

Arts, Research, Innovation and Society

Amina Omrane  
Gouranga Patra  
Sumona Datta *Editors*

# Digital Technologies for Smart Business, Economics and Education

Towards a Promising Future

 Springer

# **Arts, Research, Innovation and Society**

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Sumona Datta  
Editors

# Digital Technologies for Smart Business, Economics and Education

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# Preface

Transforming digitally countries, cities, and more specifically organizations, has become a continuous process that is based on the implementation of modern tools and recent technologies used for the betterment of social welfare, and business operations. Indeed, it enables not only to modernize and urbanize cities and areas via connected smart cities all over the world, but also to improve the growth and productivity of sectors like agriculture, retail business, manufacturing, services, etc.

Owing to the COVID-19 pandemic, the last few years have been very exciting in terms of usage and inclusion of digital devices and smart technologies by governments, corporations, and all kinds of organizations, which have quickly adapted to the global crisis. They have quickly reviewed their strategies and digitized their operational systems to find some solutions to their persistent problems, as well as to speed up their coping process for facing the new situation. Consequently, major transformations have been successfully observed in the areas of business, marketing, industry, higher education, and many other domains pertaining to their modus operandi. In this perspective, the present book, entitled *Digital Technologies for Smart Business, Economy and Education*, intends to present an extensive framework and a conclusive overview of numerous theories and applications based on novel and smart technologies that have been wisely incorporated in various strategic systems and operational processes. Different domains and sectors have been concerned purposely, that is education, business, and economy. The book proposes then to give a sound understanding about how digital technology-based strategies, which are adopted by organizations, are so useful and effective for them. It highlights how much digitalization serves to automatize systems of organizations, to enhance their performance, to increase their efficiency and growth, as well as to upgrade the whole sustainable development of countries worldwide.

The book contains 17 chapters written by contributors from different countries involving India, Croatia, and Tunisia. Those research works have been dedicated to address pertinent issues and provide interesting insights as stated above.

Chapter 1 entitled “How to Digitize the Human Resource Management in the Era of Industry 4.0?” gives a general overview and a theoretical scope on the main

digital and smart technologies that are used by human resource managers at this digital age, especially in the context of Industry 4.0.

Chapter 2 written on “Welfaristic Spectrum of Digital Economy: Theoretical Perspective and Empirical Evidences” focuses on the “welfaristic” side of digital economy. It shares some theoretical perspectives and empirical evidences to depict the contributions of digital economy to the improvement of wealth creation and economic welfare.

Chapter 3 entitled “Impediments to the Fourth Industrial Revolution in Africa” points out the role of the fourth industrial revolution and identifies the major challenges that some countries are facing to accomplish their digital transformation, especially in the African continent. It also highlights the multiple success factors and huge opportunities for the African continent’s digital revolution, as well as the numerous barriers impeding its advancement.

Chapter 4 on “Patterns of Misalignment between Performance and Exchange Rate Determination in a Globalized World” explains the ways to assess the pattern of misalignment of exchange rate with respect to the movement of GDP, interest rate, inflation, and current account balance in India, China, and the USA using fixed effect LSDV model.

Chapter 5 entitled “Going Smart or Smarting by Efforts: Digitising Life in Covid Times” focuses on the governmental initiatives undertaken to promote the applications of digital technologies in education and discusses their implications, specifically on accentuating the socioeconomic divide in the Indian society.

Chapter 6 on “Rethinking the Role of the Company’s Office and the Ways Employees Communicate: A Trend Accelerated by the Pandemic” explains the valuable advantages of remote work during the pandemic, specifically in Ukraine where proposals have been developed for the improvement of the company’s office design and employees’ communication methods and instruments during quarantine limitations and afterwards.

Chapter 7 entitled “Development and Validation of an Online Shopping Scale Adapted to Specific Cities of India” proposes to develop an online shopping scale that corresponds to several cities of India where young adults are intensive technology users.

Chapter 8 on “Are Startups and Small Businesses Ready to Adopt Digital Branding Strategies? A Critical Assessment” evaluates the current status of small businesses and startups regarding their digital branding adoption. The study proposes a framework adapted from the VAM model to understand the digital adoption intention of those companies. The outcome indicates that factors categorized under benefits, that is social media promotion, perceived utility, and perceived ROI, are affecting the perceived value of those enterprises in a positive manner.

Chapter 9 entitled “Perceived Service Quality of Mobile Providers through the Lens of Indian Young Adults” is a comparative study that assesses perceptions of young adults of West Bengal and those of Chhattisgarh (in India), regarding the service quality of their mobile service providers, including *respectively* Airtel, BSNL, Idea, Reliance Jio, Vodafone, and Tata Docomo.

Chapter 10 on “Contextualising Intersections Between Digitalisation and Education: Post-pandemic Psychosocial Insights from Indian Classrooms” focuses on the mental health and neurocognitive consequences and implications of digitizing education in light of the digital transformation.

Chapter 11 entitled “Online Training in Present-Day Conditions: Opportunities and Prospects” highlights the prospects and opportunities of online training during those last years marked by the shortage of physical contact among trainees. It outlines the drivers of the online training development based on a wider use of AI; chatbots; augmented, virtual, and mixed reality; automated machine learning machines; and gamification.

Chapter 12 on “Effects of Evolving Applications of IOT in the Education Sector”

Chapter 13 entitled “Effects of Gamified learning on Academic Achievements: Does Gender Matter?” demonstrates the important role of gamification as a learning strategy and its associated game-based tools in motivating and facilitating learning among students, to prepare them for future employment.

Chapter 14 on “Students’ Perception of ICT Use in Higher Secondary School Students: An Exploratory Factor Analysis Approach” explores students’ perceptions regarding information and communication technologies’ effectiveness and usefulness for their learning development. The study offers accordingly some recommendations that might promote the holistic development of students in terms of learning effectiveness, innovation, and engagement.

Chapter 15 entitled “College Management System and Ubiquitous Technologies in Education” inspects the implementation of “WonderVersity”, an Android Application dedicated to promote a smart and fluid educational method in the college management system of India.

Chapter 16 on “A Framework for Transforming the Indian Education System Through Smart Learning” examines the framework of information and communication technologies in education and their impact on transforming the Indian education system through smart learning. The study also puts light on few important initiatives taken by Indian Government and other organizations towards holistic development of Indian education system by bringing sophistication in the field of education.

Chapter 17 entitled “Information and Communication Technology Tools in Language Learning Classroom: Developing Metacognitive Skills and Its Social Ramifications” discusses the specific applications of digital technologies in developing the metacognitive skills of passive and non-interactive learners with English as a second language.

Finally, the authors hope that the chapters included in this compilation will provide the readership with valuable insights and meaningful guidelines about the practices and applications of digital technology in education, business, and economy.

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# Chapter 1

## How to Digitize the Human Resource Management in the Era of Industry 4.0?



Amina Omrane, Mohsen Akbari, and Gouranga Patra

**Abstract** In a current dynamic and VUCA globalized environment, the management of human resource departments is changing worldwide. Its functional role is no more limited only to recruiting and selecting employees, but it encompasses henceforth the development of a skillful human resource capital for the organization. In this perspective, numerous firms have changed their traditional human resource processes to digitalized ones, thanks to the implementation of innovative and digital technologies. In this regard, the present study aims to explore the different innovative technologies that have emerged in this digital age marked by Industry 4.0. It also examines the role played by those technologies in digitizing the HR systems of organizations, to help them reduce miscellaneous costs, increase their efficiency, and gain competitive advantages into the market.

**Keywords** Digitalization · Human resource management · Human resource innovations · Industry 4.0 · Digital technologies

## 1 Introduction

The process of managing human resources is changing worldwide. Indeed, the functional sphere of human resource operations is no more limited to recruiting and selecting talent, but it includes also the development of a strong human resource capital for organizations (Arthur, 1994). Such a process is becoming more complex in this current volatile, uncertain, complex and ambiguous, i.e., VUCA business

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world (Omrane et al., 2020). Global development, technological advancements, and greater dependence on data analytics have significantly accelerated markets' disruption. Such changes have invited managers and employers to quickly adapt and transform their organizations by leveraging best opportunities and developing new capabilities, so that they could maintain competitive advantages (Barney, 1991; Omrane, 2020). Besides, the digital transformation that occurred those last years with the emergence of digital and SMAC technologies (including social media, mobile applications, analytics, and cloud) has shifted strategic plannings as well as operational processes of organizations (Brikinshaw & Mol, 2006). For this purpose, many firms have been called to review their strategies as well as their internal practices (Cooke & Saini, 2010). For instance, many of them have implemented a new way of organizing their manufacturing resources, switching them to the "industry 4.0," which is also known as "the future industry" or "the fourth industrial revolution" (Neugebauer et al., 2016). This new industry is defined as the coming together of the virtual world, digital management (operations, finance, and marketing), and real-world products and objects. It aims at attracting consumers with unique and personalized products while maintaining profits despite low manufacturing quantities. Such a fourth industrial revolution has an impact on various areas of modern societies. It has obvious implications, not only economically but also socially, politically, and environmentally. It raises the question of the employment of millions of people worldwide. For this reason, it is necessary to consider the support of current employees and the training of future workers to highlight the role of people and shift into this digital arena.

On the other hand, the viability and sustainability of each organization depend on the talent pool of employers who should take into account the recent needs and aspirations of their workers, especially those ones belonging to Generations Y, Z, Millennials, and Alpha (Kagermann, 2015; Horváth & Szabó, 2019). Those new generations' employees, likewise consumers, are rapidly trying to catch up with the technological changes through smartphones and PCs leveraging business Apps and social media. Consequently, their capability of using the technology and platforms is getting enhanced day by day (Sakellaridis & Stiakakis, 2011; Götz & Jankowska, 2020). Accordingly, employers have to redefine their organizational human capital management practices by implementing digital innovations and digitalizing their systems for smooth and flawless human resource processes. For instance, SMAC technologies could help them to afford an effective and rapid talent hiring, selection, and retention (Demartini et al., 2018; Cichosz et al., 2020).

Consequently, the goal of this present research is to examine the positive effects of new digital technologies in modernizing the human resource management processes of organizations in this digital age. Furthermore, it helps emphasize the role of human resource managers in coping with the rapid growth of changes occurred in such a globalized world.

## **2 Digital Transformation: Which Associated Technologies in the Era of the Industry 4.0?**

### ***2.1 History of the Industrial Revolution 4.0***

“Industry 4.0” refers to the networked integration of all domains involved in the value creation process. In fact, visions have already advanced in areas, such as production and policy, but not in the development of products and services related to the products (Kagermann et al., 2013).

On the other hand, since the use and development of digital factories are transforming manufacturing, businesses find themselves in need for employees with diverse qualifications and skills in order to implement and exploit new technologies.

In fact, businesses have made significant investments to ensure their conversion to Industry 4.0, while policymakers have begun to align public policies to facilitate change, as evidenced by the numerous action plans and national strategies adopted by many countries. However, the problem of transitioning to Industry 4.0 has been treated primarily through technical means, putting the transformation of the company’s technical product model to the test. Moreover, these ramifications for employment and work skills are significant.

Therefore, it is necessary to learn about the many stages of the industrial revolution in order to better understand the industrial revolution 4.0.

#### **Industry 1.0 or Mechanization**

This industrial revolution is the consequence of the scientific and technological advances of the time. Moreover, the first industrial revolution came to existence in 1784 because of the invention of the first mechanized system through the creation of the steam engine and the electric weaving looms, which greatly increased the production capacity. This first industrial revolution focused mainly on mechanization, steam power, and the weaving craft (Rüßmann et al., 2015).

#### **Industry 2.0**

The second industrial revolution occurred about the year 1870. It was based on the use of alternative energy sources such as petroleum, natural gas, and electricity (Neugebauer et al., 2016). Indeed, the establishment of a mass production and assembly line was accompanied by the introduction of new modes of transportation and communication, such as the airplane, automobile, and telephone. Furthermore, by the mid-nineteenth century, electricity, assembly lines, fordism (or business development, and labor division) made mass production standardized (Thoben et al., 2017).

#### **Industry 3.0 or Digitalization**

On the other hand, the third industrial revolution began in 1969 and saw the rise of automation, industrial computing, and electronic technology (Rennung et al., 2016). This third industrial revolution was also accompanied by the widespread use of

microprocessor computers and the Internet, which appeals many businesses to automate and control their manufacturing processes using technologies, such as “PLC/PID” (Sipsas et al., 2016).

### **Industry 4.0 (i.e., The Fourth Industrial Revolution)**

The fourth industrial revolution corresponds to the era in which we are living. It is based on the cyber-physical revolution of the Internet of Things (IOT) of networks, BIG DATA, cloud computing, the “RFID,” virtual assistants, quantitative computing, artificial intelligence (Varghese & Tandur, 2014). Furthermore, all of these technologies, as well as others, provide a complete interconnection across all manufacturing centers, allowing for optimal decision-making in a fraction of a second under the control of a central computer (Waidner & Kasper, 2016).

## ***2.2 The Principles of Industry 4.0***

According to Hermann et al. (2016), Industry 4.0 is based essentially on the following four principles:

### **2.2.1 Interconnectivity**

Industry 4.0 connects all devices, tools, and machines. Indeed, it enables its users/operators to extract, share, and analyze real-time data in both internal and external industry processes, based on customer feedback and market conditions. As a result, interconnection refers to the ability of machines, devices, sensors, and people to connect and communicate with one another across the Internet of Things (IOT) or the Internet of people (IOP) (Lee et al., 2014).

### **2.2.2 Information Transparency**

Transparency offered by Industry 4.0 provides operators with massive amounts of the useful information they may require to make the appropriate decisions. Furthermore, interconnectivity enables them to collect massive amounts of data and information at all stages of the manufacturing process, facilitating innovation and improving productivity (Bratukhin & Sauter, 2011).

### **2.2.3 Technical Aid**

This assistance is ensured on two levels: firstly, by improving the ability of the physical system to physically support operators while performing unpleasant, time-consuming, or dangerous tasks; and secondly, by making the systems support them

by providing them with all the information needed to resolve problems and make the best decisions (Lu, 2017).

#### **2.2.4 Decentralized Decisions**

It is the capacity of physical systems to make their own decisions and carry out autonomously their tasks as such tasks are delegated only to higher levels in exceptional circumstances (Sasson & Johnson, 2016).

### ***2.3 Digital Technologies/Tools Associated to Digital Transformation***

Big Data & Analytics, Internet of Things, COBOTS, Cloud, Artificial intelligence, and Augmented reality represent the main technologies that have emerged in association with the digital industrial transformation.

#### **2.3.1 Big Data and Analytics**

Data are regarded as the first matter of the twenty-first century. In fact, the quality of data available in organizations appears to be nearly doubling every year, despite the fact that more than 50 billion devices were connected globally by 2020 (Witkowski, 2017). Big data analytics is then more than a technology, which serves to inform, manage, clarify, and lead to the determination of organizational strategies, marketing actions, and human resource trends. Furthermore, big data analysis aims to treat, clean, transform, and model large amounts of data, with the diversity of sources and formats allowing the creation of meaning, knowledge, and solutions to support the ultimate decision-making (Bagheri et al., 2015; Lee et al., 2013; Xu & Hua, 2017).

On the other hand, BIG DATA and analytical techniques help to optimize the quality of the production, increase the efficiency, improve the quality of the equipment, and above all reach unequal levels of productivity (Santos et al., 2017). It is finally essential to mention that big data networks and the related analytical capacities seem to be more adequate to the characteristics of big organizations and give then an economic dimension (Bloem et al., 2013; Elhoseny et al., 2018).

#### **2.3.2 Industrial Internet of Things (IOT)**

Internet is the product of a gradual evolution initially characterized by Web 2.0 through which a two-way communication can take place. It refers to the traditional use of social networks, blogs, and other Wikis where interaction, collaboration, and

participation are effectively possible (WhitMore et al., 2014). Web 3.0, however, offers an online content which is understandable by machines. De facto, it enables those machines to navigate without human mediation on search engines in order to process, assimilate, and share a standardized informational content (Atzori et al., 2010).

Furthermore, Internet of Things makes these devices generate, exchange, and consume data without any human intervention (Witkowski, 2017). In fact, it is a technology that equips machines with machine-to-machine (M2M) communication capability.

On the other hand, Internet of services enables operators to use software, middleware, algorithms, and data embedded in industrial products and systems to predict and analyze the product performance and degradation in order to optimally manage the service needs associated with those products (Lui & Xu, 2017).

Therefore, Internet of Things and Services helps with the integration of networked products that are connected directly to Internet and which fundamentally break with the previously used radio frequency identification (RFID), and tracks a product only when it is present in the supply and production chain (Whitmore et al., 2014).

### 2.3.3 COBOTS

Cobaltics lies in the addition of the terms “robotics” and “cooperation” and “designates the real, direct or teleoperated interaction between a human operator and a robotic system” (Gimélec, 2019). According to Danjou et al. (2020), this new kind of collaborative robots makes it possible to assist humans in their work in a more flexible and safe way. Indeed, the humanoids of robot arms or robotic practices enable operators to be connected to the production lines as well as to the administrative tasks via an integrated management software (Faller & Feldmuler, 2015).

This new technology, which seems to promise a significant growth of the productivity, constitutes a way of improving the quality of life at work (Gimélec, 2019).

### 2.3.4 The Cloud

The cloud offers a virtual digital space, as one of the on-demand IT services with more reliability, flexibility, and dispensability without any relative payment on consumption (Terrissa et al., 2016; Xu & Hua, 2017). This technology enables companies to reduce drastically their costs by outsourcing the management of their IT infrastructure (Elhoseny et al., 2018; Khan et al., 2017; Ren et al., 2015). Moreover, it reduces the financial risks associated with the infrastructure investments. It is a particularly suitable solution for managing the amounts of data emitted by cyber-physical systems, generating an effective data analysis without any location and time constraints. That is why infrastructures are becoming increasingly built around



the cloud through which businesses and users are able to access connected networks, regardless of their location (Marilungo et al., 2017).

### 2.3.5 Artificial Intelligence

Synthesizing huge amounts of data is today possible via dashboards and graphs. However, how to exploit all this data to deduce trends and make predictions over time could be a difficult task: This is what artificial intelligence offers to the industry (Lee & Yoon, 2021). In this perspective, despite the experiments and applications proposed by Google, the platforms suggested by professionals are still not very intelligent. Fortunately, the methods associated with deep learning enable an automatic learning with a high level of abstraction linked to the observation of data (Dutra & Silva, 2016). It makes it possible to give a certain meaning to data that can, for example, allow artificial intelligence to optimize a production line or even to predict the risks of slowdown or failure. Actually, artificial intelligence involves objects that can collect large amounts of data and interferes, not only in their analysis, but also for any related automated decision-making processes (Liu & Fisher, 2021). Therefore, these intelligent functions will be able to intervene effectively in systems such as RES or Manufacturing execution system, ERP (enterprise resource planning), Big data databases, and other supervision platforms, etc.

### 2.3.6 Augmented Reality and Virtual Reality

Augmented reality is a technique that enables to visualize live objects or any physical environment in an enhanced way via a digital medium (glasses, tablets, smartphones). This technology can play many roles in this digital age and may bring a real benefit to the production line of the Industry 4.0 (Landherr et al., 2016; Malý et al., 2016; Kerpen et al., 2016).

On the other hand, virtual reality proposes to its users to immerse in a virtual or semi-virtual world (Paelke, 2014). The whole of the visualized “world” is virtual and users can interact with the elements that compose it. As this technology proposes a virtual world, explanations can be proposed in text, audio, or even with a virtual assistant for the most advanced cases.

In the industrial environment, this technology brings for example a new methodology to train its teams: to interact with the machines of the production line, to learn how to react in case of malfunction, and to apprehend different use cases (Haleem & Javaid, 2019; Da Silveira et al., 2019). Therefore, the use cases of this technology are limitless, but virtual reality will be undoubtedly so present in the industry.

### 3 Human Resource Management (HRM): Essence, Roles, and Functions' Digitalization

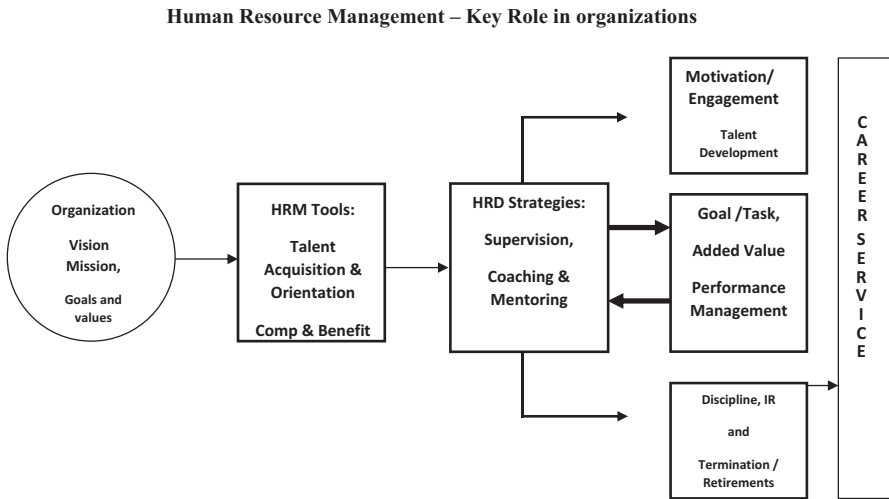
#### 3.1 HRM Essence and Roles

The essence of HRM is the ability to build and sustain a comparative advantage by leveraging the organization's strengths to take advantage of emerging opportunities in the environment. More precisely, human resource management consists of a set of tools which help organizations anticipate and respond to threats and opportunities in their external environment (Ulrich et al., 2013; Demartini et al., 2018; Horváth & Szabó, 2019). For this purpose, HRM requires that organizational managers and leaders continuously assess external threats and opportunities arising from political, economic, technological, and socio-cultural trends. It also requires an understanding of competitive markets, especially in the appropriate sector or industry in which organizations compete for resources, visibility, prestige, and credibility (Nivlouei, 2014; Li, 2018). Management places special demands on organizational leaders, requiring them to have an external as well as internal perspective on their organizations. HRM also requires leaders to develop human resource strategies (recruitment, placement, assessment, and development) that contribute to the achievement of organizations' strategic goals (Nivlouei, 2014; Marler et al., 2016; Li, 2018).

Human resource management, or HRM as it is referred to, is the process used by organizations to obtain, place, manage, and develop the people and talents needed by them to achieve their mission (Selmer & Chiu, 2004; Sakellariadis & Stiakakis, 2011; Bajer, 2017). Indeed, the success or failure of every organization will depend in a large measure on its ability to attract, develop, and hold committed people (Johnson et al., 2016). In this perspective, Peter Drucker suggests that managers should be asking three important questions about their organizations' human resources.

- Are we attracting people we are willing to entrust this organization to?
- Are we developing them so that they are going to be better than our competitors are?
- Are we holding them, inspiring them, recognizing them?
- Are we, in other words, building our talents for tomorrow, i.e., on the appropriate people practice decisions, or are we settling for the convenience and the easy today?

## Human Resource Management—Key Role in Organizations



Source: Armstrong (2009)

### 3.2 HRM Functions: How to Develop and Digitize Them?

Transforming digitally HRM departments inside organizations enable HR managers to find some solutions to their persistent problems, to automatize their functions, to speed up their services, as well as to save their expenses (Poba-Nzaou et al., 2020). In fact, employees could benefit from the use of self-service Apps which have simplified the HR processes for employees and how they interact with their organization (e.g., TCS UX Apps for leave and Timesheet entry). On the other hand, the implementation of digital forms and approvals moving through HR Information Systems makes it possible for HR processes to go paperless.

#### 3.2.1 Talent Acquisition and Orientation, Sourcing, Recruitment, and Induction

For their recruitment politics, HR managers could resort to online hiring by leveraging social media platforms such as LinkedIn and Facebook. For instance, Indian IT and ITeS major TCS use its popular Coding competition and Computing Platform Code Vita for its digital hiring. Besides, in many industrial Indian companies, procedures are established for recruitment to fill vacancies, for selecting the best qualified persons according to valid criteria, and for orienting new employees and volunteers—the employment of SMAC technologies (i.e., by using Social Media

Analytics for insights into right fit and, Cloud computing for managing recruitment database). Teams platforms are also used for online test and conduct of remote interviewing and induction processes (Sankar & Yogan, 2021).

In IT sectors for instance, large-scale talent acquisition plays a major role in ensuring business scalability and continuity of human resources. That is why, many IT firms and start-ups resort to digital/smart hiring processes by making it possible for candidates to fill up online, via appropriate applications and flow, their identity, their personal and cultural attributes, as well as their technical skills. The flow is generally based on online rounds of written tests and interviews which could be planned by the corresponding managerial/HR panelists. Those ones would be then responsible for selecting or rejecting the target candidates according to the fit of their academic, professional, and social knowledge to the job positions' expectancies.

Consequently, it appears that digitized recruitment processes, in both offline and online hiring modes, help fulfill the recruitment and selection goals of organizations with speed and accuracy. It also supports them in sustaining and developing their competitive advantages.

### **3.2.2 Compensation and Benefits**

Job descriptions could be created through the use of appropriate platforms (e.g., Resources Management Group tools in Ultimatix for IT & ITeS Major TCS). Those ones are prepared for all open positions and a pay band is assigned to each job based on their relative worth to the organization and to similar jobs in the job market. A package of employment benefits is also made available according to the current practices. Besides, all leaves and advances are applied and approved and a permanent record is accordingly maintained online (Zehir et al., 2020).

On the other hand, employee welfare and wellness are driven online by linking the organizational platforms to the digital portals of the corresponding service providers (e.g., the Medical Assistance Portal, Medical Expense Reimbursement, and cashless admission of employees).

### **3.2.3 Employee Motivation and Morale/Talent Engagement**

To accompany and support the changes associated to any digital HR Transformation and innovations, it is essential to keep up an organizational morale and motivation. For this purpose, managers are invited to cultivate a millennial-safe, friendly, and diversity culture that is based on a set of cultural diversity principles and habits amongst baby-boomers, Gen X, Gen Y, and millennial at workplace. For example, People Analytics and Predictive Analytics, implemented via Intelligent Urban Exchange Platforms, have widely helped companies to tracking the associate composite risk factors for ready deployment while keeping the work place safe during COVID-19 pandemic. Predictive analytics can estimate the time period till which he

associates health condition shall remain critical allowing quarantine leave for covid positives and their direct contacts (Manuti & de Palma, 2018).

Additionally, adopting engagement strategies by HR managers could serve to encourage creative initiatives and provide intrinsic rewards for their employees. For instance, during the post-Covid pandemic, such recognition activities moved to digital platforms and talent commitment takes place through organizations' intranet and it is often driven by closed community social platforms (e.g., KNOME for IT and ITeS major TCS associates/TCSers; GEMS portal within Ultimatrix for TCS).

### **3.2.4 Talent Performance Management**

Managers are called upon to guide their subordinates/collaborators and support them in doing their work by varying their styles of management and motivating each employee or business associate. Accordingly, goals are set with clear achievement parameters and appraisal of performance takes place bi-annually for announcing the annual rating and performance banding (Slovensky & Ross 2019). Specific digital applications and sub-modules inside the HR information system could then be used for the purpose of performance management (e.g., Global SPEED module inside the HRIS for TCS). In this perspective, we can cite the role of gamification (via Application of game dynamics) in ensuring a better engagement. For example, Deloitte is accustomed to use gamified dashboards for driving efficiency and promoting friendly competition at work (Brettel et al. 2014; Gorecky et al. 2014).

### **3.2.5 Talent Development, Via Training, Coaching, and Mentoring**

Training is recognized as an important strategy that is adopted by individuals to improve their personal and professional performance and development. It is also used to bridge the existing gaps between competency and performance of employees. Such shortfalls result essentially from the lack of workers' knowledge or skills and could be reduced and filled via planned performance improvements. For this purpose, IT managers can implement digital platforms of Integrated Competency and Learning Management Systems in order to upgrade talent development, help employees update their digital profiles, and enable them to seize good opportunities of job rotation and internal fulfillment. Furthermore, many online digital platforms offer interesting links for MOOCs that are useful for continuous learning and talent development of workers, making them ready to meet future challenges. On the other hand, several Cloud-based platforms and technologies could be leveraged by employers for scaling up training delivery and offering a borderless training to their internal collaborators through Zoom/MS Teams. For instance, Walmart has developed their training system by leveraging Virtual and augmented reality to train its employees how to prepare for black Friday Sale.

## 4 Transition to Industry 4.0: Associated Technologies and HRM Practices

Digital Transformation and HR Innovations, along with demographic changes occurred via the emergence of next Employees in Gen Y, Gen Z, and Millennials, are redefining the organizational human capital management practices (Zehir et al., 2020). The viability and sustainability of the organization depend then on its digitalization as well as the attraction and retention of skillful talent pool of workers (Rübmann et al., 2015).

### 4.1 *Role of Digital and Innovative Technologies in Modernizing Human Resource Management Systems*

The increasing presence of Generation Y in the workforce presents many new challenges for employers and is causing many businesses to re-think their working practices (Kapoor & Solomon, 2011). Moreover, failure to effectively attract and engage these new workers will significantly hamper organizations' competitiveness in the long run (Tulgan & Martin, 2001). Another factor that differentiates GenY is that they have grown up in the age of information technology and social media which environment has shaped the way they view the world, including their expectations of the workplace (Harrison, 2010; Kapoor & Solomon, 2011).

On the other hand, digital technologies are increasingly involving the HR department and other business units of organizations in order to improve their performance and generate positive outcomes through the strategic use of technology inside them (Oxford Economies, 2012). However, the Information Technology "IT" department still play an important role in doing so by serving to monopolize the digital-analytical expertise that becomes necessary to guide HR management.

Such a department has to deal with more and more complex data. In this line of thoughts, some researchers pointed out that the analysis of individual data will make it possible to accurately assess the behaviors, activities, and more generally the performance of employees at workplace (Betchoo, 2016; Yano, 2017).

Researchers like Sivathanu and Pillai (2018) have established a typology of a HR function that takes into account the impact of descriptive technologies. They developed a concept that is similar to a system of resources 4.0 on "Smart Human Resources 4.0 (SHR 4.0)".

In theory, it would be possible to implement the most appropriate technologies and shape the organizational culture in such a way that facilitates the management of employees whose multigenerational characteristics make their operationalization more complex. This could be particularly possible through the diversity of expectations and profiles of the organizational workforce (HESS, 2017). In this perspective, transforming the HR function into a human development function is required even if technological improvement remains at the heart of the "4.0" transition. Indeed, such a transformation would make it possible to move the current focal point of

consideration inside organizations. It implies that those ones have to migrate from a vision of “human resource” as something that is exploited, to a “human capital” perspective as something that we develop and in which we invest human capital designating “the set of knowledge, inhabited, faculties, skills and qualifications that end the productive capacity of the individual” (Mincer, 1958). Therefore, investment in human capital leads to the development of a plurality of these attributes and is mainly a result of training, highlighting the importance of understanding how digital technologies will impact, shape, or revolutionize HR practices.

