. No	Underlying Technologies of ICCT	Objectives	Ultimate Goal
1	Artificial Intelligence Technology	Performing by thinking and doing things better than human beings	Ideal artificial brain & connecting brains with computers
2	Big data and Business Analytics	Developing effective information using hidden patterns, unknown correlations, market trends, and customer preferences to help organizations for making better business decisions	Ideal Business prediction [5]

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3	Cloud Computing Technology	Using computer infrastructure at cost effective and optimum level from ubiquitous location	Ideal Computer [4]
4	Digital Business & Marketing	Ubiquitous mobile business and e-marketing using digital and internet technology	Ideal Business [5, 34]
5	3D printing Technology	Preparing three dimensional structures from a digital file. This is achieved using additive processes using less material than traditional *manufacturing methods*	Ideal Production of components & Devices
6	Internet of Things (IoT)	Interconnection and integration of the physical world and the cyber space remotely to control the devices from distance	Ideal interconnection & Control
7	Online Ubiquitous Education & Training	Education for everybody irrespective of location, age, economic level using technology	Ideal education system [35, 36]
8	Optical Computing Technology	High speed data processing	Ideal Computers [37, 38]
9	Information Storage Technology	Huge amount of information storage in a small region using suitable technology	Ideal storage system
10	Virtual Reality & Augmented Reality	Virtual reality is an immersion experience which gives the physical world feelings	Ideal virtual experience [39]

3.1 Artificial intelligence Technology:

Artificial intelligence (AI) is an area of computer science which focuses on the creation of intelligent machines which can mimic the decisions of human beings. The primary objective of AI technology is to develop machines which can think and do things better than human beings. The main functions of artificial intelligence machines are to recognize the environment such as speech recognition, Learning, Planning, Problem solving, and hence decision making. Artificial intelligence machine mimics cognitive functions of human beings associated with other human minds, such as learning & memorizing and decision making for problem solving. ICCT has created a platform for AI to be introduced and developed for adding intelligent thinking components in electronic systems used in any industrial sectors. Artificial intelligence has its applications in almost all industries in the primary sector, secondary sectors, tertiary sectors, and quaternary sector.

3.2 Big data &Business analytics:

The emerging subfield of ICCT named big data and business analytics focus on handling huge amount of data continuously generated in any business or data capturing process and analyses it using various quantitative analytical techniques and mathematical models to study the pattern and descriptive information, predictive information, and prescriptive information for supporting the decision makers to take optimum decisions to the problems related to future aspects of the business. Predictive analytics in various functional areas like Marketing analytics, Retail Analytics (Customer Analytics / Supply Chain Analytics), Pricing Analytics, Financial analytics, Social media analytics, sports analytics, and Healthcare analytics are finding importance in the business environment for effective decision making. Further Prescriptive Analytics for optimizing the decisions with multiple objectives / portfolio analytics, optimizing complex decisions / sales

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force analytics, and Retail Analytics, etc are also have a futuristic impact on effective business decisions.

3.3 Cloud Computing:

Cloud computing is one of the advances in computer technology and is uses information communication technology as well. Due to the ubiquity of cloud computing facility with flexibility in scaling it has become an important topic of research and provides the value for computing processes in the business. The cloud computing model also provides a most important application called Business Intelligence (BI) for effective decision making in business processes via the Internet. Cloud computing model provides its clients with both hardware as well as software to process the data and information online as a rental service. Cloud computing model has three variations as Software as a Service (SaaS), Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS) to provide ubiquitous computing service solutions to the business. The cloud computing solution used by any business will allow companies to reduce their investment cost, maintenance cost, and hence business cost without compromising to have access to BI solution which will give the business an edge on their competition. Could computing is a subfield of the Information Communication and Computation Technology (ICCT).

3.4 Digital Business &Marketing:

ICCT created a new business model called E-business/ M-business model. This model consists of the ubiquitous selling proposition. *Digital marketing* is the *marketing* of products or services using *digital* technologies as per such new business model using mainly on the Internet, but also including mobile phones, display advertising, and any other *digital* medium.

D*igitalmarketing* technology represents advertisements delivered through *digital* channels and internet including search engines, websites, social media, email, and mobile apps. Digital business and marketing are emerged as an essential future business &marketing activity using ICCT general purpose technology.

3.5 3D Printing:

3D printing is an ICCT application where various materials are joined or solidified using various processes under the control of the computer to create a three-dimensional object. In 3D printing, an object is created by laying down successive layers of material until the object is created. 3D printing can be divided into metal, fabrics, bio and a whole host of other industries with many applications in many industries worldwide.3D printing is a variant of ICCT general purpose technology and has wide scope in various industrial automation and home automation processes. 3D printing technology is expected to revolutionize material fabrication processes. 3D printing comprises of many other technologies along with ICCT. Some of the 3D printers make use of nanomaterials and nanocomposites for anything, anywhere manufacturing.