## ***4.2 New HR Practices and Challenges Faced by HR Managers in the Era of Industry 4.0***

The digital economy implies new business models, especially a renewed management, which involves major issues for employment and work.

Industry 4.0 has deeply transformed not only the technical production model of companies, but also the whole world of work (Gril et al., 2017). HR managers have also a leadership role to play to enable their organizations to achieve their transition to the 4.0 mode. They have to cultivate the appropriate digital culture, to adjust their practices and skills, as well as to review their goals and roles so that they remain relevant for the company (Poba-Nzaou et al., 2020).

Furthermore, Industry 4.0 implies the existence of a new position with an Innovation Department. Thus, the impact of the changes in data and flows will be so powerful that it requires a special section to manage them. Software packages will help the HRD to interact efficiently with this other unit.

Within Industry 4.0, the company is appealed to digitalize gradually its tools and its employees are called to use mobile solutions to manage their work. HR managers and executives will need to collect business information and cannot do so without using innovative tools. They are invited to take into account into their HR strategy that innovation might have an essential impact. BIG DATA will be the first lever to be mastered as it constitutes the set of data that feeds the HRIS. From the smallest information to the most important one, every detail should be considered.

The objective is to be able to better interact with the candidates, to make a better work of sourcing in recruitment. Internally, the usefulness of BIG DATA allows to modernize the practices.

Machine learning will be also an important area that professionals cannot manage without these modern programs.

### **4.2.1 Skills and Human Capital Management**

Industry 4.0 is undoubtedly bringing major changes for organizations even if it represents an evolutionary process whose dissemination is intended to be gradual rather than as a proven phenomenon. The challenge for HR managers is to develop

strategies, implement projects, programs, and processes that can support this new work organization and develop a social-relational system that meets the 4.0 requirements.

In concrete words, its implementation into firms requires not only a technical innovation, but also social transformations. Indeed, some activities will disappear while new tasks and skills will emerge. According to several studies, some jobs will become obsolete or take new forms while others will be created, requiring highly skilled persons (Kohler & Weisz, 2016). It is then legitimate to ask what are the new jobs and skills that are required by 4.0.

#### **4.2.2 Organizational Development**

Industry 4.0 refers to the creation of a more flexible work organization in terms of time and location, as well as more digitized operations and tasks within the hierarchy (Munclier Kreis, 2013). As a consequence, there will be a new human-machine interface the characteristics of which are still unknown today (Gomez, et al., 2020), despite the fact that the adopted automation scenario appears to be imposed in some factories: The operators routinely come in to correct the assembly faults on the robot lines, which could bring the whole production process to a halt for precious minutes (Kohler & Weisz, 2016, p. 75). In fact, these changes involve real-time communication and cooperation between humans and smart machines as well as increased problem-solving skills.

As a result, employees will have to deal with an increasing number of data and information systems. In this regard, some people see a new work organization emerging in several companies, or they see highly qualified employees working in a group that is self-regulating through informal social processes and collaboration (Hirsch-Kreinsen, 2014).

## **5 Conclusion**

To conclude, with 4.0 transformations, the HR executives may have a better understanding of business issues and the strategic impact of changes without having to participate in the change process. Furthermore, HR managers could be directly involved in the transformation by adapting RH practices and tools to new digital trends, enabling them to be regarded as active actors rather than as simple participants in the corresponding changes.

On the other hand, the transformations of Industry 4.0 on the workforce enable researchers to test the hypothesis that the more advanced an organization is in Industry 4.0, the more the workforce's skills and profits evolve.



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# Chapter 2

## Welfaristic Spectrum of Digital Economy: Theoretical Perspective and Empirical Evidences



**Brajesh Kumar**

**Abstract** Welfare in simple term is distributional equity over the growing wealth of the nation. Therefore, welfare joins two things together – growing wealth in an economy and its equitable distribution in tandem. Anything that contributes towards welfare is defined as welfaristic. The challenge that lies of being welfaristic is most of the time due to inherited trade-off between growth and equitable distribution. Scholars’ assumption for welfare is divided into two flanks: trickle down theorists those who believe in power of free market forces to achieve the same while interventionists deny this natural and timely trickle down of growth to the masses and suggest schemes to make wider and equitable participation of masses in the process of creation of wealth so that gain or loss is equitably shared by the larger audience. Digital economy is a new Avtar (incarnations) of wealth creation and has definite impact on creation of wealth along with distributional equity based on the characteristics of participation of masses in wealth creation. This paper focuses on the welfaristic spectrum of digital economy. It will consist of theoretical perspective and empirical evidences in identifying this spectrum which will be useful for the policymakers to regulate this sunrise industry in a manner which ensure growth of this industry with inclusivity and welfaristic flavour.

**Keywords** Digital economy · Welfare · Creation of wealth · Distributional equity · Welfarist spectrum

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## 1 Introduction

Information and communication technology-enabled economy is defined as digital economy. Major digital technologies are as follows: blockchain technologies, three-dimensional printing, Internet of Things, 5G broadband, cloud computing, automation and robotics, artificial intelligence, and data analytics. Basic economic and business activities and facilitating services are organised and managed on this platform. Don Tapscott first coined the term in his bestselling book *the Digital Economy: Promise and peril in the Age of Networked Intelligence* (Pratt & Cook, 2017). It is about using technology of acquiring, storing, analysing, and distributing information and ICT-enabled facilities to execute required tasks in better and faster ways. Digital economy is indeed shaping economic and business activities in a way that ensures higher productivity and therefore better financial results. Actually, it has helped to turn consumers into a group which promotes customer loyalty. Further competition has been enhanced due to wider visibility to both the competitors and consumers. It has also promoted time and procedural efficiency.

As per UNCTAD (2019), digitisation facilitates the businesses and the economy in the following manner: 1. captures both high level of knowledge and the ability to apply knowledge towards particular goals, 2. given the knowledge about its web visitors, the e-commerce platform can adjust prices, 3. targeted advertising to increase sales information applied to answer “why” questions, 4. profile data used and contextualised as answers to “who, what, where, when” questions, 5. data indicate who is looking at what web shop item from which location at what time and for how long, 6. discrete, objective facts about phenomena, often obtained from sensors, experiments, or surveys, 7. E-commerce platform registers website visits and user activity, and 8. DATA leads to INFORMATION, information leads to KNOWLEDGE, and knowledge finds WISDOM. And we can add to it that wisdom is the most fundamental ingredient for any meaningful action including economic or business activities.

## 2 Welfare Enroots of Digital Economy

Efficient allocation of resources, comprehensive monitoring of production process, a closure look at marketing, round-the-clock customer relationship, and real-time funding of business activities have really promoted wealth creation in many economies of the world. However, the question of distributional equity is still a long-standing issue even in the present time, sometimes called, fourth industrial revolution. Since trickle-down theory of distributional efficiency has not yet proven its worth beyond any doubt; digital economy’s advocacy on the basis of allocation and production efficiency is not complete. Its distributional efficiency and challenges on its path need to be examined astutely. Nonetheless, it is also true that evidences have emerged in recent times that give some assurance in this regard.

It is shown that digitalisation has improved the delivery of government support and public services. It is further claimed that it gave impetus to better governance. For example, universal identifier in Aadhaar helped the government target its welfare efforts and save crores of rupees. It is quite encouraging to see that improved delivery of welfare expenditure is expected to have a multiplier effect on economic growth and welfare (Sharma, 2022). Ability of digital economy to render growth is acceptable against the supporting evidences; it is still doubtful to expect digital revolution as welfare inducing development for the masses both as a consumer or as a supplier of factors of production. It is said that while digitalisation of things is transforming both our business and personal lives, there is little information currently available that helps us understand its economic, social, and environmental impacts (Lorangeramanda & Tebrake, 2019). Digitalisation indeed can make economic or business processes manageable at easier terms. It equips common consumers to acquire needful information and use it at their service in alacritous manner. Comparatively, it costs lesser and brings transparency and accountability in dealing with business or economic demands. It is said that entitlements can be easily cross-checked through different database. Also, response times can be reduced that can help those who are in sudden or urgent need. It is worth noting that the research findings have confirmed positive impact of the digitalisation in the developed countries. It is due to a high level of digital inclusivity, digital literacy, and trust. On the other side of the spectrum of reality, we find contrary results in the developing countries due to a low level of state involvement in digitalisation and non-flexible institutional environment (Zvereva et al., 2019).

To make welfare a reality for the masses, it requires flawless identification of beneficiaries, transparent delivery mechanism, and real-time round-the-clock monitoring of the process and interactive beneficiary–benefactor relationship. Digital platform provides all the three and this motivates policymakers. However, an objective criterion for judging imperatives of digital economy for a welfare state endeavour is offered by Jones and Klenow based on the expected utility of consumption and leisure for a representative citizen up to his or her final life years (Jones & Klenow, 2016). It reads between the line that ultimate gain of digitalisation of economy for consumers is to have a promise of better consumption potential and span of leisure and the same may be a referent for promotion of digital economy. Other dimensions of technology diffusion fostering welfare flares are also reported. For example (1) income growth linked to technology diffusion, (2) the inequality of income arising from complementary–substitution polarisation of the workforce with technologies, (3) the risk of unemployment (i.e. forced leisure) arising from mostly technological automation and labour market frictions, (4) leisure deployment, especially linked to home automation, (5) improvement or pressure on health and longevity via new technological progress, and finally (6) the evolution of consumption relative to income as result of a technological shift in economy.

How did we fare on the tall claims made on our achievements thereof? It is reported that income and productivity growth is evident in various economies of the world in return of their devoted drive in favour of digitisation and automation. But inequality also rose higher during the same period. Disruptive technologies

promoted unemployment among less resourceful labour force in terms of education and bargaining power. Constructive destruction failed to promote reconstruction in favour of replaced workforce. It is a focal point in the debate on distribution of productivity gain of digitalisation among the masses. Whether the distribution is beneficial to the society as a whole or concentrated for few is the underlying concern. Right now, the most pertinent question is whether the market can ensure a just distribution of the automation-related benefits or whether they will accrue only to a small group of wealthy capital owners. There is a history of rising inequality of income in most of the economies of the world in past, still there is no such sign found in recent times, despite recent infusion of digitalisation and automation of economies, that signals rising inequality in income distribution (Sebastian, 2019).

Werner and Rinne state digital challenges for welfare as potential digital divide and social inequalities, the challenge of skilling workforce to combat disruptive technologies and dealing with “Firm” functioning as virtual companies on cloud technology (Eichhorst & Rinne, 2017).

PWC finds the other major welfare risks of digitalisation on economies and the society: 1. data abuse, loss of privacy and security consumers and workers, 2. competition abuse, 3. mental health impacts of viewing harmful/ inappropriate content – viewed by children (and others), 4. distorted decision-making (for example, misleading content, fake reviews, biased recommendations), 5. harassment, cyber bullying, and cyber stalking, 6. discrimination and opacity, 7. reduced media pluralism, 8. disinformation, 9. misuse/abuse of personal data, 10. distorted consumption decisions, 11. unfair price personalisation, 12. distorted consumption decisions, 13. harmful business practices, 14. poorer employment conditions, 15. welfare impacts of lower human interaction/empathy, and 16. loss of opportunities for those without digital skill sets.

Above is an account of major debates centred on the central theme of welfare in the era of digitalisation of our economy. It is equally important to have a survey of evidences supporting or refuting opinion and conviction sprawled over the debates in recent times.

1. *Digital divide* is a phenomenon which expresses the inequity in distribution of ownership and use of digital technology for consumption or business purposes. It results into unequal income generation and its distribution. Opportunities for creating wealth and its sharing falls skewed among the world population. It promotes monopolies and dominance in economic, social, and political sphere. Thus, welfare of the people is challenged or compromised. For example, we can appreciate the following evidences compiled by UNCTAD in the year 2019:
  - (a) 50% of Internet things are used by the USA and China
  - (b) 76% of mobile technology mix would be working in the hand of North America and Europe by 2025
  - (c) More than 60% of cloud traffic controlled by North America and Northern Europe



- (d) 50% of exabytes of Internet will be consumed by America and Europe and 80% will be by consumers
- (e) Out of 25 trillion-dollar E-commerce businesses, America, Japan, Germany, and China share approximately 15 trillion dollars out of it.

### 3 Digital Economy Contribution in GDP

Share of digital economy strides fast and has reached a remarkable share in GDP of respective economies. Within short span of time, this has reached 10% mark in developed nations and around 5–6% in fast developing countries. However, it is mostly concentrated in developed countries and more particularly in the hands of few large multi-national corporations. They are called tech giants. For instance, we can see the table below (Table 2.1):

### 4 Income Inequality and Digital Economy

Dramatic transformation of world economy has been attributed to digital revolution in last few decades. Potential economic gains from digital technologies are enormous, but with new opportunities come new challenges. Inter- and intralevel production design, distributional channels, business strategy, and business monitoring everything have changed in a significant way within world economies. Income and wealth inequalities have risen as digitisation has reshaped markets and the world of business and work. Inequalities have increased between firms and between workers. The distribution of both capital and labour income has become more unequal, and income has shifted from labour to capital. Technological change, however, is not the sole reason for the rising inequalities. Policy failures have been an important part of the story (Zia, 2020). Academic research has pointed out in their research that technological changes have declined labour share in income twice as much what by globalisation has done. The rise in market concentration is greater in industries that are more intensive users of digital technologies. Mark-ups over marginal cost for US publicly traded firms have nearly tripled, with the rise concentrated in high mark-up firms gaining market share (Loecker, et al., 2018).

**Table 2.1** Share of digital economy

Particulars	USA	China	EU	Brazil	India
Share of digital economy in GDP (%) which includes	10.9	10.0	8.2	6.2	5.5
ICT export	1.4	5.8	2.5	0.1	2.9

Source: McKinsey Global Institute (2018)

## 5 Dying Professions, Unemployment Risk, and Digital Economy

An interesting and comprehensive study was found that there is wide-ranging displacement and elimination is happened in professions previously flourishing. Constructive destruction is order of the world stage which revolutionised the world but disruptive technology is never balanced by faster and timely replacement of workers skill set to cope up new developments around them. Professions die without for want of skills replacement and it risk employment scenario especially among less resourceful and educated on trained workforce. The following details are an eye-opener (Table 2.2).

Digital economy is an iconic proviso of opportunity to newly educated and trained graduates but it is also an irony that a huge reduction is seen in such opportunities to traditionally trained youths or less educated unfortunates. (Tyutyunnikova & Romanika, 2019). At the same time, the overall unemployment rate is growing together with the digitalising processes in the global labour market. The highest unemployment rate is observed in the countries divided into two groups: the least developed countries and developed countries which have not overcome the consequences of the financial and economic crisis (AzmuK, 2016). Digital technology has opened a new gateway of which allows market forces to displace skills of job seekers for skilled labour force. This places low-skilled young people as well as older workers in need of up- and re-skilling in a particularly vulnerable situation because they face both upward pressure (the risk of automation) and downward pressure

**Table 2.2** Employment risk of new digital economy

Industry	Substitute	Eliminated professions	Reason (advantage)
Private banking	Blockchain solutions	Consultants	Speed
Investment banking	Crowd funding Platform	Analyst	Availability
Construction industry	Industrial 3-D printing	Designer engineers	Speed and quality
Private banking	Infographics and automated presentation	Designers	Speed and quality
Heavy industries	3D printings	Workers	Flexibility
Stock and ForEx trading	e-portals	Brokers and traders	
Corporate consulting	Self-learning algorithm Big data analysis	Consultancy	Cost-cutting
FMCG	E-commerce	Supply chain workers	Cost-cutting
Accounting	Accounting programmes	Accountants, Lawyers	Speed and quality

*Source:* Itsakov, Evgeny & Kazantsev, Nikolai & Yangutova, Soizhina & Torshin, Dmitry & Alchykava, Maryia. (2019). Digital Economy: Unemployment Risks and New Opportunities. [https://doi.org/10.1007/978-3-030-37858-5\\_24](https://doi.org/10.1007/978-3-030-37858-5_24)

(displacement by more highly qualified people). The future of work in the digital economy (International Labour Organization, 2020).

## 6 Digital Economy and Loss of Human Interaction or Socialisation

The increase in the use of technology to communicate could also cause a rise in loneliness, especially among elderly people who may rely on these transactional encounters as their primary source of social contact. Technology has had a huge impact on the way we communicate with each other. While it allows us to make instant connections with people on the other side of the world, it also puts us at risk of loneliness, as well as new forms of harassment and manipulation. How has technology affected social interaction? (Jake, 2020) In the present time people are living in virtual world. Due to fast and busy life, life is becoming individualistic, mechanical, and self-occupied. We are becoming more a crowd than groups which feels each other as relevant though it is relevant at the core. This gap is being tried to be filled up by searching more on digital or social media which is not giving intimacy of any real value. It creates perception of connection but no connect when life desires so in the testing time. This has often resulted in a myriad of shallow relationships. Reduction in intimacy which directly affects the way people operate, the values and expectations people have, and the way people think about others. Technology-led entertainments and digital games confined children to a limited space which affects their mental, emotional, and social competencies. The effects of technology on human interaction, what are they? (Wardynski, 2019). Though it is true that technology has allowed us some means of social connection that would have never been possible before and has allowed us to maintain long-distance friendships that would have otherwise probably fallen by the wayside, the fact remains that it is causing ourselves to spread ourselves too thin, as well as slowly ruining the quality of social interaction that we all need as human beings (The Bottom Line, 24 January, 2012).

## 7 Consumer Surplus

An estimate claims that, if household consumption in U.S. GDP were adjusted to include the total consumer surplus of Internet users, its level would increase by about 30%. USA and China are the major consumers and producers of Internet-based services; other economies are also a major consumer relative to their GDP. In this sense, they are also enjoying major consumer surplus for them and value of the same would be a substantial number (Table 2.3).

**Table 2.3** Median annual consumer surplus from free digital goods in the USA

Digital goods	Surplus in dollar
Search engines	14,760
E-mail	6139
Digital maps	2693
Online videos	991
E-commerce	634
Social media	205
Messaging	135
Music	140
Total	25,697
Household disposable income per capita in USA	

*Source:* Brynjolfsson, Eggers, and Gannamaneni, 2017 in MEASURING THE DIGITAL ECONOMY The Staff Report prepared by IMF staff and completed on 28 February 2018

## 8 Women and Child Abuses and Digital Economy

Though both men and women can experience incidents of online violence and abuse, women are considerably more likely to be victims of repeated and severe forms of harmful actions online or with the help of technology on social media platforms. The use of tracking apps and devices, as well as impersonation, and economic harm are operated via digital means. But this is just a snapshot of the problem. Digital violence against women and girls and ensuing impunity remains colossal, having an impact on society as a whole. The most disturbing facts are the rising use of digital platform where women's body is being projected as commodities. Image of women, women's emotions, and women's body are projected as stereotype. It creates image crisis among common women. It promotes lowering self-esteem among them and rising distorted demand of men regarding women's body and behaviour. It has entered a new era of criminal exploitation of this community from the initial phase commoditisation of women body and emotions as stereotype through advertising. Psycho-sociological and legal aspects of online child sexual abuse such as criminalisation, offender profiling, and rehabilitation have been thoroughly studied in the literature in recent times (Açar, 2017).

## 9 Distortion of Consumer Choice and Digital Promotion

A conventional economic theory lauds consumers as ardent rational. However, behavioural economics and finance have challenged this assumption and proven presence of biases, bounded rationality, and strategic barriers to functioning of rationality through media intervention in the era of digital marketing. Obtaining and analysing information may be costly, and as a result, rational consumers may not

search the entire market before making a decision. In addition, firms may have incentives to try to exploit these behavioural biases for their own benefit (for instance by trying to encourage inertia or by making complaining or seeking redress seem very costly). As a result, the higher level of competition online compared to the offline marketplace may not necessarily benefit consumers (Muller et al., 2017).

## 10 Gender Divide and Digital Economy

Individuals need to be able to analyse and create meaning from the vast amounts of information available. Moreover, as economies continue to digitise, digital skills are becoming essential. Over 90% of jobs worldwide already have a digital component\* and most jobs will soon require sophisticated digital skills. If governments equip girls with digital skills through prioritising education in ICT subjects, they will help girls thrive in economies where routine work has been automated and digital skills are prized. Technology can also be a powerful tool for girls to become activists and lead change on issues that affect them. Social media platforms, for instance, allow activists to reach a wide audience and organise action towards common causes.

As societies become increasingly dependent on digital technology, women, their broader communities, and national economies are at risk of losing out on the positive promise of full participation in digital economies. If the digital gender gap is not addressed, digital technologies may exacerbate gender inequalities rather than help to reduce them (Reiko, 2019). To be beneficial to women, access to and use of digital technologies must be universal, affordable, unconditional, meaningful, and equal and must meet women's varying circumstances, needs, and priorities. Gender gap in digital use still persists in most of the poor economies of the world. For example, the gender gap in Internet penetration is around 17% in the Arab States and the Asia and Pacific region. The proportion of men using the Internet is higher than the proportion of women using the Internet in two-thirds of countries worldwide. There is a strong link between gender parity in the enrolment ratio in tertiary education and gender parity in Internet use. The only region where a higher percentage of women than men are using the Internet is the Americas, where countries also score highly on gender parity in tertiary education (ICT, 2017) whereas the gender gap in ICT skills is as high as 25% in some Asian and Middle Eastern countries (EQUALS-Research-Report, 2019). In sub-Saharan Africa (SSA), the Internet penetration rate in 2019 was 33.8% for men and 22.6% for women. The Internet user gender gap was 20.7% in 2013 and up to 37% in 2019 (The Mobile Gender Gap Report, 2020). The Internet user gender gap was 20.7% in 2013 and up to 37% in 2019. The Internet penetration rate in 2019 was 33.8% for men and 22.6% for women. The Internet user gender gap was 20.7% in 2013 and up to 37% in 2019. The Internet penetration rate in 2019 was 33.8% for men and 22.6% for women (Araba & Nancy, 2019).

## 11 Conclusion

There are two kinds of changes that are seen in the journey of our life on earth. One is called evolutionary and other revolutionary. Evolutionary changes have merited that people life move alongside the changes occurring in the domain of nature or society. Digital uprising is called fourth revolution. Other three were mechanical, electric and electronics, and information technology. Fourth revolution is fusion of all the three. It has changed the system of production, distribution, promotion, communication, consumption, saving, investment, organisation, and management of preceding components of our modern civilisation. This revolution has generated huge opportunity for some section of the society which is well poised to use this opportunity but highly disruptive for many others those who were replaced by new technology and turned obsolete as their existing skills become redundant. It is reflected in form of rising inequality in distribution of income and wealth, skewed ownership of resources including skill set, monopolisation of market and opportunities, regional, gender, and economic disparities and discrimination. However, revolutionary changes are irreversible and therefore learning to live with it is the only option. It is better to accepted it for its proven duality of benefits and inevitability. Strategic management of this challenge is definitely in our favour. Following steps would be fruitful in this regard.

1. Society and government at different levels should make sufficient investment to educate and train the displaced workforce in new technologies.
2. Reduction of the digital divide in the society at gender, regional, and social groups' level should be promoted.
3. Above two proposals may be funded by taxing monopolised earning of doyens of digital monopolist firms or corporations.
4. Misuse of digital platforms against women, child, and other vulnerable groups of consumers of such services by state and non-state actors including the producers and intermediaries of digital technologies must be dealt with stringent legal provisions and iron hand policing of it.
5. Educating every section of the society regarding the benefits and risk of digital world and make them regularly informed through public awareness programmes of various types including public advertising on electronic, non-electronic, and social media platforms.

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# Chapter 3

## Impediments to the Fourth Industrial Revolution in Africa



Hebatallah Adam 

**Abstract** The Fourth Industrial Revolution refers to a range of new technologies, digitization, and robotization that are affecting all disciplines, economies, and sectors. The complete transformation of society into a digital one opens numerous opportunities for economic growth and development. The purpose of this study is to situate Africa's place and involvement in the Fourth Industrial Revolution and to identify the major challenges that are facing its complete digital transformation. Africa's digital revolution has the potential to bring development and revolutionize the continent in the same way that Europe's industrial revolution did in the nineteenth century. Since the beginning of the second millennium, the African economy has grown steadily, thanks to increased merchandize exports and several structural drivers (i.e. demographics, emerging internal markets, and urbanization). Between 2000 and 2019, African economies grew at a rate of 4.1 per cent, which is greater than the rate for South American countries (World Bank, World development report 2021: Data for better lives, 2021). However, most African countries continue to lack critical information and communication technology infrastructure, Internet access, and related online services. This study examines the progress of Africa's digital transformation, emphasizing the continent's potential and challenges in this regard. We compared African countries to developed and developing countries using the ICT Composed Index 2017 dataset. The Minima and Maxima techniques were employed to investigate the overall performance of Africa on the Networked Readiness Index for the period 2012–2016. Box-and-Whisker The E-government Development Index (EGDI) 2018 data set was analysed using plot and correlation. While this study identifies multiple success factors and huge opportunities for

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Africa's digital revolution, notably in terms of poverty reduction and commercial development, it also identifies numerous barriers impeding its advancement. The penetration of networks into rural areas and the adoption of critical digital platforms and services, such as the availability of affordable Internet online services and the development of e-government online services, are identified as major obstacles to the African continent's digitalization.

**Keywords** Africa · Fourth industrial revolution · Digital revolution · Industry 4.0 · Digital transformation · Information Society · ICT sector · Economic Digitalization · Digital Economy · Development

## 1 Introduction

ICTs are considered a vital industry for job creation and economic development, particularly in developing economies with slow growth and high unemployment rates. (Chege & Wang, 2020). According to the OECD, ICTs are “a synthesis of manufacturing and service industries whose products electronically acquire, transmit, or display data and information.” The ICTs industry's output is largely directed towards performing or enabling the function of information processing and communication via electronic means, including transmission and display, (OECD, 2009). Since the 1990s, the world has witnessed massive breakthroughs and innovations in the information and communication technology (ICT) sector, followed by an exponential growth in the number of global network connections. The most recent wave of the so-called “digital revolution” introduced new technologies that shifted the focus of governments, businesses, and markets towards a new global digital economy (Braña, 2019). Competitive ICTs sector, free-market mechanisms, a competitive business sector, highly qualified human resources, and an independent regulatory authority are all important aspects of a successful digital transformation strategy (Aleshkovski et al., 2020). Making the digital transformation, a narrative of success requires inclusive, comprehensive, and well-coordinated policies that reflect all relevant stakeholders, including government, business, and development partners.

Africa started its digital transformation by the end of the 1990s where it has begun with the so-called mobile or telecommunications revolution. The progress of the ICTs sector in Africa is remarkable over the last two decades (Foster & Briceño-Garmendia, 2011). The widespread use of digital technologies among Africans is rising rapidly. In 2018, Africa accounted for 45.6 per cent of global mobile money transactions, totalling \$26.6 billion (GSMA, 2018). The rise of mobile money influenced the continent's IT industry and digital entrepreneurship. A rising number of digital technology start-ups are being developed across the continent (Andjelkovic

& Imaizumi, 2012; Deloitte, 2017; Friederici et al., 2020) (i.e. 618 tech-hubs operate across Africa, helping small tech start-ups and software and app developers, (GSMA, 2019b)). Nonetheless, significant efforts must be made to prepare African countries to follow the lead of other regions in meeting the requirement of the digital revolution. The purpose of this paper is to assess Africa's digital transformation status in comparison with other regions and to identify the key success factors needed to fasten the digitalization growth speed in Africa.

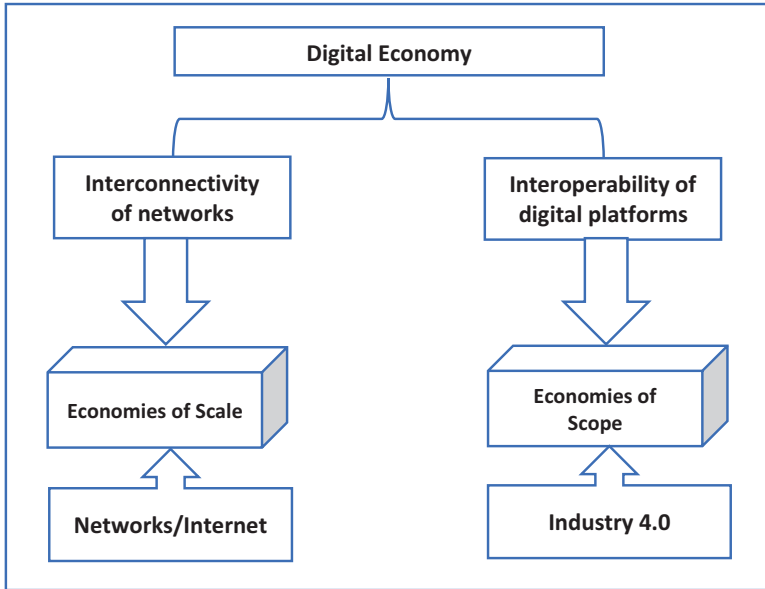
This paper is structured as follows: In the first section, the literature review defines the digital economy and Industrial 4.0. Following that, we explain the role of governments in the digitization process. Then, we examine the economic consequences of the digital revolution from two perspectives: (a) the impact on economic growth and (b) the impact on the labour market. Finally, we discuss digital transformation in developing countries by outlining the necessary policy framework as well as the primary challenges that developing countries face during the digitization process. In the second section, we examine the digital revolution in Africa from a variety of angles, including major ICT trends, digitization progress (as measured by the Networked Readiness Index and the United Nations E-Government Survey), and major digital transformation challenges. And finally, we conclude and recommend policies and actions for a faster and more effective African digital transformation.

## 2 Literature Review

### 2.1 *Industrial 4.0 and Digital Economy: Definition and Main Concepts*

The digital economy can be defined as “all sectors operating using the Internet Protocol (IP)-enabled communications and networks,” regardless of industry type (ISOC, 2015). The Internet and IP-enabled networks have created a common platform for shaping the digital economy's foundations across all sectors.

To offer convergent services, the digital economy relies on enhanced network connectivity and the interoperability of digital platforms across all sectors of the economy. Lovelock, P. (Lovelock, 2018) stressed the critical nature of interconnectivity and interoperability in establishing a digital economy. The interconnectivity of networks refers to the traffic that can flow between and across them. This enables economies of scale, as the fixed costs of infrastructure deployment are spread across a higher level of output, resulting in a decrease in unit costs (Rietveld, 2018). The interoperability of digital platforms refers to the ability of traffic to flow successfully across multiple types of networks (e.g. telecommunications, banking, educational, and health networks, among others). This results in scope economies since fixed costs are dispersed across a greater spectrum of output from various products and services (Kerber & Schweitzer, 2017).



**Fig. 3.1** Digital Economy's Key Elements Analysis. (Source: Author's construction)

The interconnectivity and the interoperability have two significant economic consequences, as illustrated in Fig. 3.1: First, there are the economies of scale that result from the widespread use of networks throughout society. Second, the economies of scope that have resulted from the recent advent of Industry 4.0, which has simplified the process of leveraging cross-sector opportunities, such as the emergence of FinTech “finance+technology” and AgriTech “agriculture+technology,” (Montes & Olleros, 2019. and Büchi et al., 2018).

The Fourth Industrial Revolution (or Industry 4.0) refers to a shift in economic value away from manufacturing (Industry 2.0) and services (Industry 3.0) towards information and intellectual property, new technologies, digitization, and robotization (Kagermann, 2014). Industry 4.0 is a German concept that combines industry with information technology (Adolph et al., 2016; Danielsen et al., 2022). Industry 4.0 can fundamentally alter how goods are conceived, made, distributed, and billed. (Stock and Seliger 2016; Hofmann and Rüsçh 2017). It opens numerous opportunities for economic growth, including the incorporation of new business models based on product and service digitization; the development of innovative industrial management models for SMEs with lower startup costs; cost, time, and product quality improvements; and new products and services combining new technology and a scientific discipline (e.g. FinTech).

## 2.2 *Strategic Plan for Digital Transformation and Development*

The fourth industrial revolution is required for a successful implementation of a new development strategy (Aleshkovski et al., 2020). Governments and leaders should focus on managing and growing the digital economy to achieve national socio-economic agendas. Policymakers are constantly challenged in their efforts to implement digital transformation. Six basic digital policies should be implemented by governments (Lovelock, 2018):

1. Establishing a national high-speed broadband infrastructure is vital.
2. Making vital networks (such as telecommunications and banking systems) interoperable, allowing apps and services to work across all systems, always available (e.g. interoperability among mobile money services).
3. Monitoring and handling three sorts of sharing economy challenges: (a) traditional sectors versus new platforms, (b) reputation rating accuracy in the sharing economy, and (c) concerns for consumers (e.g. users' data protection, liability, and insurance).
4. Ensuring privacy and data protection through laws and regulations that need citizens' agreement before collecting data and prevent data loss or misuse. Critical national information infrastructures (CNII)<sup>1</sup> should be protected by cybersecurity policies that encourage timely information exchange concerning assaults.
5. Monitoring sovereignty and cross-border data flow. Regulating AML/CFT, cybercrime detection, and anti-terrorist monitoring is vital.

The key factor for success in digital transformation is the collaboration between governments, businesses, and civil society (Hanna, 2016; Nosova et al., 2021). Therefore, governments need to implement an integrated policy framework that combines three main pillars (OECD, 2017) (Table 3.1):

The amount of time and effort required to make a successful digital transformation varies by country, depending on factors such as economic development, market openness, sectoral composition and competitiveness, government- and private-sector institutional capacities, and educational advancement and R & D position (Nosova et al., 2021).

The digital divide between developing and developed countries must be bridged by a new development strategy that expands their local access to new technologies and improves their productivity and competitiveness levels (Pakistan, 2011). An effective digital transformation strategy is challenging for many developing countries. In LDCs, complementary assets and coordination structures are weak or absent (Hanna, 2016).

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<sup>1</sup>Critical National Information Infrastructure (CNII) is a set of assets, systems, and operations that are critical to a nation's economic strength, image, national defence, and security, as well as public health and safety.

**Table 3.1** Governments' Digital Transformation Integrated Policy Framework

Main Policy Pillars	Actions to be taken
1. Building the Foundations for the Digital Transformation	Enabling environment for free-market policies and trade openness. Providing affordable digital infrastructure and services for all (encompassing broadband communication networks, data, software, hardware, and services.).
2. Making the Digital Transformation useful for both the economy and society	Comprise all acts required to enable people, businesses, and governments to make efficient use of digital technologies, including but not limited to: Transformation to e-government Firms use new technologies in production activities. Supporting innovation and research activities Labour market adaptation to new needed skills and new jobs Fostering citizen's trust and acceptance in the digital economy Ensuring more equitable digital transformation
3. Policy Coherence and Strategy Development	Setting one coherent and strategic national digital agenda which depends on: Actions coordination among ministries other governmental bodies, and key stakeholders.

Source: Table constructed by the author based on:

OECD (2017), *Going Digital: Making the Transformation Work for Growth and Well-Being*, OECD Council Ministerial meeting Paris, 7–8 June 2017, p. 12–13

### 2.3 *The Macroeconomic Effects of Digital Revolution*

The fourth industrial revolution had a dual impact on the economy: economic growth and labour force participation (Katz, 2017). The digital revolution has boosted productivity and economic competitiveness significantly (Skilton & Hovsepian, 2018). The introduction of new digitalized services and products, such as electronic commerce, distance education, and social networks, as well as sharing economy services and online B2B and B2C platforms that enable domestic businesses to reach international markets, could all contribute to economic growth acceleration. The evolution of digital technology should have a significant impact on operating expenses and productivity growth (i.e. economies of scale and scope) (Rekettye & Rekettye Jr, 2019).

However, an Internet disruption resulting from a natural emergency, cybercrime, technological failure, or a politically motivated blackout could have a detrimental economic impact on economies (Skilton & Hovsepian, 2018).

Major technology advancements have always been accompanied by significant labour market changes. Increased labour productivity allows producing more goods and services with less labour, thus leading to technological unemployment (Chege & Wang, 2020). At the same time, innovation also generates new job opportunities in a variety of industries and new markets (OECD, 2016).

We can categorize the consequences of the digital revolution on the labour market into two types: First, a job creation effect as digital technologies have spread across a wider range of jobs and industries, the demand for individuals with analytical, interactive, and problem-solving skills has evolved and second a job destruction effect especially for low- and middle-skilled workers because of task automation (Goos, 2018).

### 3 Research Methodology

This study focuses on African countries. The period covered is from 2003 to 2018. Secondary data in the form of published reports were studied to determine the status of Africa's digital transformation and to identify the opportunities and difficulties that Africa faced. This study analyses archives of international organizations like African Development Bank Group (2018a, b), African Development Bank Group, AFDB Socio-Economic Database (1960–2016), ITU World Telecommunication/ICT Indicators database, ICT Development Index (2017), United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index (2018), the World Bank: World Development Indicators, World Economic Forum, The Networked Readiness Index Historical dataset.

We have used ICT Development Index 2017 data set and the ICT Composed Index to compare Africa with developed and developing countries. The technique of Minima and Maxima was used to explore the overall performance of Africa on the Networked Readiness Index for the time series 2012–2016. Furthermore, we have used the ranking method to describe the top ten countries of the African region on the Networked Readiness Index. Box-and-whisker plot and correlation have been used to analyse the data set of the E-government Development Index – EGDI 2018.

## 4 Discussion

### 4.1 ICT Developments in African Countries

The latest data on ICTs development published in 2017 by the ITU (The United Nations specialized agency for information and communication technologies – ICTs) in its annual report “Measuring the Information Society” show that Africa continues to be the region with the lowest ICT Development Index – or IDI performance. In 2017, Africa's average score reached 2.64 points, slightly more than half of the global average of 5.11., see Table 3.2.

Mauritius is the only African country that ranks in the top half of the global IDI distribution, whereas the rest of Africa (28 of the 38 countries included in IDI 2017) falls into the lowest quartile of least connected countries (LCCs). Nonetheless,

**Table 3.2** IDI<sup>a</sup> 2017 Africa, Group of Countries, and World Comparison

Global IDI and Sub-Indices values	Africa	Developed	Developing	World
IDI 2017 Value	2.64	7.52	4.26	5.11
IDI 2016 Value	2.48	7.4	4.07	4.94
IDI ACCESS SUB-INDEX	<b>3.28</b>	<b>7.83</b>	<b>4.8</b>	<b>5.59</b>
Fixed-telephone subscriptions per 100 inhabitants	1	38.07	8.54	13.57
Mobile cellular telephone subscriptions per 100 inhabitants	74.6	127.27	96.25	101.53
International Internet bandwidth per Internet user (Bit/s)	51,000	140,000	53,000	74,464
Percentage of households with a computer	9.6	81.53	34.35	46.61
Percentage of households with Internet access	16.3	82.85	40.43	51.46
IDI USE SUB-INDEX	<b>1.74</b>	<b>6.91</b>	<b>3.32</b>	<b>4.26</b>
Percentage of individuals using the Internet	19.9	79.55	38.98	45.91
Fixed (wired)-broadband subscriptions per 100 inhabitants	0.4	30.31	8.71	12.39
Active mobile-broadband subscriptions per 100 inhabitants	22.9	94.39	43.58	52.23
IDI SKILLS SUB-INDEX	<b>3.16</b>	<b>8.12</b>	<b>5.05</b>	<b>5.85</b>
Mean years of schooling	5.24	11.67	7.4	8.52
Secondary gross enrolment ratio	50.48	109.79	74.88	84
Tertiary gross enrolment ratio	9.49	68.18	28.25	38.69

*Source:* Table constructed by the Author from the ITU World Telecommunication/ICT Indicators database, ICT Development Index, 2017. Scribbr. <https://www.itu.int/net4/ITU-D/idi/2017/index.html#idi2017comparison-tab>. Seen 25 October 2018

<sup>a</sup>The ITU-IDI was created in 2008 and integrates 11 variables into one benchmark measure that can be used to compare ICT advances between nations and over time. The IDI has three sub-indices: (1) access sub-index (It includes: fixed-line phone subscriptions, mobile phone subscriptions, international Internet bandwidth per user, households with computers), (2) use sub-index (it includes: using the Internet, fixed-broadband subscriptions, and mobile-broadband subscriptions), and (3) skills sub-index (it includes: mean years of schooling, gross secondary enrolment, and gross tertiary enrolment)

Namibia and Gabon are the two African countries that rank among the top three in terms of year-over-year growth in their IDI values. (ITU, 2017) (see Table 3.3).

Africa improved at the fastest proportional rate for the IDI and all three sub-indices, with an average of 6.5 per cent overall and 17.6 per cent for the use sub-index, which measures ICT intensity using three different usage and intensity indicators: (a) Internet users, (b) fixed-broadband subscriptions, and (c) mobile-broadband subscriptions. The 2018 Africa Infrastructure Index - AIDI report describes the ICT sector as the primary driver of AIDI improvement over the last decade. Fig. 3.2 illustrates the phenomenal evolution of the AIDI's ICT composite sub-index throughout the period (2003–2018). The value of the ICT composite index has climbed 338.5 times since 2003.

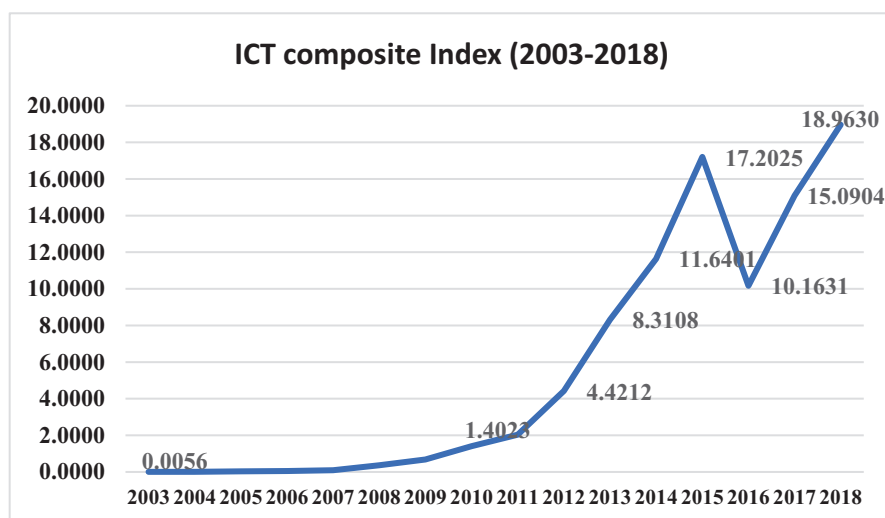
Between 2000 and 2014, Africa's Internet users per 100 population increased dramatically. It increased to 21.4 users per 100 in 2014, up from 0.5 users in 2000, see Fig. 3.3. Mobile devices accounted for most of the web traffic in Africa's largest

**Table 3.3** Africa vs. Regions and World: Average IDI and Sub-Index Values (IDI 2017 & IDI 2016) and Percentage Change 2017–2016

Region <sup>a</sup>	IDI 2017				IDI2016				Percentage Change 2017–2016			
	Access	Use	Skills	IDI	Access	Use	Skills	IDI	Access	Use	Skills	IDI
Africa	<b>3.28</b>	<b>1.74</b>	<b>3.16</b>	<b>2.64</b>	<b>3.18</b>	<b>1.48</b>	<b>3.07</b>	<b>2.48</b>	<b>3.1%</b>	<b>17.6%</b>	<b>3.3%</b>	<b>6.5%</b>
Arab States	5.51	3.96	5.26	4.84	5.41	3.78	5.17	4.71	1.8%	6.9%	1.9%	3.4%
Asia and the Pacific	5.27	3.99	5.65	4.83	5.12	3.63	5.48	4.6	2.0%	7.2%	1.8%	3.5%
CIS	6.6	4.79	7.47	6.05	6.48	4.39	7.44	5.84	1.5%	5.9%	1.3%	2.7%
Europe	7.8	6.94	8.02	7.5	7.73	6.62	7.97	7.34	1.3%	3.9%	1.3%	2.2%
The Americas	5.64	4.21	6.34	5.21	5.54	3.86	6.24	5.01	1.8%	6.7%	1.6%	3.2%
World	<b>5.59</b>	<b>4.26</b>	<b>5.85</b>	<b>5.11</b>	<b>5.49</b>	<b>3.95</b>	<b>5.75</b>	<b>4.93</b>	<b>1.8%</b>	<b>6.6%</b>	<b>1.7%</b>	<b>3.2%</b>

Source: Table modified by the Author from ITU (2017), Measuring the Information Society Report: 2017 – Volume 1, The United Nations specialized agency for information and communication technologies – ICTs, Switzerland Geneva, 2017. p(66)

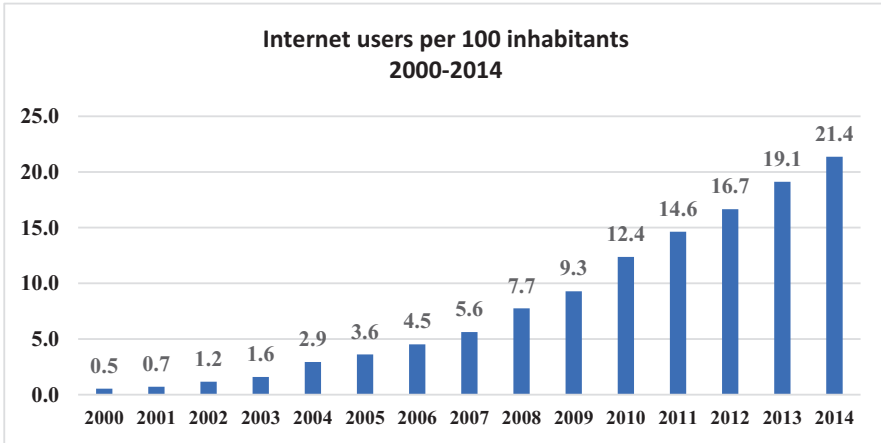
<sup>a</sup>Number of economies per each region: Africa (38), Arab states (19), Asia and the Pacific (34), CIS (10), Europe (40), The Americas (35), World (176)



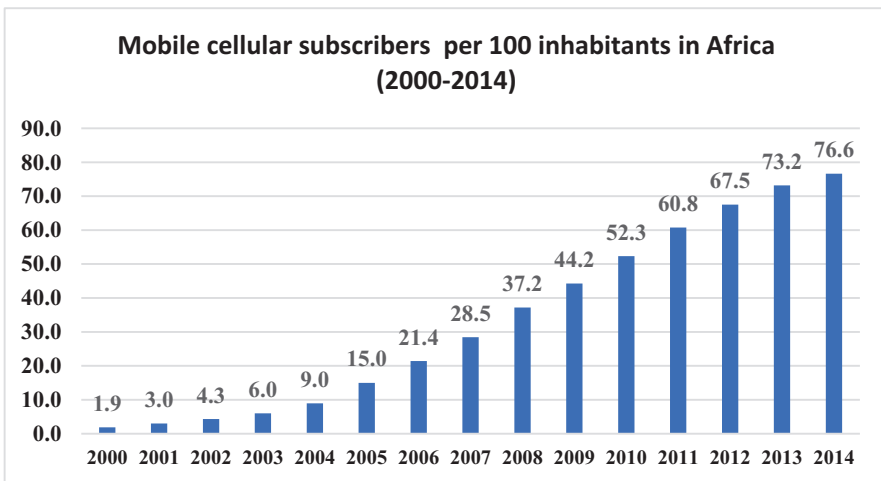
**Fig. 3.2** Africa Infrastructure Index: ICT Composite Index (2003–2018). (Source: Figure constructed by the author of data collected from African Development Bank Group (2018a, b). Scribbr. <http://infrastructureafrica.opendataforafrica.org/pbuerhd/africa-infrastructure-development-index-aidi-2018>)

digital marketplaces. For example, smartphones accounted for 81 per cent of web traffic in Nigeria, one of the world's most populous countries, while computers accounted for only 16 per cent. (African Development Bank Group, 2018a, b). There are two primary reasons for this (a) the low cost of mobile connections and





**Fig. 3.3** Internet Users per 100 Inhabitants in Africa (2000–2014). (Source: Figure constructed by the author of data collected from African Development Bank Group, AFDB Socio-Economic Database, 1960–2016. Scribbr. <http://infrastructureafrica.opendataforafrica.org/kjxrbg/afdb-socio-economic-database-1960-2016>, website seen on 21 October 2018)



**Fig. 3.4** Mobile Cellular Subscribers per 100 Inhabitants in Africa (2000–2014). (Source: Figure constructed by the author of data collected from African Development Bank Group, AFDB Socio-Economic Database, 1960–2016. Scribbr. <http://infrastructureafrica.opendataforafrica.org/kjxrbg/afdb-socio-economic-database-1960-2016>, website seen on 21 October 2018)

(b) the fact that Internet via mobile connections does not require the same level of infrastructure as traditional fixed-line Internet connections.

The rapid expansion of Africa’s mobile phone industry has benefited the ICT sector (Beda, 2019). Africa’s mobile phone users per 100 people increased from 1.9 in 2000 to 76.6 in 2014, as illustrated in Fig. 3.4). Many growth-driven changes have occurred in the African mobile phone market over the last decade (AFDB,

2015), including new entrants; massive coverage expansions; faster broadband; higher subscriptions; decreased prices followed the network's growth; increased competition level; and increased focus on low-income households by the network operators. The construction of new submarine and regional overland connections across Africa's coast has facilitated mobile operator consolidation. The large private-sector investments and the rise of PPPs in various African countries had a major positive impact. Regulatory change has been a major driver of ICT expansion in Africa; it has increased investor confidence (especially foreign investors) and allowed competitiveness to grow.

The GSM Association (GSMA, 2016b) report on the *Mobile Economy in Africa* shows that the overall adoption rate for mobile phones in Africa relative to the population size is 46 per cent in 2015, and it is predicted to rise at a rate of 6 per cent every year. The rise of the mobile economy (i.e. the economic impact of mobile communications and related service industries) is consistently adding to Africa's total economic growth and development. In 2015, the value-added generated by the mobile economy accounted for 6.7 per cent of Africa's overall GDP (153 billion US dollars of economic value). The GSMA (2016b) anticipates that by 2020, the contribution of the mobile economy to Africa's overall GDP will grow to reach 7.6 per cent (214 billion US dollars).

To sum up, in this section, we can conclude that the increased access to mobile telecommunications services has spurred growth in Africa's ICT sector. The other segments of the ICT market have not progressed at the same rate as mobile businesses (i.e. fixed-broadband subscriptions and Internet access).

## 4.2 Digitization Progresses in Africa

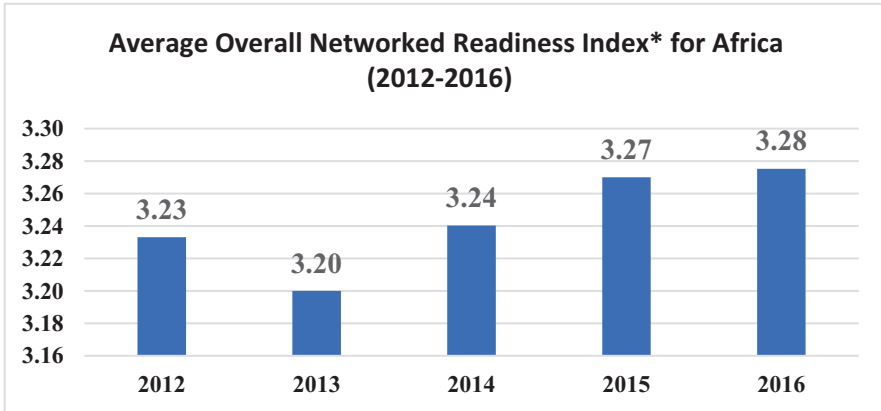
### 4.2.1 Analysis of the Networked Readiness Index

Global digital connections, low-cost processing, and high-density data storage, as well as an increasingly networked population of active users of digital technology, are all prerequisites for digitization progress. The 2016 World Economic Forum report on global information technology was introduced for the Networked Readiness Index (NRI)<sup>2</sup> as an assessment of the country's ability to profit from and take advantage of emerging technologies and digital transformations (WEF, 2016).

The overall Networked Readiness Index (NRI) for African countries remained stable between 2012 and 2016, scoring 3.28 in 2016, up 0.05 from its 2012 fig. (3.23), see Fig. 3.5. For the 36 African nations covered in the 2016 report, the

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<sup>2</sup>Countries are assessed over four categories of indicators: (1) the overall environment for technology use and creation (political, regulatory, business, and innovation); (2) networked readiness in terms of ICT infrastructure, affordability, and skills; (3) technology adoption/usage by the three groups of stakeholders (government, the private sector, and private individuals); and (4) the economic and social impact of the new technologies (WEF, 2016).



**Fig. 3.5** African Countries' Average Overall Networked Readiness Index for Time Series 2012–2016. (Source: Figure constructed by the author of data collected from World Economic Forum, The Networked Readiness Index Historical dataset (2012–2016). Scribbr. [http://www3.weforum.org/docs/GITR2016/WEF\\_NRI\\_2012-2016\\_Historical\\_Dataset.xlsx](http://www3.weforum.org/docs/GITR2016/WEF_NRI_2012-2016_Historical_Dataset.xlsx), website seen on 25 October 2018)

Note: Each year's average is calculated using the following number of countries: 32 for 2012, 35 for 2013, 36 for 2014 and 2016, and 32 for 2015. Appendix 1 contains the complete lists of these countries

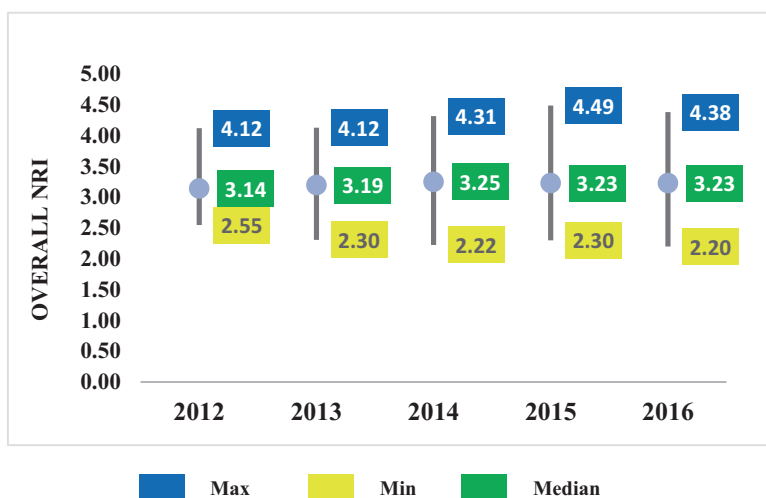
maximum NRI value is 4.38 (Mauritius), the minimum value is 2.20 (Chad), and the median value is 3.23 (Fig. 3.6).

Mauritius, which is ranked 49th overall in the NRI, is Africa's top-ranked country in 2016. South Africa is last, but it has improved greatly from the previous year, jumping from 75th to 65th place. Ethiopia (120th, an increase of 10) and Côte d'Ivoire (106th, an increase of 9) were among the top NRI movers in 2016, see Table 3.4.

Apart from a few exceptional countries, the African countries remain on the periphery of the new wave of digitization. They still need to work on improving their technological responsiveness to adapt to the needs of the fourth industrial revolution. In comparison with examples of best performers in developing and developed countries, Africa's average of the overall Networked Readiness Index (3.28) still lay behind their scores by a difference of 2.76, 2.54, and 0.96 with the sample countries Singapore, USA, and China, respectively, see Fig. 3.7.

#### 4.2.2 Analysis of the United Nations E-Government Survey

In 2001, the United Nations Department of Economic and Social Affairs (UNDESA) launched the United Nations E-Government Survey, which examines the state of e-government development in all UN member countries. It includes three essential aspects necessary for users to derive value from online services and information: (1) the infrastructure's sufficiency, (2) human resources' capacity for developing and



**Fig. 3.6** Max, Min, and Median of Africa's Overall Networked Readiness Index for Time Series 2012–2016. (Source: Figure constructed by the author of data collected from World Economic Forum, The Networked Readiness Index Historical dataset (2012–2016). Scribbr. [http://www3.weforum.org/docs/GITR2016/WEF\\_NRI\\_2012-2016\\_Historical\\_Dataset.xlsx](http://www3.weforum.org/docs/GITR2016/WEF_NRI_2012-2016_Historical_Dataset.xlsx), website seen on 25 October 2018)

*Note:*

Each year's average is calculated using the following number of countries: 32 for 2012, 35 for 2013, 36 for 2014 and 2016, and 32 for 2015. Appendix 1 contains the complete lists of these countries.

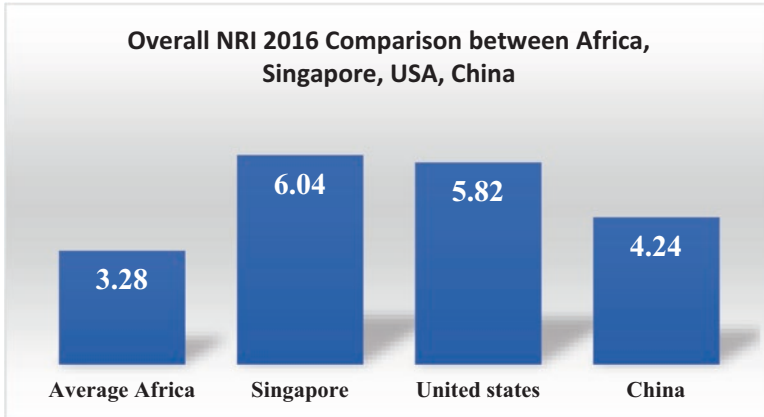
The Overall Networked Readiness Index (2016) covers 139 countries with main statistics (Min 2.20; Max 6.04; Median 4.83).

**Table 3.4** Top 10 Ranked African Countries in the Networked Readiness Index (2016)

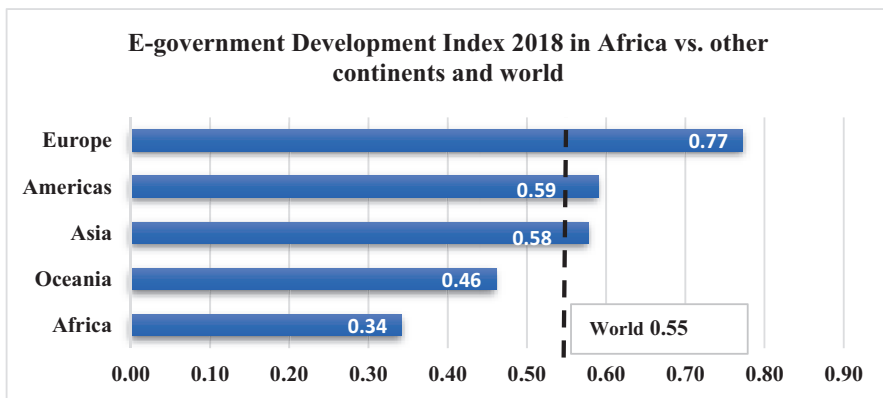
Country	Africa Rank	Overall NRI Rank (2016)
Mauritius	1	49
South Africa	2	65
Seychelles	3	74
Morocco	4	78
Rwanda	5	80
Tunisia	6	81
Cape Verde	7	85
Kenya	8	86
Egypt	9	96
Namibia	10	99

*Source:* Table constructed by the author of data collected from World Economic Forum, The Networked Readiness Index Historical dataset (2012–2016). Scribbr. [http://www3.weforum.org/docs/GITR2016/WEF\\_NRI\\_2012-2016\\_Historical\\_Dataset.xlsx](http://www3.weforum.org/docs/GITR2016/WEF_NRI_2012-2016_Historical_Dataset.xlsx), website seen on 25 October 2018

*Note:* There are 139 countries in the NRI 2016, with 36 of them being African countries



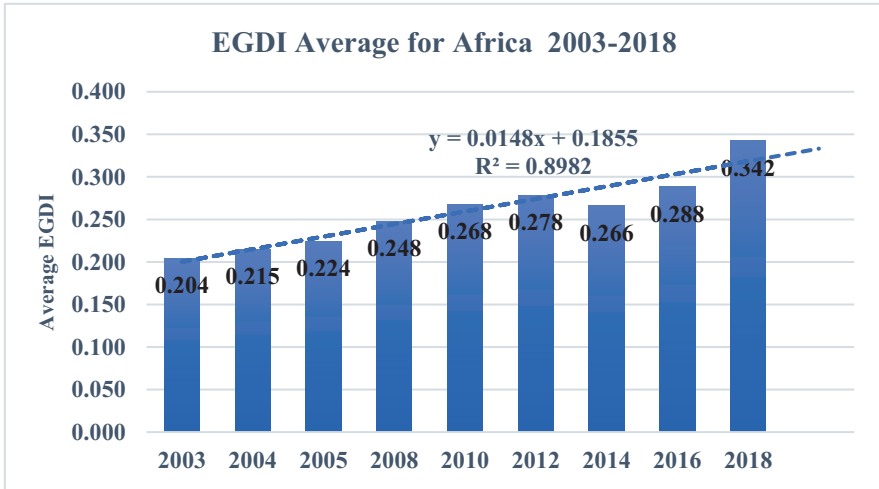
**Fig. 3.7** Overall NRI 2016 Comparison between Africa, Singapore, USA, China. (Source: Figure constructed by the author of data collected from World Economic Forum, The Networked Readiness Index Historical dataset (2012–2016). Scribbr. [http://www3.weforum.org/docs/GITR2016/WEF\\_NRI\\_2012-2016\\_Historical\\_Dataset.xlsx](http://www3.weforum.org/docs/GITR2016/WEF_NRI_2012-2016_Historical_Dataset.xlsx), website seen on 25 October 2018)



**Fig. 3.8** E-government Development Index (EGDI) 2018 in Africa vs. the Other Continents and the World. (Source: Figure constructed by the author of data collected from United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://publicadministration.un.org/egovkb/en-us/Data-Center>. Website seen on 26 October 2018)

utilizing ICTs, and (3) access to online services and content. The United Governments E-Government Survey uses the E-Government Development Index to assess nations’ e-government progress (EGDI).