3.6 Internet of Things:

It is a network of various electronic, computing, and optical devices/objects including human beings connected virtually by means of internet or intranet for enabling them to send and receive data and information. These objects are provided with unique identifiers (UIDs) and are capable to transfer data and information over a network without requiring human-to-human or human-to-computer interaction by using IoT technology. Such a connection of physical things/objects to the Internet makes it possible to access remote sensor data and to control the physical world from a distance. The mash-up of captured data with data retrieved from other sources, eg, with data that is contained in the Web, gives rise to a new synergistic service that go beyond the services that can be provided by an isolated embedded system. Internet-of-Things (IoT) is not in any new disruptive technology but is the pervasive deployment and innovation of ICCT.

3.7 Online Ubiquitous Education:

To provide education to everybody, the transformation of traditional campus based education system into Massive Online Open Courses (MOOC) system is essential. Even though initially MOOC is considered as complementary to traditional campus based education HE system, as time progress, it may

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replace campus based HE system completely. Higher education focuses on enhancing knowledge, skills, experience, and hence confidence to make innovations and better decisions can be offered equally effective through online using wireless video channels. Ubiquitous online education offered through multidisciplinary areas using simulation may out pass the traditional laboratory based education in the HE system. The other underlying ICCT technologies also support online ubiquitous education system to make it more effective, efficient and easily accessible system for everybody without their geographical locations and economic conditions. Some of such growing brands includeEDX, COUSERA, NPTEL, SWAYAM, etc.

3.8 Optical Computing:

High speed computers based on optical signal switching and optical signal processing are expected to a breakthrough with their full potentials and capabilities using optical logic gates and flip-flops fabricated by nanocomposites are expected to breakthrough in this century. High speed computation and data storage using nanotechnology based optical computers are going to revolutionize the entire computer industry. Optical computation is joining both general purpose technologies of Nanotechnology and ICCT through the processes of design & production as well as operation & applications respectively. Various optical principles like photo-refraction, optical spatial solitons, and optical logic gates are under considerations for building all-optical computers.

3.9 Information Storage Technology :

Information storage technology supports to develop devices to store & retrieve information in digital format. The trend in this field is to enhance the capability of devices to store huge amount of information in a small region at high speed and low cost. Various storage devices used and under consideration include Semiconductor Storage, Hologram Storage, Optical Storage, DNA Based Digital Storage, etc. which should have capability to store information in Terabytes, Petabytes, Exabytes, Zettabyte, and even Yottabyte in order to cater the forthcoming information storage applications.

3.10 Virtual & Augmented Reality :

Virtual reality is an artificial environment that is created with the help of computer-based software and presented to the user in such a way that the user suspends belief and accepts it as a real environment. On a computer, virtual reality is primarily experienced through two of the five senses: sight and sound. Currently, the virtual reality is mainly developed and used in simulated training and education as well as the simulated game environment. But it may further find its applications in many other areas including business as augmented reality and may enter the group of general purpose technology.

ICCT has many applications in the many Industries and Industry sectors. Almost all Industries and industry sectors belonging to Primary, Secondary, Tertiary, and Quaternary Industry Sectors are basically supported by and get benefits from ICCT. In next section, the applications of ICCT underlying technologies in some of important service industry sectors are discussed.

4. DIGITAL SERVICE STRATEGY IN TERTIARY INDUSTRY SECTOR :

Industries and industry sectors in tertiary sector called services sector are expected to get benefit from ICCT. Table 4 lists some of the services sector gets benefit from underlying technologies of ICCT.

Table 4: Some applications of ICCT in Tertiary Industry Sector

S. No.	Underlying technologies of ICCT	Applications in Tertiary Industry Sector
1	Artificial Intelligence Technology	Artificial Intelligence technology is used in many areas of service industry sector including tourism, telecommunications, citizen services, Banking sector for loan decisions, retail sector, etc. [40-44]

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2	Big data and Business Analytics	In Supply chain management, Banking sector, Tourism sector, health sector, financial & insurance sector, fashion industry, [45-49].
3	Cloud Computing Technology	Financial service industry, Education industry, Security industry, Brokering service, Healthcare, Gamming industry, Supply-chain industry, Telecommunication industry, [50-52]
4	Digital Business & Marketing	Digital Marketing and customer relationship in all kind of industry including hotel industry, tourism industry, health industry etc. [53-54]
5	3D printing Technology	Health sciences, Forest industry, [55-56]
6	Internet of Things (IoT)	Service innovations are possible using IoT. Smart city services including Tourism, Healthcare, Telecommunication, Logistics, Transportation, Retail, etc. [57-61]
7	Online Ubiquitous Education & Training Technology	Education industry, Library services, Retail banking, Healthcare services, etc. [62-64]
8	Optical Computing Technology	Optical technology based high speed computers are essential in future Retail industry sectors, Logistics & Supply chain industry sectors, Telecom industry sector, Information security industry, etc. [65-66]
9	Information Storage Technology	All services industry sectors where huge amount data and information related to the business are to be stored and retrieved at high speed in small device.
10	Virtual Reality & Augmented Reality	Education & Training, Tourism, Travel industry, Finance, etc. [67-69]