African region ranks behind other regions when it comes to e-government development. Africa ranks worst with an average of 0.34, compared to the other regions (Europe 0.77, Americas 0.59, Asia 0.58, and Oceania 0.46) and the global average (0.55), see Fig. 3.8.



**Fig. 3.9** Evolution of the African Average EGDI from 2003 to 2018. (Source: Figure constructed by the author of data collected from United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://publicadministration.un.org/egovkb/en-us/Data-Center>. Website seen on 26th October 2018)

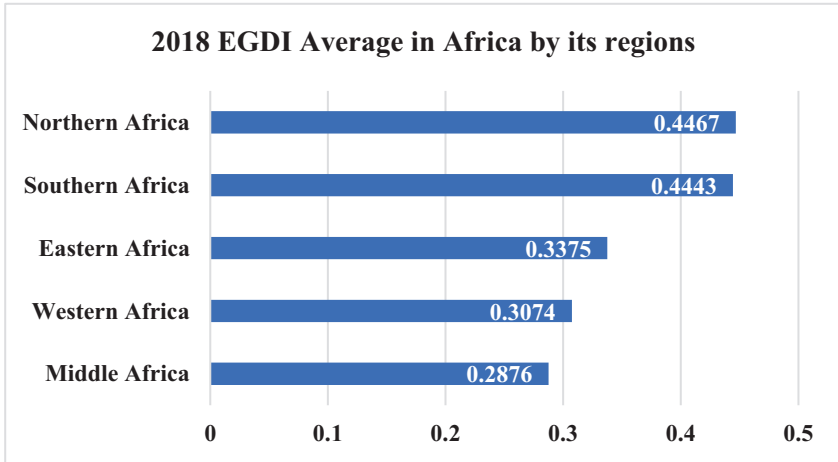
The regional average EGDI scores for Africa improved moderately from 2003 to 2018, see Fig. (9). When compared to 2003 (0.204), the African average EGDI climbed by 67.6 per cent to 0.342 in 2018. We can estimate promising future growth in the African average EGDI using regression analysis (Fig. 3.9).

Northern and Southern Africa, with an average EGDI of 0.4467 and 0.4443, respectively, are Africa’s best-performing regions in 2018, see Fig. 3.10. The 54 African nations featured in the 2018 E-government Survey have a rather tall box plot for their EGDI scores, showing significant heterogeneity in their EGDI ratings. The interquartile range is 0.1727 and the range is 0.6112 (the minimum value is 0.0566 in Somalia and the maximum value is 0.6678 in Mauritius), see Fig. 3.11.

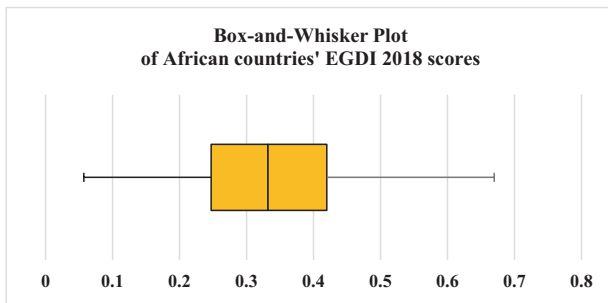
Africa’s top-ranked countries in the EGDI 2018 are also top-ranked in the Networked Readiness Index. Nonetheless, Mauritius is the continent’s top performance, followed by South Africa, see Table 3.5.

Mauritius, South Africa, Tunisia, and Seychelles were the only African countries to score above the global average of 0.55. On the other hand, the Central African Republic, Chad, Comoros, Djibouti, Equatorial Guinea, Eritrea, Guinea-Bissau, Mali, Mauritania, Niger, Somalia, and Sudan have EGDI scores that are extremely low. All these countries fall within the low-income category. They are challenged with significant socio-economic development issues, which impose additional constraints on successfully implementing their ICT strategy and allocating resources for e-government development, see Table 3.6.

Most African countries (34 out of 54) belong to the middle EGDI group (between 0.25 and 0.50). The remaining countries are divided into two groups: those with a



**Fig. 3.10** Average EGDI 2018 for the Different African Regions. (Source: Figure constructed by the author of data collected from United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://publicadministration.un.org/egovkb/en-us/Data-Center>. Website seen on 26 October 2018)



<b>Min</b>	0.0566
<b>Q1</b>	0.2471
<b>Median</b>	0.332
<b>Q3</b>	0.4198
<b>Max</b>	0.6678

**Fig. 3.11** Box-and-Whisker Plot of African Countries' EGDI 2018 Scores. (Source: Figure constructed by the author of data collected from United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://publicadministration.un.org/egovkb/en-us/Data-Center>. Website seen on 26 October 2018)

low EGDI (14 countries) and those with a high EGDI (six countries). The percentages of African countries grouped by EGDI in 2018 are shown in Fig. 3.12 and listed in Table 3.6.

Ghana is the only African country to have advanced from a middle to a high EGDI rank (ranks the fifth in the African countries EGDI list). Ghana's government has made great achievements in improving the ICT sector through the e-Ghana and e-Transform programmes. Ghana's Shared Growth and Development Agenda (GSGDA) includes a promising ICT strategy that aims to optimize ICT use across all economic sectors and establish an e-government framework to meet the needs for steady growth and foster long-term development (Quaye et al., 2019).

**Table 3.5** Africa's Top Ten Ranked Countries in the 2018 E-Government Development Index (EGDI)

Country	Africa Rank	EGDI 2018
Mauritius	1	0.6678
South Africa	2	0.6618
Tunisia	3	0.6254
Seychelles	4	0.6163
Ghana	5	0.539
Morocco	6	0.5214
Cabo Verde	7	0.498
Egypt	8	0.488
Rwanda	9	0.459
Namibia	10	0.4554

Source: Table constructed by the author of data collected from United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://public-administration.un.org/egovkb/en-us/Data-Center>. Website seen on 26 October 2018

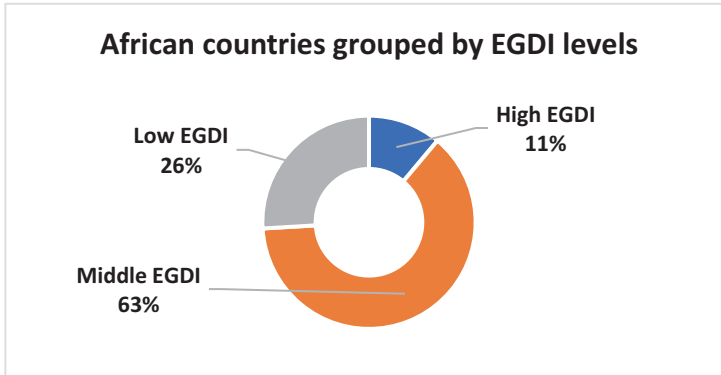
**Table 3.6** African Countries Classified According to their EGDI Levels<sup>a</sup>

High EGDI 2018 (Between 0.50 and 0.75)	Middle EGDI 2018 (Between 0.25 to 0.50)	Low EGDI 2018 (Less than 0.25)	
Mauritius	Cabo Verde	Senegal	Mali
South Africa	Egypt	Ethiopia	Djibouti
Tunisia	Rwanda	Sao Tome and Principe	Sudan
Seychelles	Namibia	Angola	Guinea
Ghana	Kenya	Benin	Comoros
Morocco	Gabon	Mozambique	Mauritania
	Botswana	Congo	Equatorial Guinea
	Algeria	Burkina Faso	Guinea-Bissau
	Zambia	Burundi	Central African Republic
	Uganda	Lesotho	Eritrea
	Cameroon	Gambia	Chad
	Togo	Madagascar	South Sudan
	United Republic of Tanzania	Côte d'Ivoire	Niger
	Libya	Liberia	Somalia
	Eswatini	Sierra Leone	
	Nigeria	Malawi	
	Zimbabwe	Democratic Republic of the Congo	
6 countries	34 countries		14 countries

Source: Table constructed by the author of data collected from United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://public-administration.un.org/egovkb/en-us/Data-Center>. Website seen on 26 October 2018

<sup>a</sup>EGDI levels: Three levels: very high EGDI (more than 0.75), high EGDI (between 0.50 and 0.75), and low EGDI (less than 0.50) (less than 0.25)





**Fig. 3.12** African Countries Grouped by EGDI Levels. (Source: Figure constructed by the author of data collected from United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://publicadministration.un.org/egovkb/en-us/Data-Center>. Website seen on 26 October 2018)

The box plots of the four income groups<sup>3</sup> demonstrate a clear difference between the EGDI Index 2018 results by income groups in Africa: (1) high income, (2) upper-middle income, (3) Lower middle income, and (4). Low income. The disparity is greater between lower middle-income countries and those in the upper middle-income group (The interquartile range is equal to 0.197), see Fig. 3.13. The key descriptive data of the examination of the EGDI 2018 scores of the Income Groups in Africa are summarized in Table 3.7.

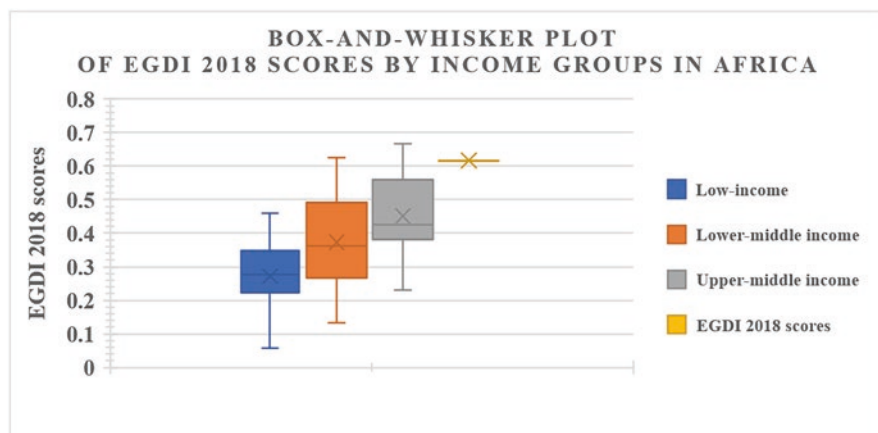
A strong positive correlation ( $R^2 = 0.9738$ ) between the country's income level and its e-government ranking has been detected, as presented in Fig. 3.14. Most countries in high and upper middle-income groups tend to have higher-than-average EGDI scores.<sup>4</sup>

Furthermore, the analysis of the correlation between the EGDI 2018 and log (GNP per capita) for the 54 African countries reveals a positive correlation between the EGDI 2018 scores and log (GNP per capita, current US\$). Telecommunications infrastructure, human capital development, and online services all have a favourable impact on a country's economic prosperity, see Fig. 3.15.

<sup>3</sup>The new country classification by income level has been adopted by the World Bank since 1 July 2017. (<https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2017-2018>)

\* According to the new country classification by income level that have been adopted by the World Bank since 1 July 2017, the different income groups are classified as following: (1). High income: GNI/Capita (current US\$) = > 12,235. (2). Low-income: GNI/Capita (current US\$) = < 1005. (3). Lower-middle income: GNI/Capita (current US\$) = 1006 - 3955. (4). Upper-middle income: GNI/Capita (current US\$) = 3956 – 12,235

<sup>4</sup>Equatorial Guinea is the sole exception, with a low EGDI score (0.2298) despite being an upper-middle-income country.

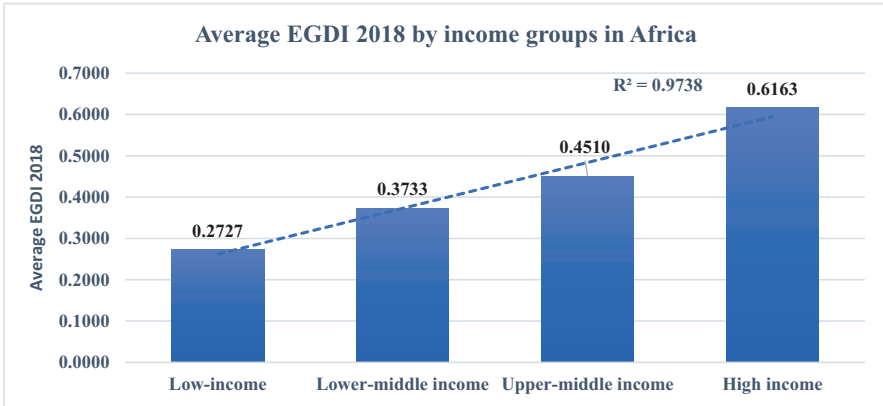


**Fig. 3.13** Box Plots of EGDI 2018 Scores by Income Groups\* in Africa (Source: Figure constructed by the author of data collected from: World Development Indicators, THE WORLD BANK. Scribbr. <http://wdi.worldbank.org/table/WV.1#> United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://publicadministration.un.org/egovkb/en-us/Data-Center> The details of these countries' lists are in Appendix 2)

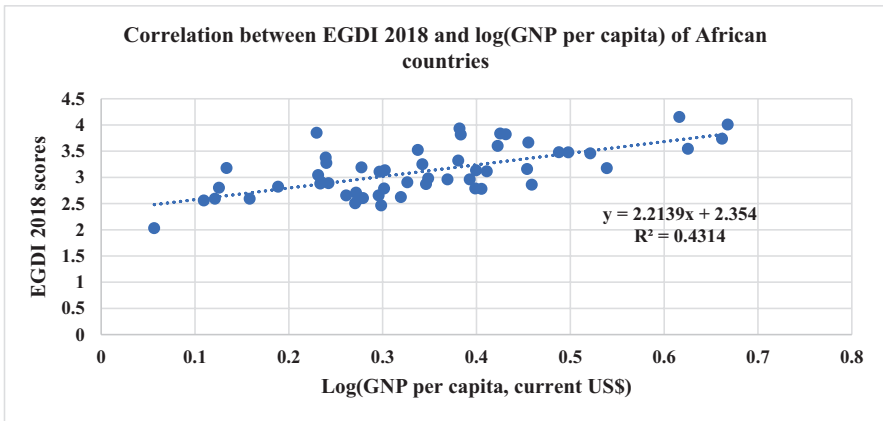
**Table 3.7** Main Descriptive Statistics of the Analysis of the EGDI 2018 Scores of the Income Groups in Africa

Descriptive statistics	Low-income group	Lower middle income group	Upper-middle income group	High income
Min	0.0566	0.1337	0.2298	–
Q1	0.2339	0.2824	0.3833	–
Median	0.27645	0.36155	0.4253	–
Q3	0.341325	0.479525	0.4554	–
Max	0.459	0.6254	0.6678	–
Average	0.27268846	0.37326667	0.45104444	0.6163
Interquartile range	0.107425	0.197125	0.0721	–
Range	0.4024	0.4917	0.438	–
Nb of Countries	26	18	9	1

*Source:* Table constructed by the author of data collected from: World Development Indicators, THE WORLD BANK (last updated date 09/18/2017), <http://wdi.worldbank.org/table/WV.1#> (Website seen on 26 October 2018). United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018, <https://publicadministration.un.org/egovkb/en-us/Data-Center> (Website seen on 26 October 2018).



**Fig. 3.14** Average EGDI 2018 by income groups in Africa. (Source: Figure constructed by the author of data collected from: World Development Indicators, THE WORLD BANK. Scribbr. <http://wdi.worldbank.org/table/WV.1#> United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://publicadministration.un.org/egovkb/en-us/Data-Center> (Website seen on 26 October 2018))



**Fig. 3.15** Correlation between EGDI 2018 and Log (GNP per capita) of African Countries. (Source: Figure constructed by the author of data collected from: World Development Indicators, THE WORLD BANK. Scribbr. <http://wdi.worldbank.org/table/WV.1#> United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://publicadministration.un.org/egovkb/en-us/Data-Center> (Website seen on 26 October 2018))

### 4.3 Digital Transformation Challenges for African Countries

In the last two decades, Africa's ICT sector has outpaced other areas, contrary to popular assumptions. Despite their achievements thus far, African countries still confront numerous challenges in meeting the digital revolution's aspirations. The following are among the main challenges (World Bank, 2011): See Table 3.8

**Table 3.8** Opportunities/Drivers to Success and Challenges of Digital Transformation in Africa

	Opportunities/Drivers to success	Challenges
Access to Communications	A remarkable increase in the availability and access of telecommunications services. Expanded networks with lower prices	Low number/high cost of subscription to fixed-line networks. Low Internet online access/high cost compared to the rest of the world. Low Internet service quality (average bandwidth is low compared to the other regions)
ICTs Infrastructure	Expansion in communications infrastructure (fixed and mobile networks) The rapid growth of mobile network infrastructure in urban areas mainly.	Africa's communications infrastructure is becoming obsolete in comparison to global technologies (A broad variety of ICT services are now delivered on fixed wireless networks that are becoming mobile and fibre-optic.). Rural areas are not getting sufficient access to telecommunications in Africa.
Institutions and Market Reform	Market liberalization Increased competition in the mobile market Growth of private investment (+Privatization of formerly state-owned operators) Regulation and reform of the ICT's sector by a complete reform of the legal framework, new telecommunications laws, new national regulatory institutions The attraction of FDI in telecommunications (Few countries restricted FDI: Comoros, Djibouti, Eritrea, and Ethiopia)	Incomplete market liberalization (few countries have more than three operators, rest mostly two or some cases only one) Lower competition level between mobile operators decreases the market performance (less service/low quality with high prices) Low performance in the fixed-line market because of the absence of competition (Exception: Nigeria has liberalized fixed-line market) Restricted licensing framework: the licensee is limited in what they can do (such as network construction, mobile voice service provision, and Internet service provision). Typically, regulatory approval is required to operate new services or infrastructure.
Investment and sector financing	The remarkable growth of private investment (in mobile infrastructure specifically).	Most of the investment is concentrated in urban areas. More investment is needed in rural areas. Governments must raise funds to subsidize / finance investments in rural areas where commercially viable mobile networks are not yet available.

Source: Author's construction

1. Access to communications: Despite improved availability and access to telecommunications services in Africa, the population's need for fixed-line users remains unmet. Furthermore, Africa falls behind other regions in terms of Internet and online service access.
2. ICT infrastructures: Although Africa has expanded spending on telecommunications infrastructure over the previous two decades, the network architecture used across the continent is becoming outdated. In addition, rural Africa is underserved in terms of network coverage.
3. Institutional and market reform: Market liberalization, increasing competition, and market regulation have all helped Africa's ICT performance since the 1990s. The region's market liberalization, however, is yet incomplete (few countries have more than three operators, the rest mostly two or in some cases only one). The operator's ability to address market needs or exploit new services and market opportunities is likewise limited by the applicable licence system.
4. Investment and industry financing: Africa has undergone huge telecommunications developments since the late 1990s. The business sector provided the majority of the funds. In rural areas where cell networks are not financially feasible, greater investment is required. Governments must promote full market liberalization and increased competition while simultaneously providing government subsidies or financial incentive programmes to fund rural network growth.

## 5 Conclusion and Recommendations

The ICT sector in African countries has evolved significantly during the last two decades, owing mostly to market reform, regulation, and liberalization measures. Still, Africa lags other regions in terms of network penetration and adoption of critical digital platforms and services. African governments must immediately implement critical policies, such as expanding network coverage to rural and underserved areas, ensuring universal access to affordable Internet online services, and developing e-government online services, to fully benefit from the digital revolution. We urge that African countries embrace the following policies and reforms to speed up the digital transformation progress:

1. Expanding the mobile market license to more than two operators and revising the licensing system are the first steps towards full telecommunications market liberalization.
2. Public sector telecommunications companies should be privatized to spur competition and hence improve profitability.
3. Assuring the independence of the regulatory authority and bolstering its legal authority to design and implement sector decisions will improve its performance.

4. Improving the human skills to adapt to the digital revolution needed job qualifications, such as telecommunication engineering, entrepreneurial, and management skills.
5. Governments must mobilize funds to subsidize/finance developments in rural areas where mobile networks are not commercially feasible.
6. When it comes to telecommunications infrastructure, governments should invest more in digital technologies like submarine fibre-optic cables and extend investments in wireless broadband access networks.
7. Promote and accelerate public-private partnership investments in digital infrastructure and service delivery.

## 6 Practical Implications for Research and Policy

The study contributes to the expanding literature and knowledge by presenting a detailed analysis of Africa's digital transformation advances. ICT researchers, academics, and students are expected to gain from such a study. It should also help policymakers, investors, and aid donors by emphasizing the continent's prospects and challenges and by recommending policies to speed up the digital transformation process in the continent.

## Appendices

### *Overall Networked Readiness Index (NRI) for African Countries (2012–2016)*

Country	2012	2013	2014	2015	2016	Overall NRI Rank 2016
Algeria	3.01428717	2.78277509	2.98282334	3.08664739	3.2057467	117
Benin	3.04842292	2.96859819	2.82301182	N/A	2.88634706	128
Botswana	3.5832413	3.49842346	3.43340943	3.42993346	3.53227897	101
Burundi	2.57334671	2.30482395	2.30600438	2.41386741	2.39695255	138
Cameroon	2.93481326	2.94970841	2.94366363	2.9878204	2.98217529	124
Cape Verde	3.71155927	3.7782262	3.73370308	3.78350462	3.82630028	85
Chad	2.55303686	2.53281004	2.2237678	2.29794552	2.19769772	139
Côte d'Ivoire	2.97828057	2.99720867	3.13544304	3.23096761	3.38570905	106
Egypt	3.76605908	3.77938419	3.71262105	3.62673421	3.66133686	96
Ethiopia	2.85312248	2.85304043	2.94933398	2.86584377	3.10775058	120
Gabon	N/A	2.97179877	2.98480275	3.03759855	2.94150555	125
Gambia	3.40879757	3.47191843	3.38243672	3.32123796	3.30807129	113
Ghana	3.44253997	3.51117372	3.64734349	3.48970576	3.5070749	102

Country	2012	2013	2014	2015	2016	Overall NRI Rank 2016
Guinea	N/A	2.60986653	2.48367479	2.39095987	2.64872864	134
Kenya	3.51444491	3.53870415	3.71036825	3.81711673	3.82595378	86
Lesotho	2.77507477	2.68413548	2.88381261	2.99060049	3.2761689	115
Liberia	N/A	3.48491737	3.1883241	N/A	2.80852736	130
Malawi	3.05447515	2.82879105	2.90321655	2.78058379	2.72869684	132
Mali	2.92971547	2.97133548	2.99688312	2.98083069	2.90295315	127
Mauritania	2.5464707	2.70860212	2.61209433	2.54040963	2.50121711	136
Mauritius	4.0601376	4.12393733	4.31435212	4.48502633	4.37917533	49
Morocco	3.55529772	3.64200276	3.60656451	3.93170617	3.94604914	78
Mozambique	2.98671418	2.76424874	2.77414391	2.91839779	2.99660769	123
Namibia	3.34992857	3.29483705	3.41220133	3.46851673	3.59676524	99
Nigeria	3.22328981	3.26561979	3.3119252	3.16962094	3.15120258	119
Rwanda	3.70015636	3.68165778	3.77953	3.87170431	3.92170507	80
Senegal	3.41556819	3.3340951	3.29641163	3.33515311	3.37972609	107
Seychelles	N/A	3.80339223	4.02284297	3.99830505	4.0016851	74
South Africa	3.86983478	3.87436234	3.97562601	3.9901659	4.15929394	65
Tanzania	2.94770271	2.92108614	3.03851207	3.00324656	2.90918109	126
Tunisia	4.11649066	N/A	3.77113752	3.87951611	3.91543322	81
Uganda	3.25492622	3.30441328	3.25374558	3.22270939	3.08939011	121
Zambia	3.25650957	3.19413925	3.33853815	3.24364581	3.24740361	116
Zimbabwe	2.93603309	3.17025771	3.23781505	3.05143428	3.0345336	122
Average Africa	3.23	3.20	3.24	3.27	3.28	

Source: World Economic Forum, The Networked Readiness Index Historical dataset (2012–2016). Scribbr. [http://www3.weforum.org/docs/GITR2016/WEF\\_NRI\\_2012-2016\\_Historical\\_Dataset.xlsx](http://www3.weforum.org/docs/GITR2016/WEF_NRI_2012-2016_Historical_Dataset.xlsx)

### ***African Countries GNI Per Capita (current US\$, 2017) and E-Government Development Index (EGDI) 2018***

Country	Gross national income per capita, Atlas method \$ 2017	Income level	EGDI 2018
Seychelles	14,180	High income	0.6163
Mauritius	10,140	Upper-middle income	0.6678
Eswatini	8520	Upper-middle income	0.382
Equatorial Guinea	7060	Upper-middle income	0.2298
Botswana	6820	Upper-middle income	0.4253
Gabon	6610	Upper-middle income	0.4313

Country	Gross national income per capita, Atlas method \$ 2017	Income level	EGDI 2018
Libya	6540	Upper-middle income	0.3833
South Africa	5430	Upper-middle income	0.6618
Namibia	4600	Upper-middle income	0.4554
Algeria	3960	Upper-middle income	0.4227
Tunisia	3500	Lower middle income	0.6254
Angola	3330	Lower middle income	0.3376
Egypt, Arab Rep.	3010	Lower middle income	0.488
Cabo Verde	2990	Lower middle income	0.498
Morocco	2860	Lower middle income	0.5214
Sudan	2380	Lower middle income	0.2394
Nigeria	2080	Lower middle income	0.3807
Djibouti	1880	Lower middle income	0.2401
Sao Tome and Principe	1770	Lower middle income	0.3424
Cote d'Ivoire	1540	Lower middle income	0.2776
Eritrea	1500 <sup>a</sup>	Lower middle income	0.1337
Ghana	1490	Lower middle income	0.539
Kenya	1440	Lower middle income	0.4541
Cameroon	1360	Lower middle income	0.3997
Congo, Rep.	1360	Lower middle income	0.3024
Zambia	1300	Lower middle income	0.4111
Lesotho	1280	Lower middle income	0.2968
Mauritania	1100	Lower middle income	0.2314
Senegal	950	Low income	0.3486
Tanzania	910	Low income	0.3929
Zimbabwe	910	Low income	0.3692
Benin	800 <sup>a</sup>	Low income	0.3264
Guinea	800	Low income	0.2348
Mali	770	Low income	0.2424
Comoros	760	Low income	0.2336
Ethiopia	740	Low income	0.3463
Rwanda	720	Low income	0.459
Guinea-Bissau	660	Low income	0.1887
Chad	630	Low income	0.1257
Burkina Faso	610	Low income	0.3016
Togo	610	Low income	0.3989
Uganda	600	Low income	0.4055
Sierra Leone	510	Low income	0.2717
Congo, Dem. Rep.	450	Low income	0.2612
The Gambia	450	Low income	0.2958



Country	Gross national income per capita, Atlas method \$ 2017	Income level	EGDI 2018
Mozambique	420	Low income	0.3195
Madagascar	400	Low income	0.2792
Central African Republic	390	Low income	0.1584
South Sudan	390 <sup>a</sup>	Low income	0.1214
Liberia	380	Low income	0.2737
Niger	360	Low income	0.1095
Malawi	320	Low income	0.2708
Burundi	290	Low income	0.2985
Somalia	107 <sup>a</sup>	Low income	0.0566

Source: *Income level*: World Development Indicators, THE WORLD BANK, <http://wdi.worldbank.org/table/WV.1#>

*EGDI 2018*: United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://publicadministration.un.org/egovkb/en-us/Data-Center>

<sup>a</sup>For these countries (Somalia, South Sudan, Benin, and Eritrea), their GNI per capita was taken from the source because it was not available from the source (World Bank): United Nations E-Government Knowledgebase (UNeGovKB), E-government Development Index, 2018. Scribbr. <https://publicadministration.un.org/egovkb/en-us/Data-Center>

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# Chapter 4

## Patterns of Misalignment Between Performance of Fundamental Variables and Exchange Rate Determination in a Globalized World



Saleha Jameel and D. K. Yadav

**Abstract** In this comparative study, we attempted to trace the pattern of misalignment in exchange rate with respect to the movement of fundamental variable of the respective countries by using annual observations over the period of 27 years from 1991 to 2017. This study includes four models in which we assess the pattern of misalignment of exchange rate with respect to the movement of GDP, interest rate, inflation and current account balance in India, China, and the USA using fixed-effect LSDV model. The base theory of the study is short-run and long-run theory of exchange rate in order to identify the fundamental variable that effect exchange rate. We analyse the factors like interest rate, productivity, inflation rate, current account balance of all the three economies are important factors of exchange rate that trace misalignment in exchange rate and explain the exchange rate dynamics to a large extent. We observed that these factors are not so significant for the developed economies and significant to some extent in India.

**Keywords** Currency Misalignment · Fundamental Variables · Exchange Rate · India · China · The USA

### 1 Introduction

The growing interaction in markets between countries all over the world has made the idea of globalization increasingly trending in recent years. The developed nations favoured for globalization to get benefits from widening size of the market for their products; locating and speeding optimally capital investment across

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different countries. For developing countries like India, globalization carries benefits and opportunities as well as costs and risks. Both India and China have been recently using globalization as an opportunity to accelerate the economic growth so as to catch up with developed nations. The foreign exchange market is much affected by globalization, as it determines the competitiveness of goods and services in global markets and affects currency value too. When currency value is overvalued or undervalued and not in line with fundamentals, it is considered as currency misalignment.

Currency misalignment is an area of interest since long, there are many research papers and studies are available which proves the fact. Some studies say that it is related to undervaluation and overvaluation of currencies, while some correlates it with the movement of fundamental variable and microvariables. China is considered the best example for currency misalignment, as it is an emerging economy in matter of economic growth but its currency has been devalued since long.

In this study, currency misalignment defines whether the exchange rate follows the movement of fundamental variable or not. If exchange rate follows the movement of fundamental variables, then there is no currency misalignment, and if it not, then currency misalignment exists. Basically, it is said that the factors influencing exchange rate differ in short run and long run. Many studies investigated that fundamental variables influence exchange rate in long run; on the other hand, some argues that in long run currency misalignment corrects itself and said the movement of fundamental variables influences the exchange rate only in short run. According to Stein Masunda, movements in real exchange rate should be in line with real fundamentals, and if it has persistently wandered away from the long-run equilibrium exchange rate, then it will be misaligned.

Exchange rate misalignment acts as indicators on how the exchange rate will have to gravitate in a freely floating exchange rate regime and how authorities need to revalue (devalue) their exchange rate in countries employing the fixed exchange rate system. Exchange rate misalignment is argued to be an important determinant of economic growth. Overvaluation presumed to hurt growth whereas the correlation between undervaluation and growth is weak.

The word globalization means free trade or free movement of goods and services all over the world in an integrated manner. Nowadays, as economies are getting more integrated with the world economy and indulging more into extensive trade and capital flows with countries all over the world due to globalization foreign exchange rate plays an important role as it determines the competitiveness of goods and services in the global markets and affects the currency value. In 1973, exchange rates became much volatile after the collapse of Bretton Wood system. Due to exchange rate volatility, lot many researches have been undertaken to understand the behaviours of exchange rate movements. The exchange rate is the price of domestic currency relative to foreign currency. As exchange rate determines the competitiveness of goods and services, the exchange rate has a direct impact on international prices of goods and services as well as financial assets, the value of currencies in terms of foreign currencies are essential in determining exports and imports of countries and the exchange of financial assets in global market.