ICCT underlying technologies are considered as emerging breakthrough technologies ofthe 21st century with many types of innovative applications in all industrial sectors. When service sector industries are concerned, there are many opportunities to radically change the service models, service methods, service processes, service development, service transformation, service utilization, and service feedback. The entire lifecycle of the service as an output product of service industries and as an intangible input resource for the customers can be modified using ICCT digital technologies. The emerging underlying technologies of ICCT are so powerful and innovative so that they are really capable to destruct the existing models and methods of offering the services as disruptive technologies and able to create new avenue to realize the ambitious wants and dreamy desires of the customers. Tables 5 list some of the prominent service industries and the predicted ICCT underlying technologies which may re-define the way the services are offered by different service industries.

Table 5 : ICCT based Service Innovation in Tertiary Industry Sector

S. No.	Service Industries	Applications of ICCT digital technology for service innovation
1	Advertising industry	Artificial Intelligence Technology, Big data and Business Analytics, Cloud Computing Technology, Internet of Things (IoT), Online Ubiquitous Education & Training Technology, Optical Computing Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
2	Education industry	Artificial Intelligence Technology, Big data and Business Analytics,

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		Cloud Computing Technology, Digital Business & Marketing, 3D printing Technology, Internet of Things (IoT), Online Ubiquitous Education & Training Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
3	E-Commerce industry	Artificial Intelligence Technology, Big data and Business Analytics, Cloud Computing Technology, Digital Business & Marketing, Information Storage Technology, Virtual Reality & Augmented Reality.
4	Entertainment industry	Cloud Computing Technology, Digital Business & Marketing, 3D printing Technology, Internet of Things (IoT), Online Ubiquitous Education & Training Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
5	Fashion industry	3D printing Technology, Internet of Things (IoT), Online Ubiquitous Training Technology, Optical Computing Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
6	Financial services industry	Artificial Intelligence Technology, Big data and Business Analytics, Cloud Computing Technology, Digital Business & Marketing, 3D printing Technology, Internet of Things (IoT), Online Ubiquitous Education & Training Technology, Optical Computing Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
7	Healthcare industry	Artificial Intelligence Technology, Big data and Business Analytics, Cloud Computing Technology, Digital Business & Marketing, 3D printing Technology, Internet of Things (IoT), Online Ubiquitous Education & Training Technology, Virtual Reality & Augmented Reality.
8	Hospitality industry	Artificial Intelligence Technology, Big data and Business Analytics, Digital Business & Marketing, 3D printing Technology, Internet of Things (IoT), Online Ubiquitous Education & Training Technology, Optical Computing Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
9	Insurance industry	Big data and Business Analytics, Cloud Computing Technology, Online Ubiquitous Education & Training Technology, Optical Computing Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
10	IT services industry	Artificial Intelligence Technology, Big data and Business Analytics, Cloud Computing Technology, Digital Business & Marketing, Internet of Things (IoT), Online Ubiquitous Education & Training Technology, Optical Computing Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
11	Media industry	Artificial Intelligence Technology, Big data and Business Analytics, Cloud Computing Technology, Digital Business & Marketing, Internet of Things (IoT), Optical Computing Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
12	Online services industry	Artificial Intelligence Technology, Big data and Business Analytics, Digital Business & Marketing, Internet of Things (IoT), Online Ubiquitous Education & Training Technology, Optical Computing

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		Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
13	Public service industry	Big data and Business Analytics, Cloud Computing Technology, Internet of Things (IoT), Online Ubiquitous Education & Training Technology, Virtual Reality & Augmented Reality.
14	Retail industry	Artificial Intelligence Technology, Big data and Business Analytics, Cloud Computing Technology, Digital Business & Marketing, Internet of Things (IoT), Information Storage Technology, Virtual Reality & Augmented Reality.
15	Sports industry	Artificial Intelligence Technology, Big data and Business Analytics, Cloud Computing Technology, Digital Business & Marketing, 3D printing Technology, Internet of Things (IoT), Online Ubiquitous Training Technology, Virtual Reality & Augmented Reality.
16	Tourism industry	Artificial Intelligence Technology, Big data and Business Analytics, Cloud Computing Technology, Digital Business & Marketing, 3D printing Technology, Internet of Things (IoT), Online Ubiquitous Education & Training Technology, Optical Computing Technology, Information Storage Technology, Virtual Reality & Augmented Reality.
17	Travel & Transport industry	Artificial Intelligence Technology, Big data and Business Analytics, Cloud Computing Technology, Digital Business & Marketing, 3D printing Technology, Internet of Things (IoT), Information Storage Technology, Virtual Reality & Augmented Reality.
18	Event management industry	Artificial Intelligence Technology, Big data and Business Analytics, Digital Business & Marketing, Internet of Things (IoT), Virtual Reality & Augmented Reality.

5. HOW ICCT UNDERLYING TECHNOLOGIES USED FOR DIGITAL SERVICE INNOVATION IN THE TERTIARY INDUSTRY SECTOR :

The use of top ten digital technologies under ICCT in innovating various services offered by some of the prominent service industries are predicted using predictive analysis technique [70-71] and listed in following ten tables from Table 6 to Table 15.

Table 6 : Artificial Intelligence Technology based Service Innovation in Service Industries

S. No.	Service Industries	Applications of Artificial Intelligence Technology
1	Advertising industry	Interactive advertising, Agent mediated advertising, Intelligent advertising, Pervasive advertising, etc.
2	Education industry	Knowledge management, Educational cobots and smart classrooms, Artificial intelligence in auditing, Educational simulations, Online distributed learning, Improving mobile learning environment
3	E-Commerce industry	Intelligent Techniques for E-commerce, E-commerce intelligent agents, Order products online, track orders, and perform other ecommerce activities using AI, Intelligent e-business models, Electronic auditing, fuzzy intelligent agents for e-commerce automation, etc.
4	Entertainment industry	Adaptive robotics in the entertainment industry, Computer games, Development of entertainment robot, Entertainment software agents,

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		etc.
5	Fashion industry	Sales forecasting for fashion retailing, Fuzzy association rule mining for fashion product development, intelligent clothes search system based on fashion styles, Artificial multi-agent system, AI based designs for fashion industry, Intelligent fashion styling, etc.
6	Financial services industry	For managing fraud and identity theft, To advise clients, Strategicissues for financial services marketing, Prediction of financial health of organizations using AI, AI to create value in insurance, Neuro-based AI model for loan decisions, Service automation using AI, Blockchain techniques, etc.
7	Healthcare industry	Designing smart health care technology, AI in behavioral and mental health care, Applying agent technology to healthcare, Remote monitoring of high-risk patients AI based agent-mediated healthcare systems, For agent-mediated health care systems, AI assisted medical reference system, etc.
8	Hospitality industry	Experience-based travel, AI based service automation, AI based Yield-management approach to hotel-room pricing, Agent technologyin hotel business, Exploring customer experiences, Design of fuzzy expert system for hotel selection, Development of intelligent robot, etc.
9	IT services industry	Automation of Software development & coding, Knowledge management, Information security services, Semantic web services, decision automation, etc.
10	Media industry	Social media analytics and intelligence, Effective knowledge sharing, Ambient intelligence in multimedia, Restructuring newsroom, AI based new media model, etc.
11	Retail industry	Marketing decision making, Multivalent negotiations, Work flow automation, Marketing intelligence, Price adjustment, Expert systems with AI,
12	Sports industry	Sports performance prediction, Automation, Sports informatics, Emotion calculation based on AI, Sports strategies implementation, etc.
13	Tourism industry	Smart tourism, Tourism information technology, Tourism service automation, Knowledge management, Robotics &service automation,Tour itinerary planning, Personalizing recommendations, Travel recommender system, Tourism forecasting, etc.
14	Travel & Transport industry	Intelligenttransport system using AI, Improving parking efficiencies, Agent based logistics, Traffic forecasting, Travel time prediction, Experience based travel, Intelligent agents in traffic, Swarm intelligence, Technology assisted travel counselling, Artificial transportation system, etc.
15	Event management industry	Automatic computing, Artificial surface development, etc.

Table 7 : Big data and Business Analyticsbased Service Innovation in Service Industries

S. No.	Service Industries	Applications of Big data and Business Analytics
1	Advertising industry	Advertising analytics, Privacy and user control, Analytics based decision making, Big data analytics as service,

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2	Education industry	Analytics for education, Learning analytics, Teaching analytics, Predictive analytics, Optimizing quality, etc.
3	E-Commerce industry	E-commerce data analytics, market analytics, Big-data warehouse, Customer demand & supply chain analytics, Big data as a service, Text analytics, Big data driven e-commerce architecture, Validating e-commerce metrics, Online marketing, Intelligent service for e-commerce customers, Combating e-commerce identity fraud, etc.
4	Entertainment industry	Games analytics, Music based big data analytics, Multimedia analytics, Branded Entertainment, etc.
5	Fashion industry	Knowledge co-creation, Customer Analytics in Fashion industry, etc.
6	Financial services industry	Detecting fraud, Financial auditing, meta-analytics for risk forecast, Smarter fraud investigations, financial data modeling and analysis, etc.
7	Healthcare industry	Reduce healthcare costs, Predictive analytics, Appointment brokering, scheduling, e-referral and e- discharge,for better health planning, Making healthcare green, Clinical Decision Support,
8	Hospitality industry	Smart hospitality, Knowledge management, Decision support, Online customer service, etc.
9	Insurance industry	Customer profitability forecasting, Increasing customer orientation, Secure cyber incident analytics, Fraud Detection, Knowledge discovery, Intelligent Multi Agent Systems, etc.
10	Media industry	Social media analytics,Antecedents and Business Value, Empathic media and advertising, New business model,
11	Retail industry	Retail business analytics, intelligent operational dashboards for smarter commerce, Performance measurement, etc.
12	Sports industry	Sports analytics, Risk monitoring, Smart clothing, Predictive analytics on performance, etc.
13	Tourism industry	Smart tourism, Tourism analytics, Social media analytics in tourism, Monitoring and forecasting tourist activities, Sentiment analysis, Forecasting tourism demand, Customer knowledge management, data analytic tourism dashboard, etc.
14	Travel & Transport industry	Travel search engine optimization, Transport analytics, Railway transportation optimization, Revenue management and pricing analytics, Passenger travel behaviour, Risk management using predictive analytics, Smart transportation, Multi-model travel policies, etc.
15	Event management industry	Event risk management, Smart event management, etc.