The determinants of exchange rate are classified as short run and long run. Long-run factor is linked with goods market and labour market whereas short-run factors work through the changes in domestic and international financial markets. Inflation rate differentials, differences in domestic interest rate, and foreign interest rate or expected future exchange rates all have an impact on current exchange rate in the short run. As inflation dropped down, domestic interest rate rises or foreign interest rate falls, they all lead to increased demand for the domestic currency; consequently, the currency value increases or appreciates. Conversely as the demand for currency decreases in a domestic or global financial market, the currency value will lose its value relative to other currency. The long-run factors determining exchange rate are trade policies, differences in price levels of products in domestic versus foreign countries, differences in productivity, and preferences for foreign versus domestic products.

The exchange rate is the price of one currency relative to another currency. Since exchange rate has a direct impact on international price of goods and services on international prices of goods and services as well as financial assets, exchange rates are very much volatile nowadays after the collapse of Bretton woods system in 1973 since then lots of research have been undertaken to understand the behaviour of movements of exchange rate.

The exchange is the most important price in any economy, for it affects all other prices. In most countries, policy towards the national currency is prominent and controversial. Economic epochs are often characterized by the prevailing exchange rate system – the Gold Standard Era, The Bretton Woods Era. Contemporary development from the creation of an economic and monetary union to successive waves of currency crisis reinforces the centrality of exchange rate to economic trends, i.e. Floating Exchange Era.

International monetary regimes tend towards one of the two ideal types. The first is the fixed rate system in which currencies are tied to each other at publicly announced rates. Some fixed rate system involves a common link to commodities such as gold/silver, others peg to a national currency such as US dollar and Euro. The second ideal and typical monetary regime is free floating in which national currency value varies with market conditions and national macroeconomic policies. Nowadays, one more regime is introduced that is managed exchange rate system in which there is government intervention to some extent.

The exchange rate is such an important rate that politicians may wish to manipulate it for the purpose of winning elections, rather than stabilizing an international regime.

Two fundamental currency decisions confront policymakers, and each has distributional consequences. First policymakers must decide whether to heed external signals and join the dominant international or regional regime. Second for all but irrevocably fixed rate regimes, policymakers also confront choices involving the level of exchange rate, the price at which the national currency trades in foreign exchange markets.

## **2 Exchange Rate System: Post-reform Period**

### ***2.1 Exchange Rate System in India***

India has a managed floating exchange rate system where the exchange rate of the rupee with another currency is determined by the market factors of supply and demand and sometimes whenever needed government/RBI intervenes in the exchange rate system of India. Before 1992, India had a fixed exchange rate system but after 1992 RBI discontinued the fixed exchange rate system due to ineffectiveness of monetary policy. Economic liberalization or economic reform of 1990 resulted in the adaptation of floating exchange rate system of India.

### ***2.2 Exchange Rate System of China***

China struggled to evolve from an underdeveloped market to a central player across the world economy; it has experienced growing pains and faced policy reforms that have frequently sent shockwaves through market around the world. Foreign exchange policies have been main attempts to ease into a position as a leading world economy while promoting the Yuan as a global reserve currency. Unlike many other countries that allow the value of their currency to float freely, China has controlled its currency policy strictly. It regulates the trading activities and tries to control daily movements of the Yuan on the forex market. In order to have economic stability, China fixed its exchange rate in 1995. In August 2015, China took a step further by allowing its currency to devalue outside of the previous trading, i.e. government could consider previous day trading in the establishment of the currency rate.

A large apart of China's reserve are denominated in US dollars and are invested in US treasury bonds, which are deemed to be safe haven for capital among major central banks around the globe. It is estimated that China is the largest single nation holder of US bonds, with approximately US \$ 1.25 trillion of these securities.

### ***2.3 USA Exchange Rate System***

Most major countries with established stable economic market use a floating exchange rate. The US economy uses floating exchange rate. Floating exchange rates are determined by the market based upon supply and demand. US currency is the dominating currency across the world economy. It is also known as global currency.

## 2.4 Determination of Exchange Rates

It is foreign exchange market where exchange rate among different currencies is determined. At present, India and the USA follow floating or flexible exchange rate regime while China follows pegged exchange rate regime from 1993 onwards, earlier China was following fixed exchange rate regime, i.e. fixed by the government till 1993 and then they pegged their currency against dollar till 2015 they pegged their currency against various currencies. The exchange rate regime of the USA is totally market driven while India follows managed exchange rate regime that means RBI intervenes in foreign exchange market to influence the exchange rate of rupee (Table 4.1).

Earlier we have discussed the variations in exchange rate of three economies, viz. India, China, and the USA with respect to the movement of their fundamental variables through trend analysis. This work has been started with seven fundamental variables that are GDP growth, interest rate, inflation, domestic savings, investment, employment, and current account balance. According to the theory, only four variables affect the exchange rate, i.e. GDP growth, interest rate, inflation, and CAB; rest of the variable affects the exchange rate indirectly. As per trend analysis, we can see that India shows some variations in exchange rate with respect to the movement of its fundamental variables and sometimes it is as per theory and sometimes it is not, while China and the USA hardly show any variations in exchange rate with respect to the movement of their fundamental variables which is not as per the theory. From the trend analysis, we can also see that fundamental variable of China was performing very well whereas performance of fundamental variable in the USA was worst. But when we talk of currency, US currency is strongest whereas currency of India is weakest among all the three currencies. In trend analysis itself, we can see that there is some kind of artificial intervention in the determination of exchange rate. Therefore, there is a need to answer empirically the question such as what is the impact of fundamental variables on exchange rate of the respective countries, viz. India, China, and the USA and is there any currency misalignment among these three economies? Whether and how far the exchange rate depreciates or appreciates

**Table 4.1** Factors of exchange rate and its effect on currency value

Factors	Change in factors	Response of currency value
Domestic interest rate	↑	↑
Foreign interest rate	↑	↓
Expected domestic price level <sup>a</sup>	↑	↓
Expected import demand	↑	↓
Expected export demand	↑	↑
Expected productivity <sup>a</sup>	↑	↑

Source: *The economics of money, banking, and financial market*, Mishkin, F. S.

<sup>a</sup>Relative to other countries

Note: Only increases in the factors are shown; the effects of decreases in the variables on the exchange rate are the opposite of those indicated in the "Response" column



due to the changes in fundamental variables? We attempt to answer these questions through this study.

This study will analyse the pattern of currency misalignment of India, China, and the USA. In this chapter, first I will perform unit root test to analyse the stationarity of the data. After that, we will apply fixed-effect LSDV model. For the empirical tests, we will use four models for four different variables, i.e. GDP growth, interest rate, inflation, and current account balance and will introduce dummies accordingly because if we regress all the variable in one model, we have to introduce lots of dummies and that can create problem in the result.

### 3 Review of Literature

Bhalla (2002) found changes in the real exchange rate to be significant explanatory variable for growth acceleration – the greater the change in real exchange rate, the higher the acceleration in the per capita growth rates. The Balassa Samuelson thesis – that real exchange rate increases with per capita income – was confirmed for a number of countries, especially developed economies including Japan. So, it is a belief that exchange rate increases with the acceleration of macro variables. Charles Engel and Kenneth D. West (2005) argue that fundamental variables such as relative money supplies, outputs, inflation, and interest rates provide little help in predicting changes in floating exchange rates. In the study of Nihal Bayraktar, it is illustrated that when global economy came under real stress in 2008, Chinese economic growth dropped precipitously from 13% to 6%. But only after 12 months, growth was back up by 12%. Other countries dropped by 30% whereas in case of China it was just 15% in 2008–09 and the effect of the global downturn lasted only 12 months. N R Bhanumurthy (2006) presents the study that investigates the relative importance of macro- and microvariables in determining the exchange rate movements in India. In this study, he works on primary data collected from the Indian foreign exchange dealers. In 2004, he presented the same issue worked with secondary data. N R Bhanumurthy illustrated in his study that fundamental variables are significant for long and medium run. Parthapratim Pal and Partha Ray (2018) presents in their commentary that downfall of Indian rupee is due to global factors and huge dependency of oil imports. And the situation is not as bad as 2013. India's currency has indeed depreciated with respect of all four major currencies since April 2018.

### 4 Models

We base this empirical study on the pattern of misalignment in India, China, and the USA. The main question of this chapter is whether and how far exchange rate appreciates or depreciates with the increase and decrease of GDP growth, interest rate, inflation, and current account balance of the respective country.

## 4.1 Variables

For our analysis, we identify four independent variables as follows:

- *Inflation rate*: The purchasing power parity theory says the exchange rate between one currency and another is in equilibrium when their domestic purchasing powers are equal at that exchange rate. The inflation rate of a country can only be higher or lower than other country to the extent that its exchange rate depreciates/appreciates.
- *Interest rate*: Another important factor for movement in exchange rate in recent years has been differences in interest rate between trading countries. The open interest parity theory says that the domestic interest rate must be higher/lower than foreign interest rate by an amount equal to the expected depreciation/appreciation of the domestic currency.
- *GDP growth*: Generally booming economies always lift the value of currency, if there is no government intervention. At the same time during recession, economy will always lead to lose the value of currency.
- *Trade balance*: Trade balance is another factor that determines the exchange rate. If a country is a surplus economy, it will lead to appreciate its currency whereas deficit economies always lead to depreciate the currency.

Here, the dependent variable is Exchange rate.

## 4.2 Data Sources: Secondary Data

World Bank Development Index,  
IMF's e-library  
Trading Sites

## 5 Tests

For this, we apply Hadri LM unit root test on each variable to check whether each of these variables is stationary or not.

Now, we use fixed-effect LSDV model to be estimated as follows:

$$ER = f(\text{GDPgrowth, Interest Rate, Inflation, CAB})$$

### Model 1

$$ER = \beta_0 + \beta_1 \text{GDP} + \beta_2 \text{D2} + \beta_3 \text{D3} + \beta_4 \text{GDPD2} + \beta_5 \text{GDPD3} + u_i \quad (1)$$

where

ER = Exchange rate

$\beta_0$  = Intercept

$\beta_1$ GDP = GDP of reference country {Reference country is India}

$\beta_2D_2$  = Dummy variable {Dichotomous; 1 = China, 0 = others}

$\beta_3D_3$  = Dummy variable {Dichotomous; 1 = USA, 0 = others}

$\beta_4$ GDPD<sub>2</sub> = GDP of D<sub>2</sub>

$\beta_5$ GDPD<sub>3</sub> = GDP of D<sub>3</sub>

**Model 2**  $ER = \beta_0 + \beta_1Int + \beta_2D_2 + \beta_3D_3 + \beta_4IntD_2 + \beta_5IntD_3 + ui$  (2)

where

ER = Exchange rate

$\beta_0$  = Intercept

$\beta_1$ Int = Interest rate of reference country {Reference country is India}

$\beta_2D_2$  = Dummy variable {Dichotomous; 1 = China, 0 = others}

$\beta_3D_3$  = Dummy variable {Dichotomous; 1 = USA, 0 = others}

$\beta_4$ IntD<sub>2</sub> = Interest rate of D<sub>2</sub>

$\beta_5$ IntD<sub>3</sub> = Interest rate D<sub>3</sub>

**Model 3**  $ER = \beta_0 + \beta_1Inf + \beta_2D_2 + \beta_3D_3 + \beta_4InfD_2 + \beta_5InfD_3 + ui$  (3)

where

ER = Exchange rate

$\beta_0$  = Intercept

$\beta_1$ Inf = Inflation in reference country {Reference country is India}

$\beta_2D_2$  = Dummy variable {Dichotomous; 1 = China, 0 = others}

$\beta_3D_3$  = Dummy variable {Dichotomous; 1 = USA, 0 = others}

$\beta_4$ InfD<sub>2</sub> = Inflation in D<sub>2</sub>

$\beta_5$ InfD<sub>3</sub> = Inflation in D<sub>3</sub>

**Model 4**  $ER = \beta_0 + \beta_1Cab + \beta_2D_2 + \beta_3D_3 + \beta_4CabD_2 + \beta_5CabD_3 + ui$

(4)

where

ER = Exchange rate

$\beta_0$  = Intercept

$\beta_1$ cab = Current account balance of reference country {Reference country is India}

$\beta_2D_2$  = Dummy variable {Dichotomous; 1 = China, 0 = others}

$\beta_3D_3$  = Dummy variable {Dichotomous; 1 = USA, 0 = others}

$\beta_4$ cabD<sub>2</sub> = Current account balance of D<sub>2</sub>

$\beta_5$ cabD<sub>3</sub> = Current account balance D<sub>3</sub>

Hypothesis:

$H_0$ : Exchange rates do not follow current account balance.

$H_1$ : Exchange rates follow current account balance.

## 6 Observation and Results

### 6.1 Unit Root Test (Table 4.2)

From the above table, it is clear that our data are stationary at first difference because the  $p$  value at first difference is supporting to accept null hypothesis of Hadri LM unit tests, i.e. all panels are stationary while when data are at level  $p$  value supported to reject null hypothesis and it shows that panel contains unit root problem. Data at first difference are of same order, so we can use the original data as per the theory of cointegration.

### 6.2 Pattern of Currency Misalignment with Respect to GDP (Table 4.3)

$$\begin{aligned}
 \text{INDIA} \rightarrow \quad ER &= (D2 = 0, D3 = 0) \\
 &= \beta_0 + \beta_1 \text{GDP} + u_i \\
 &= 0.787 + 2.381 \text{GDP} + u_i
 \end{aligned}$$

$$\begin{aligned}
 \text{CHINA} \rightarrow \quad ER &= (D2 = 1, D3 = 0) \\
 &= \beta_0 + \beta_1 \text{GDP} + \beta_2 + \beta_4 \text{GDP} \\
 &= (\beta_0 + \beta_2) + (\beta_1 + \beta_4) \text{GDP} + u_i \\
 &= (50.787 - 41.242) + (2.381 - 2.283) \text{GDP} + u_i \\
 &= 9.545 + 0.98 \text{GDP} + u_i
 \end{aligned}$$

**Table 4.2** Stationarity test of independent variable

Variable	Data at level ( $p$ value)	Data at first difference ( $p$ value)
GDP growth	0.0000	0.8496
Interest Rate	0.0000	0.9154
Inflation Rate	0.0000	0.8663
Current Account Balance	0.0000	0.6988

**Table 4.3** Regression result of GDP growth

Model	unstandardized coefficients		Standardized coefficients	$T$	Significance
	$B$	Std. Error	Beta	$B$	Std. Error
(Constant)	50.787	6.006		8.457	0.000
GDP	2.381	0.861	0.283	2.766	0.007
D2	-41.242	10.247	-0.639	-4.025	0.000
D3	-49.296	6.869	-0.764	-7.177	0.000
GDPD2	-2.283	1.196	-0.358	-1.909	0.060
GDPD3	-2.400	1.427	-0.117	-1.682	0.097

Dependent variable: ER

$$\begin{aligned}
 \text{USA} \rightarrow \quad ER &= (D2 = 0, D3 = 1) \\
 &= \beta_0 + \beta_1GDP + \beta_3 + \beta_5GDP \\
 &= (\beta_0 + \beta_3) + (\beta_1 + \beta_5)GDP + ui \\
 &= (50.787 - 49.296) + (2.381 - 2.4)GDP + ui \\
 &= 1.491 - 0.019GDP + ui
 \end{aligned}$$

In India, the impact of GDP on exchange rate is 2.381 units which means as GDP increases, exchange rate will increase by 2.38 units that show that currency will depreciate instead of appreciating. When we talk of China, we can see that as GDP increases, currency is depreciating by 0.98 units rather it has to increase. In the USA, GDP is negatively correlated which means as GDP increases, exchange rate will go down which signifies that currency will appreciate by 0.019 units. So we can trace currency misalignment in case of all three economies with respect to GDP.

### 6.3 Pattern of Currency Misalignment with Respect to Interest Rate (Table 4.4)

$$\begin{aligned}
 \text{INDIA} \rightarrow \quad ER &= (D2 = 0, D3 = 0) \\
 &= \beta_0 + \beta_1INT + ui \\
 &= 74.748 - 1.485INT + ui
 \end{aligned}$$

$$\begin{aligned}
 \text{CHINA} \rightarrow \quad ER &= (D2 = 1, D3 = 0) \\
 &= \beta_0 + \beta_1INT + \beta_2 + \beta_4INT \\
 &= (\beta_0 + \beta_2) + (\beta_1 + \beta_4)INT + ui \\
 &= (74.748 - 64.233) + (-1.485 + 1.478)INT + ui \\
 &= 10.515 - 0.007INT + ui
 \end{aligned}$$

**Table 4.4** Regression result of real interest rate

Model	Unstandardized coefficients		Standardized coefficients Beta	t B	Significance Std. Error
	B	Std. Error			
(Constant)	74.748	4.545		16.447	0.000
INTR	-1.485	0.753	-0.152	-1.974	0.052
D2	-64.233	5.028	-0.996	-12.776	0.000
D3	-73.235	6.103	-1.136	-12.000	0.000
INTRD2	1.478	0.926	0.107	1.595	0.115
INTRD3	1.467	1.226	0.101	1.197	0.235

Dependent variable: ER

$$\begin{aligned}
 \text{USA} \rightarrow \quad ER &= (D2 = 0, D3 = 1) \\
 &= \beta_0 + \beta_1 INT + \beta_3 + \beta_5 INT \\
 &= (\beta_0 + \beta_3) + (\beta_1 + \beta_5) INT + ui \\
 &= (74.748 - 73.235) + (-1.485 + 1.467) INT + ui \\
 &= 1.513 - 0.018 INT + ui
 \end{aligned}$$

In India, the interest rate is negatively correlated that means as interest rate increases, exchange rate will decrease by 1.485 units which are as per the theory. When we turn to China, we can see that as interest rate increases, exchange rate will go down by 0.007 units which mean currency is appreciating only by 0.007 units. The interest rate of the USA is also negatively correlated which means as interest rate goes up exchange rate will decline by 0.018 units which signify that currency will appreciate only by 0.018 units. So with respect to interest rate, we find that correlations are as per theory but it has no significance in China and the USA because we can see that the values are so minute that it has almost no impact.

**6.4 Pattern of Currency Misalignment with Respect to Inflation (Table 4.5)**

$$\begin{aligned}
 \text{INDIA} \rightarrow \quad ER &= (D2 = 0, D3 = 0) \\
 &= \beta_0 + \beta_1 INF + ui \\
 &= 78.468 - 1.579 INF + ui
 \end{aligned}$$

$$\begin{aligned}
 \text{CHINA} \rightarrow \quad ER &= (D2 = 1, D3 = 0) \\
 &= \beta_0 + \beta_1 INF + \beta_2 + \beta_4 INF \\
 &= (\beta_0 + \beta_2) + (\beta_1 + \beta_4) INF + ui \\
 &= (78.468 - 68.079) + (-1.579 + 1.605) INF + ui \\
 &= 10.389 + 0.026 INF + ui
 \end{aligned}$$

**Table 4.5** Regression result of inflation

Model	Unstandardized coefficients		Standardized coefficients	t	Significance
	B	Std. Error	Beta	B	Std. Error
(Constant)	78.468	4.727		16.600	0.000
INF	-1.579	0.578	-0.228	-2.730	0.008
D2	-68.079	5.257	-1.056	-12.950	0.000
D3	-77.008	6.644	-1.194	-11.590	0.000
INFD2	1.605	0.663	0.204	2.422	0.018
INFD3	1.573	1.904	0.065	0.826	0.411

Dependent variable: ER

$$\begin{aligned}
 \text{USA} \rightarrow \quad ER &= (D2 = 0, D3 = 1) \\
 &= \beta_0 + \beta_1 INF + \beta_3 + \beta_5 INF \\
 &= (\beta_0 + \beta_3) + (\beta_1 + \beta_5) INF + ui \\
 &= (78.468 - 77.008) + (1.579 + 1.573) INF + ui \\
 &= 1.46 - 0.006 INF + ui
 \end{aligned}$$

From the above data, we can notice that inflation is negatively correlated in case of India and the USA which is not as per the theory while it is positively correlated to China. The increase and decrease of currency units due to inflation are significant in case of India, i.e. 1.579 units but for rest of the countries, it is insignificant because the increase and decrease of currency units are too low between 0 and 1, and when we look at the *p* value, it also denotes the same.

### 6.5 Pattern of Currency Misalignment with Respect to Current Account Balance (Table 4.6)

$$\begin{aligned}
 \text{INDIA} \rightarrow \quad ER &= (D2 = 0, D3 = 0) \\
 &= \beta_0 + \beta_1 CAB + ui \\
 &= 62.235 - 3.425 CAB + ui
 \end{aligned}$$

$$\begin{aligned}
 \text{CHINA} \rightarrow \quad ER &= (D2 = 1, D3 = 0) \\
 &= \beta_0 + \beta_1 CAB + \beta_2 + \beta_4 CAB \\
 &= (\beta_0 + \beta_2) + (\beta_1 + \beta_4) CAB + ui \\
 &= (62.235 - 52.203) + (-3.425 + 3.581) CAB + ui \\
 &= 10.032 + 0.156 CAB + ui
 \end{aligned}$$

**Table 4.6** Regression result of current account balance

Model	Unstandardized coefficients		Standardized coefficients Beta	<i>t</i> <i>B</i>	Significance Std. Error
	<i>B</i>	Std. Error			
(Constant)	62.235	2.573		24.190	0.000
CAB	-3.425	1.393	-0.354	-2.459	0.016
D2	-52.203	3.806	-0.809	-13.715	0.000
D3	-60.827	4.814	-0.943	-12.636	0.000
CABD2	3.581	1.558	0.246	2.298	0.024
CABD3	3.411	1.872	0.181	1.822	0.072

Dependent Variable: ER

$$\begin{aligned}
 \text{USA} \rightarrow \quad ER &= (D2 = 0, D3 = 1) \\
 &= \beta_0 + \beta_1 \text{CAB} + \beta_3 + \beta_5 \text{CAB} \\
 &= (\beta_0 + \beta_3) + (\beta_1 + \beta_5) \text{CAB} + ui \\
 &= (62.235 - 60.827) + (-3.425 + 3.411) \text{CAB} + ui \\
 &= 1.408 - 0.014 \text{CAB} + ui
 \end{aligned}$$

As we all know that India and the USA, both are deficit economy whereas China is a surplus economy and the trend analysis of earlier chapter proves the same. We can see from the above table that as current account balance increases, exchange rate of India and the USA will decrease that means currency will appreciate. Though the currency value of the USA is increasing but its current account balance is in deficit but in India the current account balance is in deficit so its currency is depreciating. On the other hand, when we look at Chinese currency and its current account balance, it seems opposite. The currency of China should appreciate as its CAB is in surplus but it is depreciating. The current account balances of all the three economies are insignificant in determining the exchange rates of the respective countries (Tables 4.7, 4.8, and 4.9).

**Table 4.7** Factors of india and its resulting response to currency value

Factors	Change in factors	Currency value
Domestic interest rate	↑	↑
Expected domestic price level	↑	↑
Current account balance	↑	↑
Expected productivity	↑	↓

**Table 4.8** Factors of china and its resulting response to currency value

Factors	Change in factors	Currency value
Domestic interest rate	↑	↑
Expected domestic price level	↑	↓
Current account balance	↑	↓
Expected productivity	↑	↓

**Table 4.9** Factors of the USA and its resulting response to currency value

Factors	Change in factors	Currency value
Domestic interest rate	↑	↑
Expected domestic price level	↑	↑
Current account balance	↑	↑
Expected productivity	↑	↑



## 7 Conclusion

In India, the GDP growth and inflation are significant while CAB and interest rates are insignificant. But in case of China and the USA, all the four fundamental variables are insignificant which we can see from  $p$  value of regression result. On the other hand, when we talk of exchange rate determination with respect to the movement of four fundamental variables, i.e. GDP growth, interest rate, inflation, and CAB only interest rate of all three economies supports the theory, rest of three variables are not supporting the theory. So, from the empirical analysis we can say that in determining exchange rate there are some artificial interventions which deviates the exchange rate movement with respect to the movement of fundamental variables. As a result, we can say that exchange rates do not follow the movement of fundamental variables and currency misalignment is present in case of all the three economies. The data which are observed here is a long period but still we can analyse that there is misalignment, so we can conclude that misalignment in long run does not correct itself rather it exists in long run too.

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# Chapter 5

## Going Smart or Smarting by Efforts – Digitising Life in Covid Times



Moumita Mukherjee and Anindita Majumdar

**Abstract** The two-year span of March 2020 to February 2022 has been a time of unprecedented change in human life and practically all professional spheres. ‘Work from Home’, which was previously a term known to a select few in the corporate world, became a household phrase with everyday meaning and execution. ‘Online Classes’, heretofore, a special treat of some of the top advanced technology schools, became the very base – the primary platform of imparting education, be it in school, college, or university levels. For those who could afford it, life in some fashion took on an easier form, but for those who could not, education began to be rephrased in the category of luxury as opposed to necessity. To put things in perspective, loss of employment reached a shocking figure of ten million during the second wave of COVID-19, resulting in income decrement in over 97% households (Business Today, 1 June 2021). In the light of these circumstances, how far the digitisation endeavours have panned out, in what forms, and spanning what layers of the populations, are worth exploring. Another avenue of investigation would be how efficacy in teaching and learning could be impactful and/or impacted in the given circumstances. From the governmental, both state-wise and national, efforts at making digital education affordable to an extent, to the rise of ed-tech start-ups and related ventures targeted for those in the higher income bracket, the emerging picture is at the same time dismal, as it is fascinating. The present chapter aims to explore the space and functionality of the digitisation endeavours during this phase and discusses potential long-term effects for specifically the education sector and for society in general.

**Keywords** Smart Education · Education for the Future · Digitisation and Economy · Teaching–Learning Efficacy · Academic Impact

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## 1 Introduction

The recent living experience of many people has been inundated with the term ‘smart’ in varied facets of their lives. From smart watches, televisions, to smart classrooms, the world seems to have changed and so have we. What does need deeper exploration and reflection is the nature of such change or what really is meant by the ‘smartness’. Is it only referring to technology paving the path for smoother and/or faster movement of erstwhile regular processes or are there larger multi-faceted and multi-layered issues in consideration?

The objective of the present book chapter is to discuss these questions, noted at the beginning of the chapter. It is an attempt at exploration of the overall bearing of enterprises of digitisation and what, if any, lasting impact such efforts may have facilitated. In particular, the authors focus on how smart education has become a part of the lives of many and yet remains inaccessible to some layers of society, and some of the factors influencing the contrasting reality.

Electronic education, or to use the common term e-education, is not something new that has emerged from the recent pandemic phase. E-education was there in the teaching–learning forte, globally, since early 2000. But only a few could afford to avail it, especially in a developing country like India. Though many popular private ICSE, CBSE, and IB curriculum schools in urban locality were offering e-mode of education to their students, the concept remained limited to use of smart boards, app-based projects, etc. Not the conventional syllabus-oriented studies were going on with utilisation of electronic or the digital platform. Further, the schools under state or central government, and those are in rural areas were not even getting these facilities of digital education. In view of this scenario, it would not be a mistake to state that with COVID-19 pandemic outbreak, the education world, globally, and in context to India, has witnessed a digital revolution. And now when we are passing through this endemic era, it has become even more crucial to look back and evaluate the major highlights of this educational digitisation to review its implications for the future generation.

The chapter is distributed into three sections, followed by a segment intersecting all three. While speaking from the Indian context, it is important to understand that educational digitisation here depends upon three most important predicament (1) economy, (2) digital teaching–learning efficacy, and (3) digital divide and educational policy of inclusion. In this article, all these three factors will be discussed separately and in detail.

## 2 Digitisation and Economy

### 2.1 Digitisation – Prior to COVID-19

Before the novel coronavirus pandemic hit, jumping on the bandwagon of digitisation may have been a choice for individuals and organisations, alike. When everything, as in life as we know it, shut down, it was no longer optional to incorporate

digital technology into life. And while the digital transformation may have been in process at a graded and gradual pace, the pandemic gave it a notable and urgent boost, accelerating the process. According to a report published by the OECD, digital transformation was still at a relatively early stage, even two years earlier (OECD Digital Economy Outlook 2020, OECD, 2020). However, the changes brought about or rather fast-tracked by the pandemic are likely here to stay. The change in accommodating digital technology into professions, academic, medical and health-care, governance, and even social communication is in progressive direction, and unlikely to see a reversal, even once the pandemic is over (OECD, 2020). In this context, the OECD report also raises the concern of whether access to digital resources and infrastructure can or could be truly universal, or whether a digital divide would indeed materialise.

## 2.2 *Digital Divide*

Badiuzzaman et al. (2021) defined digital divide as inequality in access, consumption, and effect of ICT and digital technology among individuals, as well as at organisational and national levels.

Different facets of digital divide, defined in terms of ‘who’, ‘which’, ‘how’, and ‘what’, have been discussed by Van Dijk (2020) in the book ‘The Digital Divide’ published from Polity Press. To elaborate, Van Dijk (2020) discusses in detail, who are experiencing the digital divide, which factors or characteristics are influencing it, how are they affected, i.e., in terms of access, skills, usage, and what type of technology is the digital aspect in concern, along with the process in which the division in digitisation access and usage appears to be affecting the populace. A nuanced understanding of digital divide is necessary to truly understand how it influences people from different walks of life. As Van Dijk (2020) cautions against an oversimplified dichotomisation of haves and have nots, the notion of ‘absolute inequality’ in terms of complete ‘inclusion’ or ‘exclusion’ may not be entirely accurate. Van Dijk (2020) clarifies that the divide may be more of a relative distinction in terms of varying motivation levels, physical access to technology, skills and availability, and degree of overall support.

### 2.2.1 **Economy, Education, and the Digital Divide – The Global Scenario**

Digital divide existed in pre-pandemic times, perhaps in terms of unequal levels of technological advancements in different geographical and financial walks of society. A PEW Report published in 2019 noted that rural areas have generally had lesser accessibility to Internet, in comparison with urban regions, even in first world countries such as the USA, (Perrin, 2019; Vogels, 2019). Infrastructure inadequacy may again be linked to lack of comparable progress in areas of education, training, health, and miscellaneous other areas, often seeing exodus of many intelligent

minds towards urban pastures. Such lack of resources, particularly in the rural regions, came more to the forefront in Covid times, when traditional mode of operation of life, as we know it, be it school or work, came to a standstill, and many countries resorted to lockdown, regionally or nationally, in the effort to contain the spread of the contagious disease. Even at residential levels, especially where multiple users require significant Internet access, issues of Internet speed owing to limitations on relevant infrastructure from service providers or the consumers or some combination of the same, often lead to unreliable and slow connections, which hampers functionality (Federal Communications Commission, FCC, 2020).

In March 2020, the United Nations released a report on response to the socio-economic effects of COVID-19, where they noted that 166 nations closed educational institutions from schools to university levels, to contain the spread of the virus. It may be noted here that this was at the early stage of the disease and resultant lockdowns. Eighty-seven per cent of the enrolled students at school up to university level, running to a staggering figure of one and a half billion, were affected, by the same. More than 60 million teachers no longer could access the physical classroom to impart education. The world economy, which was already struggling, was thrust into recession, with the advent of COVID-19 and its containment endeavours, with potentially unprecedented levels of unemployment and deprivation in demands, supply, and services. With massive restrictions in travel, manufacturing, and transport of goods, quarantines, etc., job losses were practically inevitable. However, the reality surpassed the already gigantic figure of millions, estimated in early 2020, as noted in the UN report. Among those hit, the hardest were daily wage earners, the self-employed, and small and medium enterprises, notes the UN report (2020). Another group affected hugely with job loss and consequently loss of livelihood and residences were migrants. Overall, for developing and least developed countries, many of which already had struggling economies, the potential impact of Covid, from overwhelming debt accumulation to abysmal health care sectors and severely limited hygiene facilities, marked concerns remained. Many OECD (Organisation for Economic Co-operation and Development) countries saw the migrants among the most affected, accounting up to 30% of the workforce. According to estimates by the International Labour Organization (ILO), major negative impact was likely especially at macroeconomic levels. Another concern was the impact on gender, especially women potentially becoming comparatively more economically disadvantaged, and more likely to face domestic violence. (Shared Responsibility, Global Solidarity: Responding to the socio-economic impacts of COVID-19, 2020).

According to a March 2020 report by the World Food Programme (WFP), more than 300 million children across the world were not getting school meals, owing to school closures and lockdown, in the effort to contain COVID-19. Many of the children, especially in the developing, or least developed countries, who depend on school meals are from economically disadvantaged families. The WFP Director of School Feeding, Burbano noted that for children, especially for those from deprived socio-economic backgrounds, the impact was nothing short of catastrophic, since it practically took away their only viable source of a nutritious meal of the day.

Solutions to provide meals to children, especially those in dire needs, were in the planning stage at the time. It may be noted the figures reported do not include India, since lockdown in India began 4 days after the report was published on 20 March 2020 (World Food Programme gears up to support children left without meals due to COVID-19 school closures, 2020).

The burden of investment in education lies squarely on the shoulders of households, more in poorer countries than in richer ones (Mason et al., 2016). Therefore, it is not unreasonable to extrapolate that when families, particularly in developing or least developed countries, are struggling with financial challenges, which increased enormously owing to job losses and pay cuts, during the COVID-19 pandemic times, people from lower socio-economic strata had less to spare for educational accoutrements. Putting food on the table, and if needed affording health care, may well have been greater priorities in such trying times, over education. This may be at least partly the reason behind the inequality in digital access, be it inability to purchase a suitable device, such as a computer, i.e., desktop or laptop, or tablet, or at least a smartphone, then purchasing broadband Internet connection or financing the renewal charges, every month. Another area of challenge is insufficient infrastructure in terms of bandwidth access needed by a significantly larger percentage of the population compared to the percentage who needed the same in pre-Covid days. With country-wide lockdowns in several countries, and many people who work in what was termed the non-essential services sector, having to switch to work-from-home set-up almost overnight, many countries, especially developing and least developed ones, their governments and ministries of information and telecommunications were not well equipped enough to handle the demand promptly.

A Report of an Economic Experts Roundtable organised by the ITU (International Telecommunication Union), 2020, compiled by Dr. Raul Katz of the Columbia Institute for Tele-Information presented some clarity of the financial effect of COVID-19 on global digital infrastructure. The Roundtable had two panels focusing on: (1) COVID-19 economic impact on the digital infrastructure as a crucial enabler for the changing economy and society, and (2) the contribution of digital infrastructure to social and economic resilience facing the pandemic. The report was succinct, with executable suggestions for policymakers, regulators and other industry decision makers. Thus, besides contributing lucidity, the report also discusses potential solutions to emerging challenges during the pandemic times (Economic impact of COVID-19 on digital infrastructure - Report of an Economic Experts Roundtable organized by ITU. International Telecommunication Union - Development Sector, 2020).

The scenario of Africa is also concerning. As noted in the Ibrahim Forum Report 2021, which was an attempt to take an overview of how the African countries were faring in the face of the pandemic, 1 year after its onset, revealed, among other things, notable inequalities across Africa, with regards to the educational sector. The 2021 Ibrahim Forum Report records a whopping 89% of students in sub-Saharan Africa with no access to computers at home. More than 80% do not have access to the Internet, and at least 20 million learners are beyond the network coverage of mobile phones. There is also notable gender bias, where girls lack access to digital

devices and technology overall, markedly more compared to boys (Covid-19 in Africa. 2021 Forum Report One Year On: Impact and Prospects, 2021).

The Ibrahim Report 2021 also notes that the pandemic had uncovered a two-layered problem, which presumably needed a two-layered solution. Evidently, digital device was a reality in majority of the African countries' context. However, looking at the issue in isolation wouldn't be effective. The digital divide, at least so far as device accessibility is concerned, could be bridged by ensuring every learner got a computer or other pertinent technical gadget. Yet that would not automatically translate to uninterrupted access to education, considering electricity shortage, or complete lack for many. Less than 50% of the sub-Saharan population had electricity connection, till 2018 (Covid-19 in Africa. 2021 Forum Report One Year On: Impact and Prospects, 2021). This once again highlights the multi-faceted nature of the digital divide and digitisation problems.

### **2.2.2 Economy, Education and the Digital Divide – The Indian Scenario**

A report from the World Economic Forum (Modi & Postaria, 2020) noted that the essential transition, almost overnight, from offline i.e., in the classroom education to online learning did not materialise for many students and teachers, with massive inequalities in affordability and access to technology and the Internet. The digital divide was existing long before the Covid pandemic hit, but the divide was not in the forefront until the rather sudden and fast paced shift to online learning became the call of the day for the educational sector, when lockdowns were announced. It also emphasised the necessity of responding to the need of the hour with appropriate modifications and advancements in policies in economic, digitisation and education domains, and the intersection point of the three.

A fairly comprehensive Case Study of effects of Covid and India's response, particularly in the context of the education sector, was published by UNICEF in October 2021. The report titled 'India Case Study – Situation Analysis on the Effects of and Responses to COVID-19 on the Education Sector in Asia' (October, 2021). All schools, government or private, closed in India as part of the country-wide government mandated lockdown in late March 2020. The idea was originally to reopen school in less than a month. However, with the spread of the virus increasing, no provision was found for re-opening schools till more than a year, in some states almost 2 years later. As reported in the UNICEF Case study referring to Nielsen & Internet and Mobile Association of India (IAMAI, 2019), 32% of the population in rural regions and 54% in urban areas had access to Internet. More notably, only 11% of households in the country had digital devices other than smartphones such as desktops or laptops or tablets. The Oxfam India Status Report (2020), published in September 2020 with over 1500 participants from five states, Bihar, Chhattisgarh, Jharkhand, Odisha, and Uttar Pradesh, including parents of children studying in private or government schools and government school teachers noted that more than 80 per cent of learners enrolled in government schools in Bihar, Chhattisgarh, Jharkhand, Odisha, and Uttar Pradesh did not receive any educational material

during the lockdown, as schools remained closed. In many cases, the lack could probably be attributed to the families not having access to digital devices, technology or uninterrupted Internet connection (Oxfam India Status Report, 2020).

The UNICEF India Case Study Report further notes that children who were already struggling with various obstacles in the routine educational process, from living in remote locations, to having special needs, were during the lockdown facing the situation of getting severely limited to practically no teaching learning at all. Other groups affected were children of migrant workers, and refugees seeking asylum, and those families where the primary breadwinner passed away. The possibility of many such students leaving school altogether was therefore rising. Upadhyay et al. (2020) noted that India has over hundred million children enrolled in the mid-day meal schemes, and for many from impoverished backgrounds, the same is a big draw to schools. Also, sanitary hygiene, etc., is provided to girl students in schools. Schools closing down meant an end to both.

Unemployment became a major issue for India's economy, in Covid times (UNICEF India Case Study Report, 2021). More than 100 million Indians lost employment in April 2020, including over 90 million small business owners, and labourer. Almost 18 million each of salaried persons and self-employed individuals also lost their jobs during this time (United Nations in India Covid-19 Immediate Socio-Economic Response Plan, 2020).

Therefore, in the light of the above information, it is understandable, how affording digital devices, and ensuring adequate digital infrastructure for online education may not have been a top priority in many Indian households, amidst dire financial difficulties. While several government welfare schemes do exist, the part of ensuring that the neediest get them is still circumspect.

### **3 Digitisation in Education, Teaching–Learning Efficacy, Inclusion**

#### ***3.1 Teaching–Learning Efficacy and Educational Digitisation***

The word 'efficacy' in generic sense means to produce an intended outcome. In this connection, the concepts of teaching and learning efficacy signify the teachers' and students' ability to achieve their teaching–learning goals as per the designed curriculum. Weber et al. (2018) described learning efficacy as 'the degree of individual's confidence in actual application of skills and knowledge taught to them in either classroom or training sessions'. From this definition, particular emphasis on application and training could be inferred. The students need to be taught or trained in such a manner so that they can apply their skills or knowledge in most efficient way whereas teaching efficacy 'is the level of confidence teachers have in their ability to guide students to success, which includes helping students learn, building effective programmes for students and guiding students to apply their learnings into real life practices' (Gkolia et al., 2014). Here also, as teaching outcome, it can be observed



that the concept of applying learnt skills by the students is getting emphasised in respect to the description of teaching efficacy. However, while imparting application-based training to students, the teachers' themselves require to have adequate skill training. Further, when it is involving teaching with technology-based equipments, not only the in-depth subject knowledge but an expertise in technology and the digital platform in use equally becomes crucial. In most circumstances, teachers tend to have subject-relevant knowledge, but the e-mode-specific expertise is the part that lacks.

In present scenario, teaching efficacy refers not only to imparting subject skills with rote learning method, but also to make the class actively engaging where application of the theory learnt could be demonstrated. However, making this happen through digital platform can often become a challenging task to both teacher and student community. With the unprecedented shift in educational world due to Covid pandemic, in India where practising digital teaching–learning was only limited to use of PowerPoint presentation and smart board, that too in few private schools in urban sectors, it came as a blow to every student and teacher where everyone struggled to accomplish the teaching–learning goal. Thus, the concept of meeting optimum efficacy level, both in regard to teaching and learning, became a utopia. Though, at present, the words like Zoom, G-Meet, Webex, MS Teams, etc., have become common names in teaching–learning community, when it all started, adapting to this change was not the only challenge.

The real challenges like making the classes actively engaging for every student to participate in classroom interactions, inculcating discipline and motivation among students, and assigning age and merit appropriate tasks to every student to ensure that the works are actually done by them and not by the parents are still persisting. Nevertheless, now when the schools and colleges have all resumed towards this endemic time, another challenge which the teachers and facing is meeting the skill-based knowledge gap in students that caused due to complete 2 years of online learning. Some of the reasons for this knowledge gap could be because of lack of technology-based efficacy in teaching–learning forte, lack of proper training in assistive technology-based teaching and learning, gap between theory and practical lessons taught, and most importantly plunging into educational digitisation without modifying the syllabus to suit the purpose. This is noteworthy that most Indian educational institutions still follow traditional teaching–learning method with minimum revision in age-old syllabus curriculum. Though with recent education planning, and several revisions made in the course structure by NCERT in last one decade, still the style of delivering instructions mostly remaining same. With this digitisation in education forte, now a massive change in course as well as teaching–learning structure needed, and that further need wholesome training for both student and teaching community to develop digitised teaching–learning efficacy. However, in a developing country like India, building such infrastructure and making required assistive technological resources available to every educational institute, how much that is feasible and in what pace it remains a big question.

Some of the studies (Mishra et al., 2020; Muthuprasad et al., 2021; Naik et al., 2021) conducted in Indian scenario, during the lockdown phase found out that in

spite of the flexibility and convenience provided by online learning, the teachers and students are preferring traditional chalk-duster and lecture method over digital mode. This cause has been attributed to unavailability of resources, training facilities, proper tools and infrastructures, and Internet access. In the report published by Department of School Education & Literacy, Ministry of Education, Government of India (July 2021), the challenges faced by Indian education system, due to the unprecedented shift in mode of imparting knowledge, have been highlighted clearly. However, the report presented an optimistic outlook towards feasibility of hybrid education, and futuristic plan to take a step forward to this opportunity could also be noted from it.

A small survey was conducted by the authors of this article from end of 2020 to 2021 beginning noted an interesting finding. The survey was conducted with selected number of teachers and students from schools, colleges, and universities. This purpose of this survey was to assess the level of online teaching and learning efficacy among students and teachers. Online teaching (Gosselin, 2009) and online learning efficacy forms (Yavuzalp & Bahcivan, 2020) were used for the purpose. Though the number of participants was limited to 80 only, and the survey was also limited to geographical location of West Bengal, the understanding it provided in terms of overall online teaching–learning efficacy is worth noting. It was observed that the school students are lacking online learning efficacy, whereas the college and university students demonstrated considerably better online learning efficacy in comparison with the school students. Further, the online teaching efficacy findings were observed to be having no reported difference between school, college, and university teachers. However, the common limitation which was noted from this survey was that on the part of lack of Internet access, digital platform usage training, and unavailability of device/ resource to afford digitised education. The survey observation noted college and university students reporting better online learning efficacy and satisfaction, this can be explained in the light of a published work by Darius et al. (2021). This published research reported that as online teaching–learning with college and university students involves more interactive sessions in terms of power point presentations, activity-based project assignments, etc., and as these students are better equipped to manage digital devices by themselves, hence, digitised learning is more effective, productive and satisfying for them. But with school students, especially with young children below age 10 years, to achieve the same teaching–learning outcome is not only challenging but require a different level of skill training on part of the teachers.

### ***3.2 Digitisation, Inclusion, and Exclusion***

This unprecedented digitisation has not only created challenges for teaching–learning community from varied economic background, but also imposed even greater challenges to the inclusive policy of education system. Digital divide created a gap between demographics and regions in terms of information communications and

technology (ICT), 320 million in India presently are adversely impacted due to this pandemic-caused digitisation. A survey reported by Ministry of Rural Development stated that 47% Indian household does not receive more than 12 hours of electricity, and more than 36% of Indian schools operate without electricity (Modi & Postaria, 2020). Inequality in digital educational access in Indian primary level of education was noted and reported even during pre-Covid era (Venkatswamy, 2015; Thakur, 2014; Panda et al., 2013), which increased to a level up with the advent of Covid.

Most of all, the severe impact has been noted in the area of special education. Few studies have focused on this line during this pandemic phase. But it is equally important to understand the concerns and challenges faced by students with disability and/or special need and their educators and parents during this educational digitisation phase. Since very few works focused on their everyday struggle during lockdown, it would not be wrong to say that due to unprecedented digitisation the group of students who are supposedly falling under inclusive policy actually experienced exclusion from the system. A preliminary work published last year (Majumdar et al., 2021) reported the concerns faced by special educators' while continuing with online teaching during Covid lockdown. This study conducted a preliminary level of semi-structured interview with 12 Rehabilitation Council of India (RCI) registered special educators to understand their perspectives regarding digitisation of education. The special educators not only stated the challenges faced by them, but also highlighted the concerns of the parents having children with disability and/or special need. As the children with special need require unique way of skill training sessions, which are more need-based in nature, teaching them in online mode demands active engagement of parents' end as well separate assistive technology-based teaching-learning aid. Alongside, the educators too need to be trained with both knowledge and skill to work with technological tools in either online or hybrid mode. The poor Internet connectivity, lack of infrastructure, awareness, training, etc., all these definitely became concerns with sudden shift in mode of imparting education. On top of that with 2.21% of Indian population with reported disability (Verma et al., 2016), it became even more challenging to manage and keep the inclusive policy of education system on going.

Another article published recently (Das & Majumdar, 2022) presented some interesting findings both from global and Indian perspectives. According to this article, the concept of digital education in fields of disability and special need, globally, is not something new. This article cited earlier work (Betts et al., 2013; Borg et al., 2011; Borg & Ostergren, 2015; Bradshaw, 2020) that suggest utilisation of assistive technology and digital mode of education with persons with disability (PWD). But most of these works have been conducted by researchers outside India; in Indian scenario, we are yet to get there. The elaborate concepts regarding use of digital aids and platform in education that this study highlighted, points out not only lack of technology-based training, unavailability of assistive technology-based teaching-learning materials (TLM), but also lack of awareness regarding these digital facilities on educators' part.

## **4 Bringing It All Together – Summary and Concluding Remarks**

### **4.1 Summary**

To summarise, the present authors of the book chapter focused on few key aspects that have become salient during Covid times. The necessity, the execution and effective utilisation of digitisation in an injured economy. Whether access to technical devices, or uninterrupted Internet connection, or the requisite skills of the end users, the authors have discussed, to an extent how far we have come, and further how much path is left to be travelled. They have also incorporated personal accountability, efforts, preparedness and execution of digitisation, in terms of learning efficacy of students, teaching efficacy of educators, within limits and constraints of the situation and circumstances. Another facet of educational adaptation discussed in the chapter, concerns the issue of inclusion and exclusion, especially in the context of children with special needs. Assistive technology, in routine life may already be an overwhelming adaptation to handle for many; to do that during the additional constraints of COVID-19 prevention and management protocols, did not make things easier for learners with special needs.

### **4.2 Concluding Remarks**

From this context, though it is still not the right time to infer that whether educational digitisation has any future feasibility in India or not, as many more training-based research required to be conducted in this line of work to understand its future prospect. However, as every line of thought has its own positive outcome and limitations, educational digitisation revolves around the same continuum. On one hand, it has created digital and economic division, while making the adherence to inclusion policy and imparting life-skill training extremely difficult; on the other hand, to those who can afford digitisation has made education easily accessible to them, students can take more courses and engage in productive multitasking. Similarly, for the teachers who feel competent with digital mode is better able to manage online classes with more activity-based engaging and interactive session. Alongside with video recording of classes students can avail to clear their doubts with as many times re-playing the recordings, and to some extent if adequately adapted digitisation has the potentiality to make the teaching–learning process more transparent for all teacher, student, and parent community.

Another facet of ensuring better use and application of digital devices would require skills training for those using the same. In many cases, neither children nor parents, especially where parents are from poor or non-educated backgrounds, may be adequately familiar with digital devices or regular broadband routers, modems, etc., to be able to use them appropriately and effectively. Some basic training for

them would be particularly helpful. Similarly, where teachers are not tech-savvy, but were performing suitably in traditional classrooms, schools may arrange hands-on orientation and demonstration programmes for them, before asking them to overnight switch their teaching from offline to online modes. Also, should the need for social, or more accurately physical distancing be necessary again, instead of completely closing down schools, perhaps a blended or tiered approach could be considered, depending on infrastructure and human resources at the school or higher educational institutions' disposal. Overall, COVID-19 has taught the economic, technical, and education sectors a great deal. Each of the three sectors, along with other stakeholders, must begin and/or continue to work in a coherent fashion for effective outcomes for all.

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# Chapter 6

## Rethinking the Role of the Company's Office and the Ways Employees Communicate: A Trend Accelerated by the Pandemic



Yeliena V. Prokhorova, Mykhailo P. Sahaidak, Tetiana O. Sobolieva, and Nataliia H. Holionko

**Abstract** The objective of this chapter is to analyze the practice of remote work during the pandemic in the world and in Ukraine and to develop proposals on the company's office design and employees' communication methods and instruments at the conditions of quarantine limitations and after them. The recommendations for the employees' communication ways and human resource management priorities are developed.

**Keywords** Company's office role · Employees' communication · Remote work · Ukraine · COVID-19

### 1 Introduction

Over the last years, all businesses, even in the fastest growing areas, have been the most sensitive to the crisis, which has, in fact, become a logical consequence of the coronavirus pandemic. The vast majority of business organizations find themselves in a situation of significant financial stagnation, both due to environmental factors (introduction of measures by governments to close borders, reduce export-import and logistics operations, periodic temporary ban on the activities of enterprises in various areas of business) and due to top management and management mistakes made by top and HR management organizations.

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In the realities of quarantine restrictions, business owners and business management are faced with the task not only business processes optimization, but primarily to develop a new strategy for managing people and implementing elements of post-crisis management system, which is directly related to complex management decisions in conditions of uncertainty, ambiguity, limited financial resources, and risk. In this aspect, rethinking the role of the top, middle, and front office of the company directly affects the ways, methods, and channels of employees' communication, the proper allocation of resources over time, as well as effective management of remote teams. In fact, this approach can be characterized as proactive crisis management, which allows for flexible planning of activities with a focus on certain starting points of recovery.

Strategic guidelines or current trends in rethinking the role of the company's top office in reengineering key business processes and establishing effective communication between employees should be, first, the health, safety, and well-being of employees during COVID-19, and second, social, psychological, and moral responsibility of organizations, responsibility of line managers, assessment of reputational status, performance of duties by employees outside of work, which can be achieved through the organization of flexible work and effective management of remote teams.

Before the pandemic, the common idea was that offices are critically important for the cooperation between employees, organizational culture, and performance. Some surveys argued that remote work is less productive, because people cooperate less by distance technologies. But the new reality is that, for example, in April, 2020, 62% of employed Americans worked at home compared with about 25% a few years ago (Boland et al., 2020). The same situation with remote work all over the world. The survey conducted by Gartner Inc. in March 2020 (Gartner, 2020), found that almost 25% of respondents among 317 financial managers would transfer at least 20% of their employees to a permanent separate work format. In the European Union, the share of employees who worked permanently or periodically remotely in 2020 has doubled compared to 2006 and amounted to 21%. This indicates a general trend of increasing the use of flexible work schedules. The influence of the COVID-19 crisis on this trend is confirmed by the fact that this increase in the share of remote work occurred by 4% in the first 14 years and by 6% only in the period from 2019 to 2020 (Eurostat, 2021). At the same time, there is an uneven distribution of the share of remote work between European countries. In some countries (Bulgaria, Romania), this share is less than 3%, in others (Luxembourg, the Netherlands) more than 40%. More than 30% of employed people worked remotely in 2020 in Finland, Denmark, Belgium, and Ireland. In Malta, France, and Austria, the figure ranges between 25 and 29.4%. The reasons for such decisions are the understanding of CFOs the need for tight cost management in the company, and the desire to support employees (avoid layoffs) and minimize the negative impact on the enterprises' activities in times of COVID crisis.

During the last decade, researchers tried to find new models of office design and employees cooperation models, combining as physical office design, so digital technologies and instruments for productive work. The COVID-19 quarantine restrictions made this task the most actual and accelerated researches in this area.

The aim of this article is to analyze the practice of remote work pushed by the pandemic in the world and in Ukraine, and to develop proposals on the company's office design and employees' communication.

## 2 Employees' Communication Changes at the Remote Work

Researchers identified that information technologies were widely used during the last years for improving collaboration between employees. Messaging, enterprise social media, such as Slack and Microsoft Teams, and virtual-meeting software, such as Zoom, GoToMeeting, and WebEx, allow companies to save time and costs on travelling and physical presence at meetings. From one point of view, modern informational technologies (IT) support better interaction and cooperation in organizations. From another point, there is evidence that IT has produced less interaction between employees. For example, the employee may choose when to answer or to send an email, open a browser window, post on Slack or Teams, or make a call. At the same time, it was found that face-to-face interactions dropped by roughly 70% after the firms transitioned to open offices, while electronic interactions increased to compensate (The Truth About Open Office, 2019).

The studying of the digital technologies for collaboration before COVID-19 found that remote work significantly restricts collaboration by digital channels. McKinsey's study of a major technology company from 2008 to 2012 found that remote workers communicated nearly 80% less about their assignments than collocated team members did; in 17% of projects they did not communicate at all (The Truth About Open Offices, 2019). Having this research results, it is the task to develop such approaches to cooperation using informational technologies that will be effective during the quarantine limitations and after it. Taking into account that the recent study of a 700-person corporate headquarters evidence that 82% of employees would like to work from home even after quarantine limitations (Reimagining the Urban Office, 2020) the task is very actual.

According to McKinsey research (Boland et al., 2020), 41% of respondents said that they are more productive at remote work during the quarantine, than they worked in an office, and 28% respondents said that they have the same productivity. The study showed that employee productivity also depends on the balance between work and personal life, compliance with which determines the level of human happiness. The probability of possible remote work, in consultation with management and without loss of family life, directly affects the level of happiness of the employee and increases his productivity.

Very valuable is Microsoft's experience of remote work before the pandemic: in 2018 their Netherlands subsidiary renovated office, which was closed for 10 weeks. As a result, 800 employees became remote workers (Sherman, 2020). Microsoft's analytics gathered lessons from this experiment, which is actual for more than 50,000 of their employees during the pandemic. The main findings are the following. Firstly, employees reported feeling more disconnected without possibility

day-to-day meet physically, as they name it, the “water cooler or coffee machine” effect. Secondly, 42% of Dutch employees reported that they were satisfied by the possibility to plan their work and meetings flexible. It was found that after-hours activity increased by 21%, at the same time people’s total workweek remained constant. It means that people changed their schedule, for example, spent more time with family and children and made the last work in the evening. In order to prevent “always-on culture,” the rules were set about the response time and “delayed delivery” emailing used. Thirdly, it was witnessed a 10% increase in collaboration in a form of team meetings and one to one collaboration with managers.

Microsoft researchers analyzed the Global Labor Trends Index 2021, which surveys more than 30,000 people in 31 countries, analyzes trillions of productivity and labor indicators in Microsoft 365 and LinkedIn, and the views of experts who have studied collaboration, social capital, and space design for decades at work. The authors of the study identified seven main trends caused or triggered by the pandemic that will shape the future of the hybrid world of work after quarantine (The Next Great Disruption, 2021): (1) extreme flexibility and mixed work—factors that will determine the workplace after the pandemic. As a result, a new important goal for managers will be to provide employees with flexibility to work where and when they want to work, and to provide them with the tools they need to productive work; (2) constant lack of regular live communication between managers and their employees, which leads to a feeling of detachment of the latter from the office work; (3) high-digital intensity of working hours and days, a flurry of unstructured and partly unplanned communications led to the exhaustion of workers and their loss of balance between life and work; (4) the looming growing risks of work for Generation Z, a demographic group of workers aged 18 to 25, who are the first generation to have a completely remote work environment from the start of employment and who, according to the report, are most affected by loneliness and participation concerns in online meetings and the need to offer their own new ideas; (5) narrowing the workforce through a sense of isolation in the workplace, as in the personal life caused by the pandemic, threatens innovation in the company; (6) the true authenticity that workers have brought to the corporate culture of companies during the pandemic years will contribute to their future productivity and well-being. In this difficult year, colleagues relied on each other in a new way, whereupon relations at work have become more humane; and (7) expanding the talent market through remote work formats. During the pandemic, the number of vacancy announcements with possible part-time work in LinkedIn has grown more than five times and they are still in demand. This trend increases access to employment opportunities for all segments of the world’s population. An analysis of LinkedIn’s economic chart shows that women, Generation Z, and those without a degree are more likely to apply for remote vacancies.

Taken together, these trends indicate a change in the traditional view of the format of collaboration, a change in the mental model of employees and the acceptance of global extraordinary flexibility by company executives. Also, it is the obvious need for business leaders to change their operating model for a successful transition to hybrid work.

Another Microsoft research about their employees' remote work during spring, 2020, allows to make some conclusions and recommendations about effective distance work organization (Spataro, 2020). The first fact was that weekly meeting time increased by 10%. On average there were three additional meetings per week per employee. Nearly 70% of employees from all functional areas were involved in increased number of meetings. Secondly, the number of short meetings (up to 30 min) increased by 22%, while long meetings (more than 1 h) decreased by 11%. As Microsoft's managers argue, the common trend before pandemic in their company was to hold longer meetings. Therefore, the shift from long to short meetings is a positive result during remote work.

If take into account the remote work experience of Kyiv National Economic University named after Vadym Hetman, the number and the duration of meetings increased dramatically during March–June, 2020. If usually, the average number of department meetings was one-two during a month, up to 2 h; during the quarantine limitations, the meetings in Microsoft Office 365 Teams were held every week or every 2 weeks from 2 to 3 hours. Partly, this increase in number of department meetings may be explained by the new tasks, which had to be done in consequence of the quarantine limitations. But mostly this increase in meetings was coursed by the new distance mode of work and new problems with organization of remote work. Only half a year later, beginning from Autumn, 2020, the number of department meetings returned to the previous frequency, as before the pandemic.

The further Microsoft remote work analysis founded that the number of one-to-one person meetings increased by 18% and team meetings grew by 10%. And half of these new meetings were recurring. As respondents answered, one-on-one meetings replaced their physical meetings in the office. Finally, it was 72% increase in instant messages sent during the remote work in March, 2020, comparing with the average number of messages during January and February, 2020. Managers sent 115% more instant messages during March 2020; individual employees said that their instant messages increased more than by 50%.

Changes in communication methods affect both their quantity and quality. On the one hand, the number of discussions and meetings usually increases, which overloads employees both physically and emotionally. On the other hand, such communications become more focused on the purpose of discussion, add more energy to issues, lead to transformation, and strengthen organizational culture (Hilberath et al., 2020).

### 3 Corporate Office Role During the Pandemic

According to McKinsey survey, gathered responses from 283 C-suite leaders from different industries across the world, most companies are planning to change their office policy during the next 3 to 9 months (Bernauer et al., 2021). At the conditions of uncertainty, which is a result of Covid-19 quarantine limitations, 68% of respondents answered that cost management is one of the three most important priorities

for corporate centers, growth 63%, digital capabilities 47%, and only 28% reorganization. Planning cost reductions, 21% of respondents predict reductions in facilities, 19% in human resources management, 18% in strategy, and 17% in IT.

The role of corporate center is changed during and after the quarantine limitations. Answering the question “Which role will the corporate center play in changing ways of working?” 56% of respondents answered that it will be the driver of change for the rest of the organization; 34%—it has to develop the role model for the rest of the organization (Table 6.1).

Executives expect that the corporate center will be leading in strategy setting for the organization (82%) and financial steering of the organization (66%)—Table 6.2.

One of the main effects of quarantine limitations during the Covid-19 pandemic on the organization of the office work is a shift to remote work. As a result, 71% of respondents considered that the corporate centers are the frontrunners regarding the reduction of travel, allowing certain staff to work from home full-time or part-time, i.e., more than 2 days per week (60–68%); establishment of online training. The main challenges in sustaining work from home are the next: technical infrastructure, collaboration, coaching and performance management, burnout (52–61%).

As an aggressive response to cost management requirements as one of the three most important priorities for corporate centers, it is planned a more radical optimization of office space during and post COVID-19 limitations. It is planned to reconfigure, how office space is used and increase space per employee to allow for social distancing in the short run (up to 68% of respondents). In the long run, it is wanted to terminate existing leases early and then shift towards fewer and lower-cost locations (Table 6.3).