Table 8 : Cloud Computing Technology based Service Innovation in Service Industries

S. No.	Service Industries	Applications of Cloud Computing Technology
1	Advertising industry	Advertising analytics, Mobile advertising, **A**lphanumeric indexing, Social media advertisement, etc.
2	Education industry	Cloud Computing prototypes, Education platforms, Improving research productivity, Alternative IT sourcing, Value addition to education project, Micro-learning platforms, E-learning, etc.

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3	E-Commerce industry	SME e-commerce model, E-commerce cloud, Anti-Counterfeit Scheme, etc.
4	Entertainment industry	Cloud based smart home, Sounds in cloud, Cloud gaming, Mobile cloud gaming, Music in cloud, etc.
5	Financial services industry	Security enhancement, Cyber risks handling, etc.
6	Healthcare industry	Mobile cloud computing, Improved healthcare, Security platform for healthcare system, Cloud computing model for patient data collection, Cloud healthcare as service, e-Healthcare, Cloud based Hospital Information system, Medical imaging, etc.
7	Hospitality industry	Smart hospitality
8	Insurance industry	Cyber security insurance in Cloud computing,
9	Media industry	Service oriented architecture, Cloud storage solutions, Edge to cloud virtualization.
10	Retail industry	Customer behaviour analysis, Cloud based mobile commerce,
11	Sports industry	Bodycloud, Prediction cloud computing demand, etc.
12	Tourism industry	Smart tourism, e-tourism framework, Decision support, etc.
13	Travel & Transport industry	Autonomous vehicular clouds, Cloud based intelligent transport system, Traffic safety, etc.
14	Event management industry	Security information and event management in the cloud computing infrastructure, Automated cloud computing, etc.

Table 9 : Digital Business & Marketing based Service Innovation in Service Industries

S. No.	Service Industries	Applications of Digital Business & Marketing
1	Advertising industry	Digital media advertisement, Mobile advertising, Real time bidding, Banner advertising, Online advertisement, Social media advertising platforms, etc.
2	Education industry	MOOCs, SPOCs, social media, and the Cookie Monster, Digital fabrication, Enterprise architectures and portals in digital transformation, Virtual technology, etc.
3	E-Commerce industry	Digital platforms, Digital e-commerce adoption models, Digital marketing for e-commerce, etc.
4	Entertainment industry	Mobile gaming, Digital music, Digital transformation, Digital business platforms for entertainment, Online video entertainment, Digital video game, Localization of digital games, Social media marketing for entertainment, etc.
5	Fashion industry	Fashion bloggers as communication tools, Trend analysis, Predicting purchase intensions, Interactive communication, Brand building, Virtual fitting room, Handling Counterfeiting, Use of social media, Digital Transformation for Fast-Fashion Brands,etc.
6	Financial services industry	Blockchain finance model, Digital finance, Supervision of financial markets, etc.
7	Healthcare industry	Internet based observation, Patient portals and online clinical consultations, Open digital platforms, Blockchain technology in healthcare, Cyber security aspects, Medical tourism, Digital medicine, Cloudlet-based mobile cloud computing, R&D and clinical practice models etc.
8	Hospitality industry	Digital tools for innovations, Hospitality robots, Use of digital

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		social media, Digital sharing platform, Risk analysis, etc.
9	Insurance industry	Digital imaging of documents, Cyber risk management, Creative contracting, Smart business networks, Blockchain based insurance models, Secured claim processes, Digital insurance, etc.
10	Media industry	Digitization of Media business models, Digital social media support, Digital publication, etc.
11	Retail industry	Web analytics, Strategic tool, Supply chain automation, Online services, Consumer centric retailing, Web services, etc.
12	Sports industry	Internet sports marketing, Digital games, Online sports betting, etc.
13	Tourism industry	Social media on tourism, E-tourism, Website based tourism service, Digital ecosystem in Tourism, Web marketing, Agent-based cybermarketing, etc.
14	Travel & Transport industry	Web services for travel industry, Location based services, Virtual logistics, Digital lifestyle and online travel, Digital travel record, Digital sustainable travel services, etc.