Strategically oriented companies try to retain staff in order to remain competitive after the restrictions expire. Instead of laying off workers, the priority of such

**Table 6.1** Answers to the question “Which role will the corporate center play in changing ways of working?”

Role	Respondents, %
Driver of change for the rest of organization	56
Role model for the rest of organization	34
Follow the changes in the rest of organization	4
No specific role	6

Source: Bernauer (et al. (2021, p. 5)

**Table 6.2** Answers to the question “Which activities do you see the corporate center leading?”

Activities	Respondents, %
Strategy setting for organization	82
Financial steering of organization	66
Running back-office operations in select functions	31
Running back-office operations in all functions	15

Source: Bernauer et al. (2021, p. 6)

**Table 6.3** Answers to the question “What are the top steps to optimize office space?”

Actions	Respondents, %
Reconfigure how office space is used	68
Implement flexible desk arrangements, related office policies	54
Increase space per employee to allow for social distancing	51
Renegotiate existing lease terms	51
Terminate existing leases early	30
Allow leases to expire naturally	35
Modify footprint (fewer, lower-cost locations)	55

Source: Bernauer et al. (2021, p. 7)

companies is to retain employees. During the pandemic, companies are introducing various new approaches to personnel management. Companies invest in remote work opportunities, providing employees with conditions for productive work from home.

Company management offers flexible approaches to the organization of remote work, paying special attention to surveys and responding to requests from employees for tools and ways to implement work tasks. One of the key tasks of corporate offices now is to invest in the company's digital infrastructure, smart workspaces, and cybersecurity tools (Hilberath et al., 2020; Seturidze & Topuria, 2021). As remote work is a definite trend in organizational design, which will only intensify over time, the task of the office is not only to ensure the stable operation of companies today, but also to create conditions for further improvement of hybrid activities. According to Hilberath et al. (2020), the implementation of such tasks requires the transformation of the existing work model and the support of a new one. One area of such support is aimed at reviewing the purpose with strengthening the culture and leadership in the organization. Another task is review and organizational redesign with a focus on rapid and adaptive response to the needs of employees and customers. It is important to constantly receive feedback on the experience of employees, creating conditions for best practices of group cooperation. Digital infrastructure also needs to be developed to support the transformation of the hybrid work model.

## 4 Remote Work in Ukraine

### 4.1 Legislation About Remote Work in Ukraine

Before the COVID-19 pandemic, remote work in Ukraine was not very popular and did not widely used. But since March, 12, 2020, situation changed dramatically, when employees were transferred to remote work in all industries, where it was possible. At the beginning of the year 2021, Ukrainian legislation on remote and home-based work has updated to the new conditions of COVID-19 pandemic and corresponding quarantine limitations. New legislative rules introduced to the Labour

code of Ukraine in February, 2021, provided two options for formalizing labor relations for employees who wanted to work outside the office:

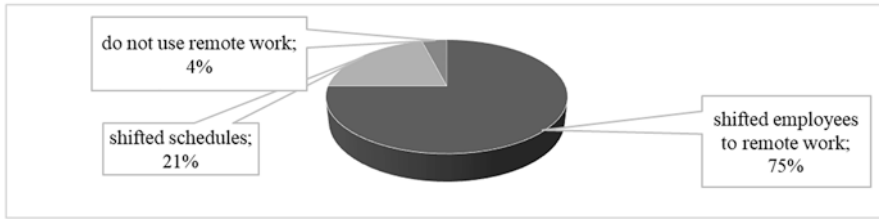
1. Home-based work: work at home is associated with work at the place of residence. The home-based workplace means a clear fixation of the physical workplace, the necessary equipment, and other conditions that ensure the workflow. The workplace at home cannot be changed without the consent of the parties, except as provided by the contract. Typically, workers with the right skills are hired to work from home or trained by the employer. The working hours of the home-based employee must correspond to the working hours of the organization—the employer.
2. Remote work: with this mode of operation, the employee independently determines where his workplace will be located outside the employer, takes responsibility for safe working conditions, and compliance with labor laws. It is possible to combine remote work with work at the employer's premises. Unlike the home-based work, remote work provides for the use of information and communication technologies. Remote work should not involve the use of hazardous materials or technologies (Pavlynska, 2021).

## *4.2 Remote Work During Quarantine in Ukraine*

In May 2020, KPMG, one of the Big Four accounting organizations in the world, conducted a survey of Ukrainian companies on the transformation of their HR strategy in response to the pandemic situation (KPMG Ukraine, 2020). More than 50 companies from various industries took part in the study. More than 50% of the participants are companies with more than 250 employees. The surveyed companies represented the following fields of activity: consumer goods (19%), information technology (17%), retail (15%), financial sector (10%), agribusiness (6%), consulting (6%), infrastructure (6%), non-profit organizations (6%), service industry (6%), industry (4%), transport (4%), and telecommunications (2%).

The study found that 96% of surveyed companies in Ukraine transferred their employees to remote work due to quarantine restrictions. Half of the surveyed companies managed to transfer more than 75% of employees to remote work (Fig. 6.1). For employees, whose work does not allow them to work remotely, almost a third of the surveyed companies (29%) use shift schedules. 31% of companies offer employees paid annual leave, and 25% of companies provide employees with unpaid leave. Companies also transfer employees to a reduced working day (15%) or a reduced working week (10%), and provide additional paid leave (6%).

About a third of companies (29%) have already laid off or are about to lay off employees, the remaining 71% of companies intend to retain staff. As of May 2020, almost half of the respondents have already reduced their salaries by an average of 20–30% during quarantine. In the following months, 35% of employers were going to reduce wages, while 65% planned to keep the current level of wages.



Source: (KPMG Ukraine, 2020, p. 7)

**Fig. 6.1** Percentage of employees transferred to remote work in Ukraine in 2020. (Source: KPMG Ukraine (2020, p. 7))

In order to reduce costs, a third of companies decreased employee training programs, and about 5% of respondents canceled supplements to compensate for lunch and travel to work.

At the same time, companies are increasing their costs to help employees in a pandemic situation. Among the costliest measures resorted to by companies are providing employees with personal protective equipment (65% of companies mentioned), paying for a taxi (43%), and paying for the delivery of necessary equipment from the office (15%). Some companies (12%) pay for consultations with a psychologist and telemedicine.

Despite the crisis due to uncertainty, 61% of companies have not yet planned to revise the HR strategy. But companies are adapting their business processes. 46% of the surveyed companies suspended the hiring of staff, whereas 33% temporarily suspended the training process.

However, still companies are trying to transform these processes into a remote format. Almost half (44%) transfer face-to-face interviews online. 43% partially transferred training to an online format or postponed it to a later date. 44% of respondents planned to return to the previous model of work and noted that all measures are only temporary. But some of the company's current practices are seen as a permanent option in further work: distance work (80%), online hiring (27%), and online training (52%).

Despite the above challenges and risks for the company's top office, Ukrainian workers feel happier from the beginning of quarantine. According to a survey conducted by the sociological group "Rating" on January 14–16, 2021, 29% of the population consider themselves very happy, while at the beginning of quarantine in March, 2020, there were only 19%, rather happy 50%, not very happy 17%, and only 2% were completely unhappy (Ekonomichna pravda, 2020). Thus, the number of those who consider themselves more or less happy is almost 80%. The survey was conducted among 1600 respondents aged 18 and older. Error of representativeness of the study with a confidence level of 0.95: not more than 2.4%. Survey method: CATI (Computer Assisted Telephone Interviewing). Based on a random sample of mobile phone numbers.

Quarantine affected the changes at the office real estate for rent in Kyiv, the capital of Ukraine. The small companies began to move to remote areas of the city, and



large began to transfer employees from rented premises to their own real estate. According to Ukrainian Trade Guild (UTG) estimates, the weighted average vacancy rate in Kyiv’s business centers reached 12.8% in early June, 2020, comparing with 9% at the beginning of the year (Shramko, 2021). The same statistics are in other countries: in the United States vacancy rates across the office sector increased to an average of 15% in the second quarter of 2020. The jump from 9% in the first quarter of the year is primarily due to the impact of the coronavirus (Statista, 2021).

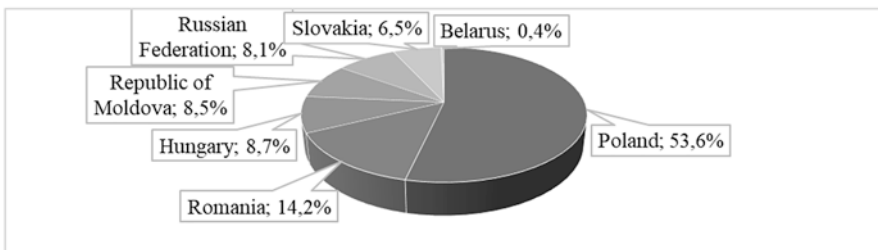
### 4.3 Remote Work During the War in Ukraine

Since February 24, when the Russian invasion of Ukraine began, more than 12 million refugees have fled their homes. Of these, 5.5 million went abroad, seven million went to the safer western regions of Ukraine. At the same time, thousands of people returned to Ukraine, when their homes became safer. Table 6.4 gives information about number of Ukrainian citizens, which went to neighboring countries in Europe. Figure 6.2 illustrates how Ukrainian refugees shared among countries. More than 53% went to Poland, 14.2% went to Romania. Also, a lot of people went to other European countries, especially to Germany, Spain, Italy, and others (Table 6.5; Fig. 6.3).

**Table 6.4** Refugee influx from Ukraine in neighboring countries at April, 8, 2022

Location country	Population, people
<a href="#">Poland</a>	2,564,994
Romania	678,081
Hungary	413,888
<a href="#">Republic of Moldova</a>	406,611
Russian Federation	389,845
Slovakia	310,989
Belarus	19,096

Source: Refugees Fleeing Ukraine [(since 24 February 2022), 2022]



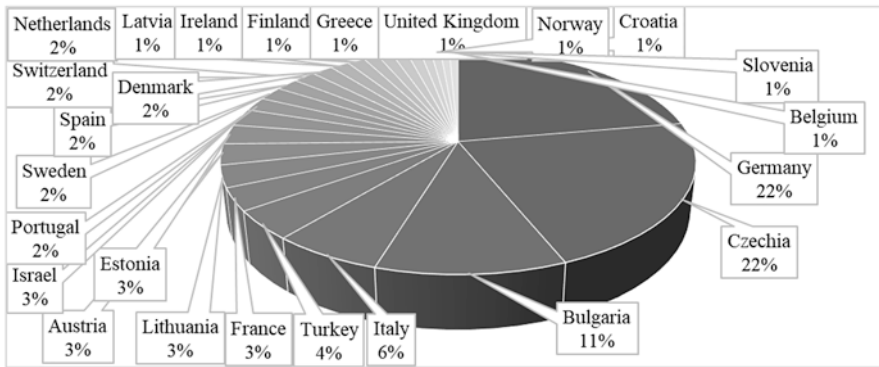
Source: (Refugees Fleeing Ukraine (since 24 February 2022), 2022)

**Fig. 6.2** Share of people, who went from Ukraine in neighboring countries. (Source: Refugees Fleeing Ukraine [(since 24 February 2022), 2022])

**Table 6.5** Number and share of people, who went from Ukraine to other than neighboring countries which have received more than 10,000 Ukrainian refugees

Country	Germany	Czechia	Bulgaria	Italy	Turkey	France	Lithuania	Austria	Estonia
Number of people	310,000	300,000	152,340	88,593	58,000	45,000	43,800	42,000	39,500
Share, %	22.3	21.5	10.9	6.4	4.2	3.2	3.1	2.8	2.8
Country	Israel	Portugal	Sweden	Spain	Switzerland	Denmark	Netherlands	Latvia	
Number of people	35,000	28,243	27,954	25,000	24,837	24,000	21,000	20,000	
Share, %	2.5	2.0	2.0	1.8	1.8	1.7	1.5	1.4	
Country	Ireland	Finland	Greece	Croatia	United Kingdom	Norway	Slovenia	Belgium	
Number of people	16,891	16,000	16,700	15,000	12,000	11,000	10,000	10,000	
Share, %	1.2	1.1	1.2	1.1	0.9	0.8	0.7	0.7	

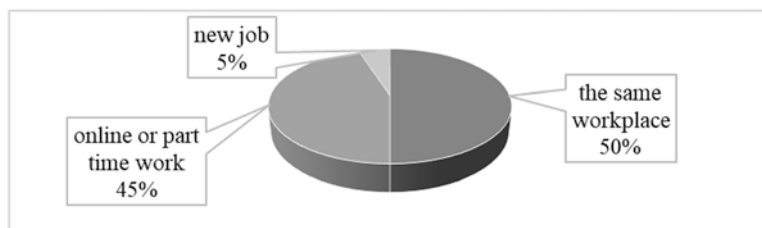
Source: Ukrainian Refugee Crisis (2022)



Source: (Ukrainian Refugee Crisis, 2022)

**Fig. 6.3** Share of people, who went from Ukraine to other than neighboring countries which have received more than 10,000 Ukrainian refugees. (Source: Ukrainian Refugee Crisis (2022))

During the survey, which was conducted by the Razumkov Centre’s sociological service at the border crossing points in Ukraine’s Zakarpattia region (Uzhgorod, Malyi Bereznyi and Chop (Tisa), 101 citizens of Ukraine aged 16 and older who were leaving Ukraine on foot or by road due to hostilities were interviewed from 15 March through 1 April 2022, the portrait of Ukrainian refugees was conducted (Ukrainian refugees: Attitudes and assessments, 2022). The majority of refugees (83%) are women. 37% of refugees are aged 30–39, 26% are aged 40–49 years old, 19% are aged from 16 to 29 years old. So, 90% of respondents older than 16 years are at the working age. 76% of respondents have higher or incomplete higher education, 18% secondary special education, and 6% general secondary education.



Source: (Eighth national poll: Ukraine in the conditions of war, 2022).

**Fig. 6.4** Changes in employment during the war in Ukraine. (Source: Eighth national poll: Ukraine in the conditions of war (2022))

Among the respondents, 26% are highly qualified specialists, 20% are entrepreneurs, and 17% are skilled workers. These people may work in a distance mode from abroad or look for the new job.

The national Ukrainian poll about living conditions and spirits of people during the war was conducted at April, 6, 2022. The survey was conducted among the population of Ukraine aged 18 and older in all regions, except the temporarily occupied territories of Crimea and Donbas. The survey covered 1200 respondents, the sample is representative in terms of age and gender. Survey method: CATI (Computer Assisted Telephone Interviews). According to the poll (Eighth national poll: Ukraine in the conditions of war, 2022), if 68% of respondents were employed before the war, at April, 6 58% had work (46% in March), among them 50% had the same workplace, 45% worked online or part time, and 5% have got new job (Fig. 6.4).

There are 65% unemployed from the East of Ukraine, 45 from the central part, 38 from the South, and 28 from the West. These data correspond to the geography of the war activities and evacuation of the people: the most internally displaced persons or those, who went abroad, were from the East of the country (46%). As a result, if it is impossible for them to work in a distance mode, they have to find a new job.

Most often, asylum is sought in the west of Ukraine, in particular, in Lviv and the region. Specialists of the portal grc.ua said that vacancies in western Ukraine account for 31% of all current job offers in Ukraine. Almost half of them are in Lviv and Lviv region—16%. Ternopil, Transcarpathian, and Volyn regions are next in terms of the number of current vacancies. Most of the current vacancies are opened in sales—15% of all current offers. The second in demand are specialists at transport and logistics and working personnel, 12% each, respectively. The third most popular field is medicine and pharmaceuticals—11% of all current vacancies (Lisiuchenko, 2022).

The most employees, who worked in a distance mode before the war due to COVID-19 limitations, continue remote work regardless of location. There are specialists like teachers, university instructors, IT specialists, many office employees, and others. As a result, the trend to remote work after the COVID-19 pandemic increased in Ukraine due to the war.

## 5 Advantages and Disadvantages of Remote Work

The pandemic has been the starting point for understanding and recognizing, that an office presence does not affect the smooth running of a business. Digital technologies and platforms have made it possible to maintain the productivity of remote work, made such work from home effective in the long run. Such findings will in the near future increase companies' attention to the use of tools and opportunities for teleworking, as well as the revision of cautionary expectations from "work from home."

The benefits for business from remote work are associated with increased opportunities to attract potential candidates for the position, because companies can consider the format of remote work applicants from around the world (Gagnidze, 2018), not only local employees. Also, there is no risk of reduced productivity due to congestion at the workplace and meeting place with partners or clients. Economic benefits (cost reductions) due to the growing savings of companies in renting office space and the lack of need to pay the costs associated with working from home. The benefits for employees from remote work are connected with flexible work schedule, which allows combining household chores to get a better balance of time between work, hobbies, meetings with family and friends, reduction of stress due to the lack of need to be in traffic jams on the way from work to scheduled meetings, the ability of remote workers to work from anywhere with an Internet connection and an available computer.

At the same time, there are some tasks for companies associated with remote work. The first is performance management, which in recent years has been widely used to measure goals and key outcomes using a number of techniques, including goal management. Such approaches allow the manager to set measurable goals for employees. The second one is cooperation, as a key factor in business success. Remote work needs to include tools for the collaboration of employees in companies. Such tools allow coordinating the work of the team and maintaining a sense of belonging to the organization. The next task is taking into account differences in time zones issue warnings to managers regarding the hiring of workers from other countries, which will require coordination and adaptation of the schedule of meetings with them due to significant gaps in the hours of activity in a particular country. Also, the important issue is security, especially cyber security which raises the issue of investing in secure software to protect the company's corporate data, even with dangerous contacts of remote employees.

Among the problems of remote work for employees the greatest threat is the presence of factors that distract from work (social networks, children and adults, family members, friends) and reduce productivity, especially workers with little experience of remote work. First, it is due to the inability of two adults living in a small apartment to find space for simultaneous work, especially during web conferencing and so on. Second, if kindergartens or schools do not work, or there are elderly people in the apartment or house, who need attention and care, it is difficult for the employee to comply with his KPIs. Third, overload the Internet during

business hours. Fourth, the growing concern about the virus infecting employees or their parents and the associated panic, stress and reluctance to return to the office. Fifth, the loss of a sense of time, as it is not necessary to spend it, for example, on the way to the office, and it should be remembered that during this time many employees will have responsibilities outside of work that are additional to those they usually have during the working day. Sixth, there are thoughts that the company will not be interested in further cooperation and the risks of non-payment of wages and so on. Seventh, the transformation of payment, settlement, and credit behavior of employees, as a result of the transition to non-cash payment and fears associated with the loss of funds (Dubyna et al., 2021).

The next is operational shutdown, which is complicated by the presence of a significant number of projects that accumulated under the condition of insufficient time management. The problem can be associated with the slow workload and longer adaptation to new work of remote workers, in particular, due to the lack of experienced employees in the environment. Also, can be mentioned the growing loneliness and fear of being left unnoticed due to remote work, also in terms of living alone and being separated from other people.

It is important for managers to use the best practices for remote work. These are such practices as management by SMART goals, daily working communication, and use of cloud technologies. Management by SMART goals allows to clearly track the progress of remote teams according to the established KPIs, especially if the practice of setting team and individual goals is the norm in the company. Daily working communication can be increased by establishing fixed meetings with the team which should be mandatory for high-performance teams. Coaching is an efficient managers' tool for training their teams in remote communication and building their own roles in the team. A good practice is celebrating the success of the team as the formation and strengthening of the corporate culture of the company. The use of cloud technologies allows realizing remote connections and ensuring the preservation of corporate attributes and security systems of the company.

The best practices of remote work for the company's employees include testing new job opportunities, using different places to work, eliminate in advance possible work disruptions. Testing new job opportunities should use different approaches to mastering yourself in new conditions. For such experiments to study their own productive work, employees can evaluate different places to work (home, coffee shop, co-working centers, etc.), other working hours (morning or day), use of musical accompaniment or not, mode of work with or without breaks. Different techniques can also be effective (for example, Pomodoro technique—25 min of work and 5 min of rest). According to research by the Wall Street Journal (Shellenbarger Sue, 2012), for example, the use of a desk for work is not mandatory for 80% of young professionals, compared to the bed. The desire to eliminate in advance possible work disruptions that may be related to children, relatives, and friends or noise from neighbors by inventing effective ways to negotiate with them.

Virtual collaboration software for employees should be used as tools designed to facilitate teamwork. It allows increasing their productivity and efficiency, providing communication, conferencing, and coordination. The leading suppliers for each of

the functions are indicated in parentheses. Among virtual collaboration, software tools are communication tools, such as e-mail, messaging applications (Slack, Skype, and others), conferencing tools that allow two or more people to communicate with each other on a single screen using online platforms or cloud platforms. At the same time, such tools allow you to share documents with the ability not only to view them by several team members but also to edit them. These are Zoom, Google Meet, WebEx etc. Coordination tools can be also used for document sharing (Dropbox, Google Drive), ERP (Hash Micro, Syiven), and project management systems (Trello, Task world).

In modern conditions, people with good digital skills combined with high-professional competence will be most in-demand in all areas. Demand for core workers and professionals will decline.

Analyzing the assessments of the leading media today, we can see that traditional jobs are really disappearing and this situation is objectively based on the development of digital and information and communication technologies. But from a technological point of view, there are still many opportunities. Over the years, digital innovations will transform almost all our usual areas of activity (Lekashvili & Bitsadze, 2021; Papachashvili et al., 2021), opening up exciting opportunities for people with the necessary skills. It emphasizes the importance of dual education. It means that people need not only traditional skills in their chosen field, such as sales, customer service, design, and accounting, but also technical skills relevant to this field. They don't have to be data processors or programmers, they just need to know how to use modern technology. For example, for traditional single-profile marketers who are accustomed to working with real-time focus groups, mail surveys, promotional materials, and print ads, employment prospects can be hazy. But dual professionals who are familiar with search engine optimization, social media campaigns, online advertising, and other digital services will have much more employment opportunities. The two-profile model can be applied to almost all professionals, including IT professionals who need more knowledge in their field and application. Such skills need to be constantly improved to advance the career ladder as even to save the job.

## 6 Conclusions

The pandemic quarantine limitations put the task for scientists and business to reimagine the role of the office and develop effective ways of communication between employees, teams and management.

The first year of remote work forced business to change their office design. The cost saving strategy is one of the first priorities for the companies' management, so business all over the world reduce office spaces, change office locations for cheaper ones. At the same time, the organization of office work is also rethinking: most companies combine remote and office work; therefore, the office space has to be reconfigured from individually- to team- co-working oriented.

A dramatic shift was made in the ways and tools of employees' cooperation during the remote work. First of all, the physical interactions in the office were replaced by increasing the number and time of e-mails and virtual meetings. After few months of remote work employees adopted for the new ways and tools of cooperation, and time for virtual interactions returns for the pre-pandemic situation.

Two main factors lead to increased remote work in recent times: social distancing due to the coronavirus pandemic, and formation of a new norm/habit—to perform most of the work in the format of “remote from the office,” which becomes common after a long (year) remote mode.

Some companies have been able to maintain productive results in remote mode and are ready to increase the share of such new work experience in the future. But the question of the successful strategy of separate performance of work by employees remains difficult because such a new regime has its pitfalls.

Under conditions of forced restrictions, the role of top office and HR management of companies should be supplemented by obligations regarding social and moral and psychological responsibility and support of employees; strict adherence to the reputational status, as the corona crisis will pass over time, and the company's reputation will be difficult or almost impossible to restore; organizational and technical support of flexible work and effective management of remote teams, which will allow to remotely perform the duties of employees. The organization of work outside the office primarily designed to take all possible measures to protect employees from COVID-19, support the entire team in changing conditions, establish new ways of working, while maintaining the quality of business operations and business processes.

One of the main factors that will allow the company to operate at the conditions of distance or remote work of employees is constant communication with all participants of business processes, stakeholders, and business owners. At the same time, the risk of loss of sense of time by line managers in communication and control of tasks, performed by employees working remotely, may increase. On the other hand, the work of an employee outside the office allows not only to form his new competencies, but also to increase his stress resistance and can serve as a driver of the company's development. Because owning and using the same resources as competitors is not a prerequisite for success in today's business environment. That is why the use of those resources and opportunities that none of the competitors has, i.e., asymmetries, contributes to a sustainable competitive advantage. Thus, resource asymmetries in this case may be rare competitive resources (intangible assets, capabilities, new skills, organizational processes, knowledge, distinctive characteristics of the company's staff), which do not have other companies and which cannot be copied even with proper cost allocation (Sahaidak et al., 2021).

The war leaves its mark on the organization of the companies' work, where it is possible. If employees have evacuated to safe places and it is possible to organize work in a distance mode, companies use the remote work model. If it is not possible to organize work remotely, maximum attention should be paid to the organization of the safe work of employees. If the enterprise moves to safe areas of the country, it is necessary to organize both remote work and relocate employees with their families.

The listed changes related to the functioning of business in war conditions require new approaches both regarding the organization of work and concern for the physical safety and mental health of personnel.

To minimize all these risks, the company's office should take care to develop an appropriate policy for work outside the office, communication plan and reporting processes, both the physical health of employees and the work performed on time. This can be an agreed time for all employees working remotely to communicate online in a convenient resource (Zoom, Teams, and Skype). Video conferencing and corporate chat are useful for keeping up with the rhythm of regular one-on-one meetings and teams, maintaining constant contact and work environment. It is also advisable, if possible, to create internal resources that the company's office will have, in particular, to support communication (e.g., payment for home internet, technical support of equipment, training to develop soft skills, etc.) and health of workers (purchase of personal protective equipment, disinfectants, etc.).

The statistics about employees' productivity during remote work is not enough and it is contradictory: one survey gives evidence about employees' satisfaction by the distance work and their higher productivity. Other sources witness about high anxiety of employees and their desire to work at least a few days a week at the office.

Based on the above, the activities of modern enterprises should be based on such basic principles as: direct priority of employees of all levels and roles in the company's business processes, even outside the office; strengthening the role of communications and information (adaptability to the environment, speed and initiative in decision-making, acquisition of new skills), creativity (anticipation of future trends, creation of a new unique product, quality service). This in turn requires a revision of the old management structures and methods used in previous changes in the environment.

The formation of a modern mechanism for managing the company requires the use of such functions that have a multi-purpose content, namely: managing the implementation of enterprise development programs; quality management; resource management and cost management; improving the marketing management; personnel management and its social and psychological and emotional development; management of a complex of integrated marketing communications, etc.

It is not enough information about the productivity of remote work comparing with pre-pandemic times, which has to be the topic of future research. That is why there is an objective need to deepen the theoretical and methodological foundations and develop applied tools to increase the strategic flexibility of the top, middle, and front office of the company and assess the productivity of employees, including remote work.

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# Chapter 7

## Development and Validation of an Online Shopping Scale Adapted to Specific Cities of India



Arif Hasan, Sunil Tiwari, and Amina Omrane

**Abstract** The present study aims to develop and validate an appropriate scale for online shoppers in the Indian context. In compliance with prior scale developmental studies on online shopping, an OSBS (i.e. Online Shopping Behavioral Scale) is proposed in order to better understand the Indian online shoppers' behavior. For this purpose, several rounds of focus group interviews with experts, retailers and academicians helped in developing a pool of preliminary set of items. Then, an exploratory and a confirmatory factor analyses were performed to develop the OSBS in order to ensure the applicability and clarity of the measurement instrument. Results reveal that the OSBS suggested in the current research is a second-order formative multi-dimensional construct, reflecting a nine-factor structural model composed of 38 indicators. This valid and reliable scale is then applicable in the Indian context. It offers a valuable framework for managers and academicians who could employ it to assess the shoppers' online behavior. Decision makers and marketers could also consider this OSBS whenever they plan to formulate and implement new business strategies in the Indian context.

**Keywords** Online shopping behavior · OSBS · Scale development · Online shoppers · The Indian context

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## 1 Introduction

Internet plays an imperative role and a conventional means to get information in this digital age (Batra, 2002; Kuhlmeier & Knight, 2005). Actually, approximately 2 billion of Indian citizens have access to internet and twice of them are mobile phone subscribers (Yadav & Rahman, 2017); while around 700 million persons are internet users in India. Besides, out of the total number of those internet users, internet penetration in the urban area is threefold than in the rural regions (Varshneya & Das, 2017). Subsequently, it was found that the widespread internet penetration has engendered a rapid growth of electronic commerce (Das, 2014). Indeed, using internet is one of the main significant factors that might explain the increase of online shopping at an exponential rate in India (Singh et al., 2017; Mosquera et al., 2019).

Earlier, Indian shoppers prefer browsing for goods and services through internet; but, at present, they are involved in an actual buying process (Das, 2014) and the trend is expected to continue in the upcoming years (Chakraborty & Bhat, 2018). Furthermore, number of persons from different age groups are spending more time in online-related activities from the past few years in Indian context (Das, 2014). Moreover, addiction towards the usage of internet; cell-phones, and mobile-phones is also nurturing the online shopping in India (Young, 1998; Chakraborty & Bhat, 2018).

By drawing on the precedent literature, it could be deduced that there is a scant attention dedicated to the specific instruments that might predict the consumers' online shopping behaviors in the Indian context. In fact, although several researches related to online shopping have been conducted in pasture western settings of India, most of them were relying on a survey/questionnaire analysis (Andreassen et al., 2015). It implies that the existing instruments were employed inadequately and their perspectives were restricted to the western regions and suburbs of India (Seo & Green, 2008). In addition, it has been shown that the instruments that have been commonly used in the industry have several psychometric problems (Carman, 1990). On the other hand, Indian urban shoppers are different from rural and western ones regarding their distant buying traditions and their usage of Internet (Hasan, 2017). Consequently, the usefulness of our developed scale for the Indian population should be ensured.

The scale developed in the current research aims at facilitating the survival and growth of online business, mainly in such an ambiguous and complex environment owed to the overwhelming pressure of competitors (Das, 2014; Poddar et al., 2009; Singh, et al. 2017). Consequently, online marketers could gain competitive advantages in the market due to the associated benefits deriving from them (Ong, 2011; Changchit et al., 2019). The aforementioned discussion illustrated the underlying reasons behind the online shopping domain for researchers by helping them to develop conceptual frameworks, to identify and assess unexplored dimensions of the Indian online shopping (Das, 2014). Moreover, it may enable practitioners and online retailers to design appropriate strategies.

Nowadays, there are various types of websites in different spheres like online newspapers, free downloaded sites, job or entertainment websites. However, the present study deals with online shopping sites. The respondents were frequent online shoppers across ample number of e-retailers, who have an array of items including books, CDS, electronic devices, apparels, and mobile phones. This study sample is confined to online shoppers (*those who bought* electronic devices and mobile phones) in the last three months and residing in four metro Politian cities of India.

On the basis of the observations cited above, the present study sought to explore and address the various determinants of online shopping in India.

Due to the enormous potential growth of the online shopping sector, this study developed and checked the applicability of existing instruments like those already proposed by Faber and O'Guinn's scale (1992), Ridgway et al. (2008), Andreassen et al. (2015), and Maraz et al. (2015). Prior researchers revealed that previous scales did not covered all the required criteria. Hence, this research is an attempt to disseminate knowledge and investigate the determinants of online shopping that has not been investigated in previous studies. Due to narrow perspectives and focusing on few dimensions like security, social desirability, functional, emotional, and social value, researchers have already argued that several other dimensions, such as mood modification, problems, salience alienation may also be included as imperative dimensions of online shopping (Andrews et al., 2007; Williams & Soutar, 2009).