Table 10 : 3D printing Technology based Service Innovation in Service Industries

S. No.	Service Industries	Applications of 3D printing Technology
1	Education industry	Low cost 3D printing, Anatomy education, Teacher education, Design thinking & education, Engineer design education, Additive manufacturing in classroom, In pre-engineering curriculum, Tool for teaching & learning in STEAM education, etc.
2	E-Commerce industry	Mass production, Networked market place, Customized production, Smart manufacturing, etc.
3	Entertainment industry	Surprise object advances for the 3D printing entertainment industry, Game object advances for the 3D printing entertainment industry, etc.
4	Fashion industry	In garments production, Virtual design & production, Digital 3D printing in fashion, Fashion textiles by 3D printing, Collective design for 3D printing in fashion, 3D printing on textile substrates, etc.
5	Healthcare industry	3D printing of biomaterials, 3D printing for personalized medication, 3D printed medicine, 3D printing in pharmaceutical and medical applications, For personalized drug delivery, Organ printing, etc.
6	Hospitality industry	3D food printing.
7	Retail industry	For rapid manufacturing, Personal fabrication, etc.
8	Travel & Transport industry	Influence of 3D printing on transport, Freight miles: the impact of 3D printing on transport, etc.

Table 11 : Internet of Things (IoT) based Service Innovation in Service Industries

S. No.	Service Industries	Applications of Internet of Things (IoT)
1	Advertising industry	IOT as Disruptive Innovation for the Advertising Ecosystem, Wireless advertising software library for distributed IOT,
2	Education industry	New education architecture, IOT learning systems, Mobile education using IOT, Smart university using IOT, IoT-based flipped learning platform for medical education, etc.
3	E-Commerce industry	IOT for cyber security, IOT based services access for e-commerce,

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		IOT reference architecture for E-commerce, etc.
6	Financial services industry	Service innovations by providing new applications or upgrading the existing one by providing enhanced security, Blockchain convergence, Value creation through enhanced privacy, Etc.
7	Healthcare industry	IOT platform for efficient healthcare services, For smarter healthcare services, For enhanced security & privacy of healthcare services, IOT to manage big data based services, Data validation services in personalized healthcare, IOT based information system for emergency healthcare, etc.
8	Hospitality industry	Smart hospitality using IOT, Paperless buffer management, Security improvements, CRM using IOT, etc.
9	Insurance industry	Risk analysis of IOT based cyber insurance, Blockchain based for digital insurance management, Self organized framework for insurance using IOT, etc.
11	Media industry	IoT architecture for multisensory media, etc.
14	Retail industry	Improving the customer experience, Controlling supply chain, New opportunity for revenue creation, Value co-creation for customers, IOT as marketing tool, etc.
15	Sports industry	Sports analytics management, Occupancy monitoring system for campus sports facilities, Security issues and creation in sports, etc.
16	Tourism industry	Smart tourism, Managing mobile smart tourism destinations efficiently, Independent mobility of tourists in smart cities, Geo targeting for marketing tourism.
17	Travel & Transport industry	IOT ensures efficient delivery and food safety, For smart transport, Ultra low power IOT based traffic monitoring system, IoT can integrate transports with human responses, travel behaviours, interjurisdictional interoperability, environmental changes, city and building ambiances, sound and video, etc.
18	Event management industry	Automation including time and process of event management.

Table 12 : Online Ubiquitous Education & Training Technology based Service Innovation in Service Industries

S. No.	Service Industries	Applications of Online Ubiquitous Education & Training Technology
1	Advertising industry	Mobile advertisement through online awareness creation, Digital training with internet video advertising, Online direct-to-consumer advertising, etc.
2	Education industry	Ubiquitous Educationprogrammes, MOOC, Vocational education & training, Mobile learning, Online education with global quality, Online engineering education, Flexible learning toolboxes, Online workforce training, etc.
3	E-Commerce industry	Awareness creation in online banking, Online training for e-commerce workforce, Online education for e-commerce models, etc.
4	Entertainment industry	Online educational game, Digital game-based learning, Online video games for education & learning, etc.
5	Fashion industry	Global online training in fashion design sector to reduce the cost,

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		Mapping e-learning courses in the fashion domain, etc.
6	Financial services industry	Customer education, Financial planning education & training, Education for financial advisors, etc.
7	Healthcare industry	MOOC on health & medicine, Processes of e-health, Clinical education & training, Mobile health, Web-based training for public health practitioners etc.
8	Hospitality industry	e-learning in hospitality, Mobile learning, Web-based training, etc.
9	Insurance industry	e-training, online ubiquitous service, online claim clearance, etc.
11	Media industry	Web-based training in media,
13	Public service industry	Public sector training, Online training, Online services, etc.
14	Retail industry	Online retail services, Online after sales services, Retail training, etc.
15	Sports industry	Online training in sports,
16	Tourism industry	Sharing tourism knowledge online, Simulation based tourism education, E-learning applications in tourism sector, etc.
17	Travel & Transport industry	Online intermediates, Online travel purchase processes, Travel data exchange,
18	Event management industry	Online event management education, Online event management training, etc.

Table 13 : Optical Computing Technologybased Service Innovation in Service Industries

S. No.	Service Industries	Applications of Optical Computing Technology
1	Advertising industry	High speed computation based advertising models, Online advertising, Digital advertising & processes, Resource advertising and optical research networks, Optimizing advertisement – systems & methods, etc.
2	Education industry	Optical computing alternative for high speed interconnectivity and storage for global MOOC, High ending computing for education, etc.
3	E-Commerce industry	Modern high performance computing for large scale e-commerce,
4	Entertainment industry	Entertainment computing, Computing at speed of light for high speed entertainment, All optical devices, etc.
5	Healthcare industry	High speed optical computers for healthcare applications.
6	Hospitality industry	Hospitality automation based on fully functioning robots which are based on high speed optical computers.
7	Insurance industry	High end computing in insurance information processing.
8	Sports industry	High speed computing for video games.
9	Travel & Transport industry	Intelligent transportation systems using high speed computers.

Table 14 : Information Storage Technology based Service Innovation in Service Industries

S. No.	Service Industries	Applications of Information Storage Technology
1	Advertising industry	Pervasive advertising
2	Education industry	Storage of information in MOOC
3	E-Commerce industry	Data management, Data analytics, Huge information storage
4	Entertainment industry	High density digital storage
5	Fashion industry	High density digital storage

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6	Healthcare industry	High density digital storage
7	Hospitality industry	High density digital storage
8	Media industry	High density &high speed digital storage
9	Retail industry	High density &high speed digital storage
10	Sports industry	High density &high speed digital storage
11	Travel & Transport industry	High density &high speed digital storage

Table 15 : Virtual Reality & Augmented Reality based Service Innovation in Service Industries

S. No.	Service Industries	Applications of Virtual Reality & Augmented Reality
1	Advertising industry	Augmented reality effectiveness in advertising, Personal augmented reality advertising, Augmented reality 3D interactive advertisements on smartphones, Exposure time and self-efficacy in augmented reality advertising environments, Adoption of mobile augmented reality advertisements, etc.
2	Education industry	Collaborative augmented reality in education, AR as visual and spatial learning tool in technology education, VR based educational games, Potential of augmented reality for teaching primary school science, Augmented reality to promote collaborative and autonomous learning in higher education, Virtual reality-based spatial skills assessment and its role in computer graphics education, AR in experimental education, In immersive training system,Educational video game design, etc.
3	E-Commerce industry	Virtual fitting room augmented reality techniques for e-commerce, Augmented reality E-commerce assistant system, Adoption of Augmented Reality Technology for E-Commerce, etc.
4	Entertainment industry	Digital interactive entertainment, Product realization, Achieving total immersion, Video games, Museum effects, Interaction techniques with virtual humans, Interactive storytelling and mobile augmented reality applications for learning and entertainment, Applying mixed realities in entertainment, etc.
5	Fashion Industry	Fashinology perspective on the perception and adoption of augmented reality smart glasses.
6	Healthcare industry	Digital surgical environment using VR & AR, Patient-specific virtual reality simulation, Use of virtual, augmented, and mixed reality to urology, VR & AR in dentistry, Virtual reality-assisted robotic surgery simulation, Clinical utility of an Augmented Reality musical software among health care professionals, Augmented reality system to guide radio-frequency tumour ablation, Trauma decision-making simulator in Oculus virtual reality. etc.
7	Hospitality industry	Augmented reality instructions in a hospital setting, Virtual reality rehabilitation and therapy, Customer emotions study in virtual restaurant, Virtual collaboration, Smart hospitality, etc.
8	Media industry	Virtual studio, Virtual simulated world, Social media with virtual
9	Online services industry	To enhance online service experiences, visual integration of virtual content into a person's real-world environment, etc.
10	Retail industry	Social mobile augmented reality for retail,Smart retail settings via mobile augmented reality shopping apps, Bringing online shopping

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		experience to offline retail through augmented reality, Multisensoryaugmented reality in the context of a retail clothing application,Mobile augmented reality for retail environments, etc.
11	Sports industry	VR simulation for football & other sports, VR based training models for sports & games, etc.
12	Tourism industry	New realities: a systematic literature review on virtual realityand augmented reality in tourism research, VR in tourism marketing using mobile device, AR as an Innovation Tool in Digital Tourism Marketing, Smart tourism, Effects of virtual reality on theme park visitors' experience and behaviours, etc.
13	Travel & Transport industry	To synthesize & immerse virtual environmentwith no touch-points to the real world, Virtual reality for travel planning,VR as a travel promotional tool, VR in automotive and aerospace sector, VR as travel promotion tool, etc.

6. MANAGEMENT OF ICCT STRATEGIES FOR ENHANCING PRODUCTIVITY &EFFECTIVENESS :

ICCT can be used for digital service innovations in many tertiary industry sectors as seen in previous section but planning and managing them systematically to get real benefit to fulfilling the objectives of the organization is a challenge. There are many strategies used in planning and implementation of their service products. Proper strategy should be identified and implemented in a given business organization to add values and to get expected benefits. As per one school of thought in strategic management, an organization may use five types of strategies while promoting a business which include : (i) Survival strategy or black ocean strategy [72], (ii) Sustainability strategy or green ocean strategy [73], (iii) Monopoly strategy or blue ocean strategy [74], (iv) Competitive strategy or red ocean strategy [75], and (v) Growth & prosperous strategy or while ocean strategy [76]. These strategies can be applied to service sector industries while managing their technology adaption to promote digital service innovations (table 16).

Table 16 : Strategies to be adopted for digital Service Innovation in Service Industries

S. No.	Service Industries	Explanation
1	Survival strategy (black ocean strategy) [71]	ICCT underlying technologies to be used for survival of the business. Some of the survival strategies in service industries are following business plan, time management in providing promised service, lobbying to promote business. Use of technology in the business.
2	Sustainability strategy (green ocean strategy) [72]	Study business environment and use ICCT underlying technologies for business sustainability.
3	Monopoly strategy (Blue ocean strategy) [73]	Study business model and use ICCT underlying technologies to radical changes in business model to kill the competition
4	Competitive strategy (Red ocean strategy) [74]	Study & compare service quality differentiation with competitors and use ICCT underlying technologies to differentiate the services quality
5	Growth & prosperous strategy (While ocean strategy)	Use ICCT underlying technologies completely to provide ideal service through Automation, through intelligence, through immediate supply of services ubiquitously, through lifetime

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[75]	support, and by maintaining all attributes of digital service.

Service industries primarily produces intangible products as service such as customer service, management service, advice & consultancy service, knowledge & decision suggestions service, design & creativity service, and services based on experience. Accordingly, there are many industries providing useful services to the users in the society. Some of the prominent service industries and the digital service innovation strategies suitable for such services using ICCT underlying technologies can be predicted.Table 17 depicts the various strategies suggested in different types of service industries to initiate and to manage digital services innovation.

Table 17: Strategies to be adopted for digital Service Innovation in Service Industries

S. No.	Service Industries	Major Strategies suitable for digital service innovation
1	Advertising industry	Survival strategy, Sustainability strategy
2	Education industry	Competitive strategy, Growth & prosperous strategy
3	E-Commerce industry	Monopoly strategy, Competitive strategy
4	Entertainment industry	Growth & prosperous strategy
5	Fashion industry	Growth & prosperous strategy
6	Financial services industry	Competitive strategy
7	Healthcare industry	Monopoly strategy Growth & prosperous strategy
8	Hospitality industry	Competitive strategy, Growth & prosperous strategy
9	Insurance industry	Monopoly strategy, Competitive strategy
10	IT services industry	Growth & prosperous strategy
11	Media industry	Survival strategy
12	Online services industry	Sustainability strategy
13	Public service industry	Monopoly strategy
14	Retail industry	Competitive strategy
15	Sports industry	Monopoly strategy
16	Tourism industry	Survival strategy, Sustainability strategy
17	Travel & Transport industry	Survival strategy, Sustainability strategy
18	Event management industry	Competitive strategy

In technology management, the organizations under various industries should identify suitable technology, plan to adopt, procure & implement, manage, and forecast effectively and efficiently to enhance productivity. For service innovation using ICCT, identifying suitable underlying technologies for a given industry, using them for improving the attributes of the services provided like method, quality, accuracy, timeliness, efficiency, and effectiveness are important. The service innovation process must consist of improving the quality attributes of digital servicesincludingSafe & Secure, Ubiquitous, Simple & Easy, Customizable, Flexibility, Adaptability, Reusability, and Innovability using adopted technology.

7. CONCLUSION :

The various underlying technologies of ICCT are in the tertiary industry sectorare used to analyse, and predict the suitable

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technologies and suitable strategies using predictive analysis model. The potential applications of ICCT as a strategic tool for survival, sustainability, differentiation, and development of various service sector industries are identified and listed. It is found that Information Communication and Computation Technology (ICCT) is having applications in many areas of society to solve problems of society as Universal general purpose technology of 21st century is one of the effective & efficient technologies for digital service innovation. By identifying, implementing, and managing these digital technologies in the service sector, industries can add value to their existing services, and develop new related services to get business benefits. Thus, the progress of ICCT underlying technologies and their abilities in digital service innovation are expected to contribute the larger objective of a technology to solve basic needs, advanced wants, and dreamy desires of Human beings as well as to adopt various strategies in organizations for surviving, sustainability, monopoly, differentiation, and development through growth & prosper.

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