The present research seeks then to validate a multi-item online shopping scale with the endeavor to add it to the existing literature. Its second goal is to examine the online shopping components and underlying attributes in an unexplored area located in the Indian context. It began with an introduction about online shopping and its determinants, followed by a section dedicated to the theoretical background for the suggested scale; while subsequent sections detailed and discussed its development procedure. The final section provides theoretical and managerial contributions of the study along with its main limitations.

## **2 Theoretical Underpinning and Research Development**

To outline the theoretical framework corresponding to the development of a multi-item online shopping scale, our focus was firstly put on specifying the domain of online shopping behaviors. Therefore, it was turned to retrieving the few existing online shopping scales that were developed in the Indian and western contexts.

### **2.1 Outlining and Specifying the Construct's Domain**

According to Churchill (1979), the domain of each construct should be defined while developing it (Churchill, 1979). Furthermore, constructs can be derived from the literature review or/and from experts' opinions (Varshneya & Das,

2017; Hasan, 2017). Drawing on the mainstream research on online shopping, it appears that researchers operationally defined the online shoppers' behavior, by qualifying those who use internet or mobile devices as a platform for goods and services (Abott, 2012). In the same perspective, precedent studies cited other similar constructs, such as internet addiction (IA) and compulsive buying (CB), which should also be considered. IA involve both specific and generalized types depending on the targets of the behavior itself (Davis, 1989), while CB concerns the propensity of repeated buying behaviors of shoppers (Müller et al., 2015; Trotzke et al., 2015).

Preliminary studies asserted that positive insights lead customers towards online shopping although it is still uncertain that perception is a convenient determinant that enables to in-depth understand the shoppers' behavior (Kotler & Keller, 2006; Mahmood et al., 2004; Nagar, 2018). Perception refers to the process of selecting, organizing, and interpreting information in order to create a significant image of the globe (Kotler & Keller, 2006; Ono et al., 2012; Chi, 2018). It depends on physical stimuli and inner feelings of shoppers who might be exposed to the same reality (Chen & Dubinsky, 2003). Besides, according to Holbrook (1994), shoppers have the tendency to evaluate and select the products or services that obtain the overall best value. That is why Shrum et al. (1995) revealed, in the same vein, that marketers actively inquire about the psychographic information related to shoppers and leading to their purchase decision. It means that the buying process follows different stages, emphasizing that the consumer behavior is not just about decision or purchasing. It rather includes a full range of experiences associated with the usage of products and services. Currently, the buying behavior is considered as a complex phenomenon, which consists of a wide set of prior and after purchase activities (Rose & Dhandayudham, 2014).

Several studies conducted mainly by Davis (1989), Liu and Arnett (2000), Muylle et al. (2004), and Shih (2004) indicated that online shopping is a multidimensional construct. Moreover, earlier scholars assessed concerns of shoppers regarding online shopping and revealed that those ones perceive a higher level of risk and uncertainties with any online purchase compared with other traditional modes of shopping (Lee & Tan, 2003; Bhatnagar & Ghose, 2004, Miyazaki & Fernandez, 2001).

It is noteworthy that the present study proposes and develops an online shopping scale, by drawing on previous researches and considering shoppers' perceptions with respect to their online purchasing habits. Nevertheless, it appears that prior empirical studies conducted in this area had not sufficiently explored the dimensions of online shopping. Furthermore, even if the online shopping domain has been investigated in different contexts, it had not been explored in a comprehensive manner, in the western Indian regions (Xu-Priour et al., 2017). Hence, a scant attention has been paid to the Indian shoppers' influencing factors with respect to online shopping. For this reason, it is expected that the scale proposed by here serves to assess shoppers' perception, attitude, feasibility, as well as to evaluate their essential psychographic characteristics.

## ***2.2 Existing Online Shopping Scales***

There are abundant standard operational scales that have been developed by marketers, dealing with online shopping dilemmas, and each scale moves towards the issue differently. By reviewing the precedent literature on compulsive buying behaviors, it appears that the most commonly used scales had been proposed by Faber and O’Guinn (1992) as well as Maraz et al. (2015). Those 7-item scales evaluate the compulsive buying by assessing buyers’ thoughts, affects, and behaviors during their purchase cycle. In addition, Rose and Dhandayudham (2014) and Trotske et al. (2015) have also suggested another online shopping scale in order to assess situations faced by shoppers during their decision-making process. Furthermore, Christo et al. (2003) proposed another ten-item scale with respect to behavioral addiction by adding certain other factors.

In the same orientation, other prior instruments exhibiting a sound reliability and validity, such as the Facebook Addiction Scale (Torsheim et al., 2012) or the Game Addiction Scale (Lemmens et al., 2009), have been adopted by researchers. In fact, the corresponding literature shows that the IA scale developed by Morahan-Martin and Schumacher (2000) and the shopping addiction scale proposed by Andreassen et al. (2016) were employed to measure the core criteria of shopping addiction.

For Horrigan (2008), attitudes and perceptions play a key role for both online and offline users who intend to purchase products, whereas Muncy and Vitell (1992) already adopted a different customers’ perspective to examine the ethical issues in the market place from the customers’ perspective.

In order to develop our online shopping scale, we considered not only the aforementioned studies, but also those respectively undertaken by Forsythe et al. (2006) in the Indian context, or Lee and Turban (2001) who developed comparable scales in similar contexts and situations. Those prior scales should be adapted to contexts like India and revisited to ensure their validity and synchronicity (King et al., 2016).

Furthermore, the existing literature documented that there has been a dearth of attempts to measure the online shopping behavior in the Indian context, stressing that the western scales would not be applicable before their alteration and adaptation (Parsons, 2002). A sound measure of the perceptions associated with online shopping is then required to fulfil the endeavor of developing an online shopping scale appropriate for different structural and cultural perspectives.

## ***2.3 Theoretical Framework for the Development of a Multi-item Online Shopping Scale***

A review of empirical studies shows that the Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1977) and the Technology Acceptance Model (TAM; Davis, 1989) are among the most popular instruments that have been applied to the online shopping situational researches.

The TRA emphasizes the individual's perceptions, which is an outcome action, whereas the TAM proposes that attitude towards the employment of a new technology is affected by its perceived usefulness and ease of usage. While constructing our scale, the preliminary items were adapted from the behavioral addiction and compulsive buying instruments (Faber & O'Guinn, 1992; Christo et al., 2003; Lemmens et al., 2009; Torsheim et al., 2012; Müller et al., 2015; Maraz et al., 2015 and Andreassen et al., 2016). Subsequently, several prior studies were employed to evaluate the online behavior of shoppers (Ridgway et al., 2008; Rose & Dhandayudham, 2014; Maraz et al., 2015; Mahnke et al., 2015; Song et al., 2018). Those precedent models helped us in developing a pool of possible indicators and modifying the items elaborately based on the comments and data emanating from corresponding pre-tests.

Miyazaki and Fernandez (2001) revealed four major shoppers' concerns regarding online shoppers. The first one is related to privacy of shoppers concerning their personal information and the undisclosed tracking of their activities. The second one corresponds to security with regard to protection devices used to acquire consumers' personal, financial, or transaction-oriented information. The third category designates fraud linked to purposeful misrepresentation or non-delivery of goods. Finally, the last concern reflects shoppers' views about internet use and online behaviors. Later, Milne and Culnan (2004) found that reading privacy notices represents one element in an overall strategy implemented by consumers to manage the risks incurred by disclosing personal information online. Accordingly, developing a new scale for measuring consumer online shopping behavior towards online shopping decisions might enrich the existing literature, by completing its theoretical insights with further practical meaningful implications.

### 3 Methods and Results on Multi-item Scale Development

A multiple item-scale serves to assess a concept and facilitates tapping its complexity (De Vaus, 1996). Probability of misleading information can be avoided in case of multi-item measurement scale with greater accuracy. Primary function of multi-item scale is summarizing the information presented by a number of questions into one variable (in this case online shopping behavior) the analysis is simplified. Quantitative statistical techniques were employed in the analysis of survey data through SPSS 22.0 and AMOS.

Since latent variables are not observable, researcher has to create instruments in order to measure them. In this study, scale development steps were adopted from (Churchill, 1979; Jain et al., 2017) and improved by using other researchers' recommendation too (Arnold & Reynolds, 2003; Bagozzi, 1980; Gerbing & Anderson, 1988; Wolfinbarger & Gilly, 2003). Four stages, drawn from the literature (Bearden et al., 1993; De Vaus, 1996), were taken to develop the online shopping behavior scale (OSBS). The scientific scale development procedure comprised item generation, exploring, and purification and validation of scale through reliability and validity.



### **3.1 Stage 1. Items' Pool Generation (Via a Qualitative Study)**

Firstly, items were identified through the previous literature, which provides a theoretical basis of scales (Churchill, 1979). For this purpose, prior developed and relevant instruments, such as Compulsive Buying Scale (Edward, 1993); Facebook Addiction Scale (Torsheim et al., 2012); Game Addiction Scale (Khazaal et al., 2018); Bergen shopping addiction scale (Andreassen et al., 2015), were revisited to generate the appropriate indicators that could be retained for our research.

However, to the best of our knowledge, there is a dearth of studies conducted on online shopping scale development in the Indian and western contexts. For this reason, a qualitative study was carried out and several questions were then addressed to experts in order to extract other relevant items that are convenient to our context (Bush et al., 2000; Kruger & Casey, 2008). In the light of an inductive approach combined with a deductive one, focus group meetings and in-depth interviews were held with respondents who were deemed to have manifested their consent to participate in our survey. Participants, who were mainly experts (including senior executives, faculty members, scholars, professionals, etc.), were then asked to share their daily-life experiences regarding what they do and how they behave as online shoppers whenever they intend to check and purchase online products. Consequently, a pool of 65 possible items was gathered from our participants, comprising both positive and negative statements. The optimal length of the scale is debated within the literature (Pritchard et al., 1999). Hereby, 13 redundant, ambiguous or poorly worded items were excluded and after the pre-test step, the number of items came down from 65 to 52. The modified pretested layout of the questionnaire was therefore administrated to the respondents for the refinement and the organization of items, which were elaborately modified.

### **3.2 Stage 2. Organization and Refinement of the Pool of Items (by Exploring the Factors) (Study I)**

The Exploratory Factor Analysis (EFA) was performed to explore the pool of items into a coherent subscales' structure, so that the primary dimensions could be reduced after the possible omission of the inappropriate indicators, yielding to a more effective scale.

#### **3.2.1 Sample and Data Collection**

A non-probability method, based on a convenience sampling, was considered in the present study for two main reasons: (i) *the exploratory nature of the research design* and (ii) *the necessity to gather the responses from the participants (if and only if*

*they had consulted and purchased online products during the last 3 months), who filled the e-questionnaire properly (Ferber, 1977).*

Consequently, our sample comprises the frequent shoppers who have bought through online retailers' websites and platforms. Moreover, only those who lived in the four major cities of India that have a high-internet penetration rate were selected. Our respondents had then more than 4 years of prior experience of using internet 2–4 h per day for any online shopping purpose. They were accustomed to use internet for an average of 27.2 h per week.

Primary data were collected through e-mails and via an online survey link (on Google Forms). Each respondent was requested to fill an attached e-questionnaire. As recommended by Best and Krueger (2002), instead of conventional interviewing methods, such as face-to-face interviews and surveys, the online procedures enable to get more efficient and convenient form of data collection.

For Parasuraman et al. (2005), a sample size composed of 200 observations could be sufficient for such analyses. However, after the elimination of missing and outlier data, our sample comprised finally 178 respondents.

From the descriptive analyses, it was found that the two main gender categories were more than 18 years old, with a mean age of 27.4 years. Besides, men were slightly more represented (58%) than women (42%). Our respondents were also of different categories of occupation, including employed (28%), self-employed (33%), and students (39%).

### **3.2.2 Factorial Analysis Through the Exploratory Factor Analysis (EFA)**

The scale refinement undergoes the administration of a multi-item questionnaire with respect to the statements generated from the pool of items deriving from the Exploratory Factor Analysis (EFA), performed to explore the possible factor structure.

The Kaiser–Meyer–Olkin (KMO), which measures the sampling adequacy, is in the acceptable limit with a value of 0.840 (Field, 2013), whereas the Bartlett's test of Sphericity is ( $p < 0.005$ ), showing that the correlation matrix is an identity and acceptable one (Field, 2013). The principal axis factor analysis was carried out on the 57 items and explored 12 factors, explaining 69.012% of the total variance after the varimax rotation. Items of respective factors were kept whether: (1) they loaded 0.50 or more on one factor, (2) they did not load more than 0.50 on two factors, and (3) for each item, the reliability analysis indicated more than 0.40 of the total correlation (Hair et al., 1998). Those criteria were not met by factor 12 (encompassing 3 items) and by six other items related to other factors. With respect to Singhapakdi et al. (1996) recommendations, a range of nine problematic indicators, whose split loadings were not above the permissible limit, were eliminated and dropped. The final exploratory analysis yielded a 11-factor structure, representing 78.75% of the total variance, as shown in Table 7.1 below.

**Table 7.1** Items retained based on an exploratory factor analysis (study 1;  $n = 178$ )

Constructs/factors (multi-item measures)	No. of items (48)	Items (label) code	Rotated factor loadings	Eigen values	Variance extracted (%)
<i>(KMO-0.840 and Bartlett's Test of Sphericity 0.00)</i>					
Entrustment (factor 1)	8	Q.13	0.720	13.938	29.038
		Q.15	0.692		
		Q.18	0.763		
		Q.25	0.672		
		Q.27	0.803		
		Q.29	0.860		
		Q.33	0.733		
		Q.34	0.841		
Salience (factor 2)	6	Q.3	0.869	4.228	8.809
		Q.5	0.774		
		Q.8	0.782		
		Q.11	0.871		
		Q.22	0.828		
		Q.32	0.791		
Security (factor 3)	5	Q.9	0.726	3.321	6.919
		Q.12	0.724		
		Q.16	0.777		
		Q.19	0.638		
		Q.23	0.794		
Problems' resolution (factor 4)	4	Q.6	0.898	2.738	5.705
		Q.7	0.737		
		Q.31	0.738		
		Q.35	0.898		
Mood modification (factor 5)	5	Q.2	0.841	2.591	5.398
		Q.4	0.738		
		Q.54	0.563		
		Q.56	0.876		
		Q.57	0.904		
Social insurance (factor 6)	4	Q.36	0.815	2.299	4.789
		Q.46	0.854		
		Q.49	0.795		
		Q.50	0.817		
Privacy (factor 7)	4	Q.38	0.877	2.118	4.413
		Q.39	0.764		
		Q.42	0.845		
		Q.43	0.613		
Conflict management (factor 8)	3	Q.10	0.876	1.868	3892
		Q.24	0.867		
		Q.28	0.917		

(continued)

**Table 7.1** (continued)

Constructs/factors (multi-item measures)	No. of items (48)	Items (label) code	Rotated factor loadings	Eigen values	Variance extracted (%)
Relapse prevention (factor 9)	3	Q.41	0.915	1.732	3.609
		Q.44	0.859		
		Q.45	0.936		
Alienation hindrance (FACTOR 10)	3	Q.47	0.901	1.586	3.305
		Q.48	0.858		
		Q.53	0.845		
Social desirability (factor 11)	3	Q.20	0.859	1.382	2.879
		Q.26	0.706		
		Q.30	0.812		
Rotation sums of squared loadings (Cumulative % of variance)					78.757%

Extraction method: principal component analysis

Rotation method: Varimax with Kaiser normalization

Rotation converged in 6 iterations

Rotated Factor loadings: Only loadings greater than the threshold value of 0.6 were reported, and those below 0.6 were excluded by researchers

Source: Prepared by the researchers, based on primary data

Note: All estimates were significant ( $p < 0.05$ )

### 3.3 Stage 3. Cross-Validation of the Factorial Structure (Through the Scale Purification) (Study 2)

A Confirmatory Factor Analysis (CFA) was conducted via the Analysis of Moment Structure (AMOS) software, with a new set of 600 respondents. Such a stage was helpful for the cross validation of the explored factors and redundancies.

#### 3.3.1 Sample and Data Collection Using Condensed Instrument

A second study was carried out for a better purification and an additional evaluation of the factorial structure. A purposive sampling method was used to select the respondents. The sample unit was the frequent shoppers of four major cities located in India (i.e., *online shoppers who were accustomed to use internet and who purchased via online platforms during the last three months*). 600 online shoppers were contacted via e-mails and asked to fill an e-questionnaire on an online survey link. From the primary data, only 547 responses were found to be complete and convenient for our factorial analysis, by fulfilling the minimum criteria of a sample size (Hair et al. 1998; Stevens, 2012). Respondents were so encouraged to fill the e-questionnaire (Google forms) on the basis of their last three months' on-line purchases. As recommended by Best and Krueger (2002), we contacted respondents via e-mails to obtain more efficient and convenient data.

Our sample encompasses both men and women shoppers whose average age was relatively older than 37.2 years. It was comprised 62.3% of men and only 36.7% of

women. Moreover, 67% of participants were highly educated. 72.3% of them were self/employed workers, whereas the rest of them were students.

### 3.3.2 Restructuring Factors and Corresponding Items

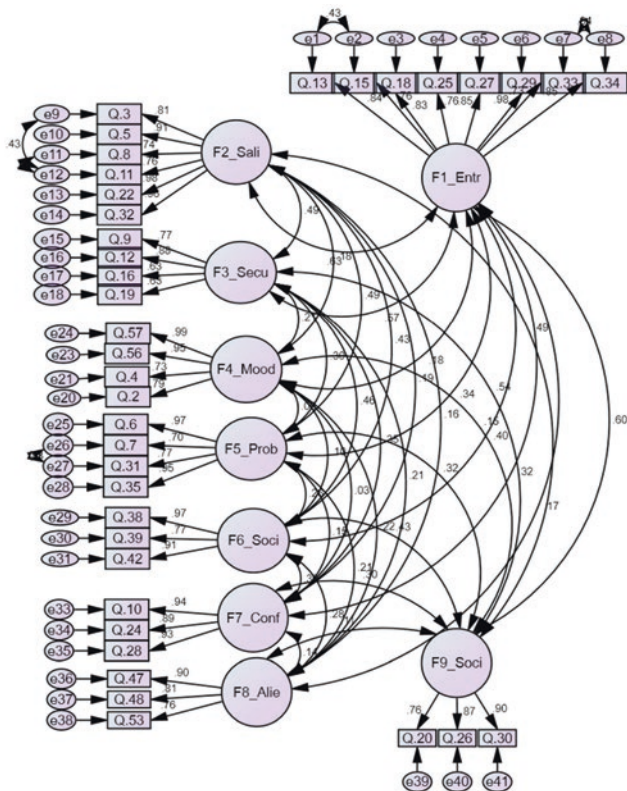
The multi-item scale was purified through a CFA. Initially, 11 factors corresponding for 48 items were estimated in the first model. The Goodness of Fit Index (GFI) and the Adjusted Goodness of Fit Index (AGFI) that range between 0 and 1, with a value of over 0.9, indicate an acceptable model fit (Hooper et al., 2008). Additionally, the Normed fit index (NFI) and the Tucker-Lewis fit index (TLI), which are preferable for smaller samples, should also be greater than 0.9 (Byrne, 1994) or 0.95 (Schumacker & Lomax, 2004). To establish good fit indices, two other approximate indexes should be considered for a reasonable model fit: the root mean square error of approximation (RMSEA) whose value should be less than 0.08; and the Chi-square/Degree of Freedom (CMIN/DF) whose value should not exceed 3 (Hooper et al., 2008).

On the basis of the criteria cited above, it appears that the fit of our model was poor and unacceptable. For this reason, problematic items were deleted one at a time and dropped from further investigations, followed by another round of confirmatory factor analyses. During the CFA process, 10 items and two factors were accordingly dropped to get values that comply with the acceptable limits. The re-specified nine-factor model obtained had thus shown an acceptable goodness, parsimony, and badness of fit indices as shown in Fig. 7.1 below.

The second-order (OSBS) structure model that comprises 38 items showed standardized factor loadings “causes” for the first-order factors (Entrustment, salience etc.), as demonstrated in Fig. 7.2 below. This provides a strong support for the nine factors structure of the OSBS. Both nine-factor models (including the one with higher order factors and the other one without), were so similar on all fitness measures, and much better than the other models.

## 3.4 *Stage 4. Validation of the Scale Through Validity and Reliability Checking*

In order to assess the validity and reliability of the scale, the EFA and CFA methods were performed, as their usefulness was already demonstrated across a wide range of other different cultural contexts (Christo et al., 2003; Faber & O’Guinn, 1992). After conducting the factorial analysis via the EFA & CFA, the obtained scale contained 38 measurement items corresponding to nine factors. Each indicator (related to a respective factor) was reflected in a convenient sentence that reports the internal or external influence of online shopping as well as the strength/intensity of the effect.



$\chi^2 (625) = 1.779; p < 0.0$   
 CFI = 0.95; GFI = 0.81;  
 NFI = 0.88; RMSEA = 0.05; RMR = 0.04

**Source:** Prepared by the researchers based on primary data

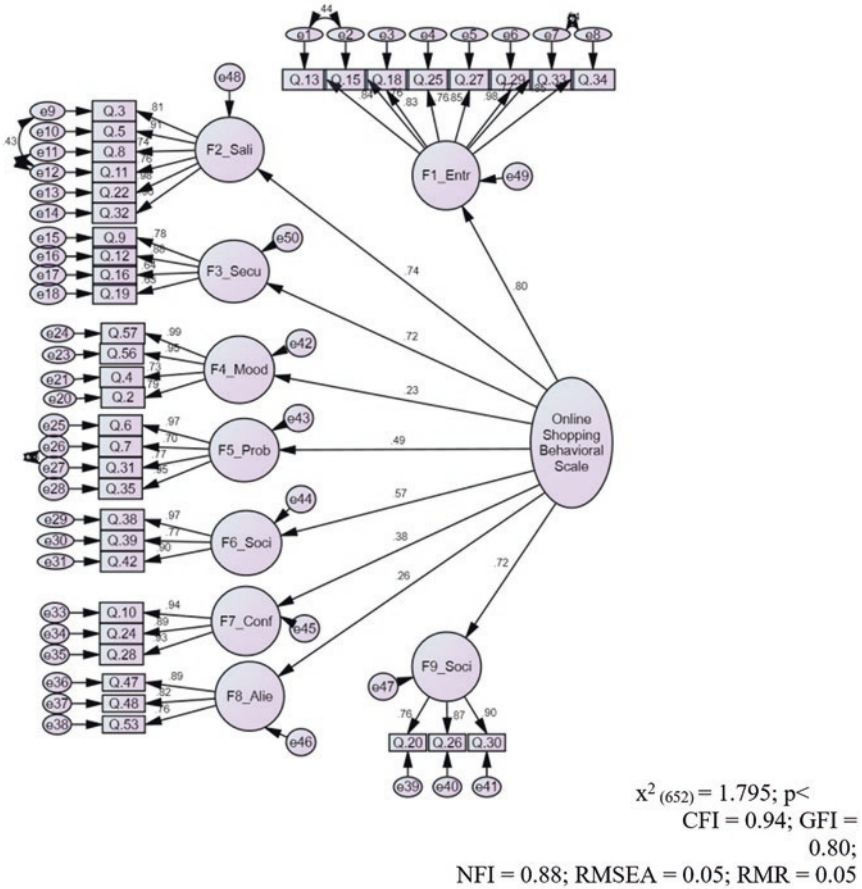
**Note.** ENTR: Entrustment; SALI: Saliency; SECU: Security; MOOD: Mood; PROB: Problems’ resolution; SOCI: Social insurance; CONF: Conflict management; ALIE: Alienation hindrance; SOCI: Social Responsibility

**Fig. 7.1** Measurement construct model of the Online Shopping Behavioral Scale. (Source: Prepared by the researchers based on primary data)

**Note.** ENTR Entrustment, SALI Saliency, SECU Security, MOOD Mood, PROB Problems’ resolution, SOCI Social insurance, CONF Conflict management, ALIE Alienation hindrance, SOCI Social Responsibility

### 3.4.1 Assessment of the Scale Validity

1. **Content Validity:** it has been examined through a Content Validity Index (CVI), where 25 independent experts were consulted to avoid any ambiguity. Accordingly, eight items were dropped and 57 others were retained.
2. **Criterion Validity:** it is assessed by checking whether there is a correlation between constructs measured into the OSBS and the other known standardized scales’ measures. It undergoes two kinds of validity: (a) **the predictive validity,**



**Source:** Prepared by the researchers based on primary data

**Note.** Q1-Q57 are the manifest variables of the scale; F1-F9 are the factors related to the scale of Online Shopping Behavioral Scale; e1-e50 are the errors of the manifest variables.

**Fig. 7.2** OSBS modelling as a reflective second-order factorial structure. (Source: Prepared by the researchers based on primary data)

**Note.** Q1-Q57 are the manifest variables of the scale; F1-F9 are the factors related to the scale of Online Shopping Behavioral Scale; e1-e50 are the errors of the manifest variables

which helps in predicting future outcomes and events and **(b) the concurrent validity**, which indicates the amount of agreement between two different measures. In other words, it is ensured whenever scores on an established measure are associated with scores on another measure taken at the same time (Adams et al., 2014).

3. **Construct Validity (Factorial Validity):** it was established by checking three main prerequisites: (i) the *assemblage of multiple sources* which include basic frameworks, like Bergen’s model and other related established measures; (ii) the *inclu-*

sion of experts' advices with respect to domestic factors, and (iii) *the wide assessment of all significant constructs via minimized likelihoods*. For more precision, the construct validity was ensured via three stages, encompassing the nomological validity, the convergent validity, and the discriminant validity.

- (a) *Nomological Validity*: Constructs and items relatedness have been duly checked and the nomological validity makes sense when there is a logical relationship between each construct (i.e., entrustment, salience, etc.) and its correspondent items.
- (b) *Convergent Validity (AVE)*: It reflects the degree to which a set of indicators could fully represent its latent variable. It was established through checking the respective values of the Standardized Factor Loadings (SFL), the Construct Reliability (CR), and the Average Variance Explained (AVE). According to Hair et al. (1998), it should be demonstrated that  $CR > 0.7$ ,  $CR > AVE$ , and  $AVE > 0.5$ . As shown in Table 7.2, the AVE of the extracted nine latent variables of our study was greater than 0.50.
- (c) *Discriminant Validity*: It evaluates the shared variance among the items of each factor (i.e., AVE), by examining the variance shared between factors (i.e., their correlation). As shown in Table 7.2, the AVE square roots of all the constructs of this study were greater than their correlations with the different other constructs. Therefore, based on Hair et al. (1998) principles, the measurement model satisfies the necessary criteria of the discriminant validity.

### 3.4.2 Assessment of the Scale Reliability

1. *Overall Reliability*: In order to determine the reliability of a multi-item scale, it should be proved that the Cronbach's  $\alpha$  value exceeds 0.7 the threshold value suggested by Nunnally (1978).  
In our study, the computed Cronbach alpha was 0.937, denoting the high-internal consistency of our instrument.
2. *Inter-Item Reliability*: It was ensured that the Cronbach's  $\alpha$  value of all the nine sub-constructs was ranging between 0.85 and 0.98, thus greater than the cut-off acceptable value of 0.7. Indeed, Cronbach's  $\alpha$  values of the nine constructs were, respectively, as follows: Entrustment ( $\alpha = 0.961$ ); Salience ( $\alpha = 0.984$ ); Security ( $\alpha = 0.866$ ); Mood modification ( $\alpha = 0.921$ ); Problems' resolution ( $\alpha = 0.936$ ); Social insurance ( $\alpha = 0.937$ ); Conflict management ( $\alpha = 0.960$ ); Alienation hindrance ( $\alpha = 0.855$ ); and Social desirability ( $\alpha = 0.908$ ), ensuring the required internal consistency.
3. *Split Half Reliability*: It was ascertained whenever the Cronbach's  $\alpha$  coefficient values of the first half items' (19 items) compared with those of the second half ones (19 items) were found satisfactory, 0.827.
4. *Inter-rater Reliability*: Results indicated that the estimated reliability between respondents is 0.263, with an acceptable confidence interval (CI) value of 95%



**Table 7.2** Validity and reliability analysis

Dimensions	SRWs	No. of Items	CR	AVE	SQR AVE
<i>Entrustment (F1)</i>		8	0.961	0.758	0.870
Q.13	0.840				
Q.15	0.761				
Q.18	0.830				
Q.25	0.762				
Q.27	0.849				
Q.29	0.979				
Q.33	0.725				
Q.34	0.847				
<i>Salience (F2)</i>					
Q.3	0.813				
Q.5	0.912				
Q.8	0.741				
Q.11	0.756				
Q.22	0.983				
Q.32	0.962				
<i>Security (F3)</i>		4	0.866	0.624	0.790
Q.9	0.774				
Q.12	0.883				
Q.16	0.633				
Q.19	0.630				
<i>Mood modification (F4)</i>		4	0.921	0.749	0.866
Q.2	0.794				
Q.4	0.732				
Q.56	0.951				
Q.57	0.990				
<i>Problems' resolution (F5)</i>		4	0.936	0.789	0.888
Q.6	0.972				
Q.7	0.698				
Q.31	0.774				
Q.35	0.952				
<i>Social insurance (F6)</i>		3	0.937	0.833	0.913
Q.38	0.971				
Q.39	0.769				
Q.42	0.906				
<i>Conflict management (F7)</i>		3	0.960	0.890	0.943
Q.10	0.937				
Q.24	0.888				
Q.28	0.931				

(continued)

**Table 7.2** (continued)

Dimensions	SRWs	No. of Items	CR	AVE	SQR AVE
<i>Alienation hindrance (F8)</i>		3	0.855	0.664	0.814
Q.47	0.895				
Q.48	0.815				
Q.53	0.760				
<i>Social desirability (F9)</i>		3	0.908	0.767	0.876
Q.20	0.762				
Q.26	0.867				
Q.30	0.904				

Keywords: *SRWs* Standardized Regression Weights, *CR* Composite Reliability, *AVE* Average Variance Extracted

Source: Prepared by researchers based on primary data

(0.221, 0.312). On the other hand, *average measures* showed 80% of stability among respondents, which ensured the consistency in information about the same construct from two different respondents. It was also revealed that the average score of established measures related to the second respondent is similar to those of the first one.

## 4 Results' Analysis and Discussion

The present study aims at developing a scale to assess Indian online shopping behavior, which is in an infant stage in many western cities and rural regions of India, where the internet occupation rate is still low. It emphasizes by the way that the online shopping behavior is a complex and a multidimensional phenomenon. It appears also that Indian shoppers perceive the online behavior differently depending on their location, their cultural heritage, and their habits. Hence, it is recommended to revisit and update the existing developed scales, which may vary whenever the context and the culture change. Indeed, on the basis of the prior literature, it is ascertained that the Shopping Addiction Scale proposed by Bergens (Andreassen et al., 2015) and the Online Shopping Addiction Scale (COSS) (Zhao et al., 2017) are becoming increasingly renowned as valid scales worldwide. However, those scales should be reconsidered and adapted before applying them to the Indian context as they do not reproduce the alike dimensions. For the present study, few measurement items were chosen and maintained in the light of a qualitative analysis and on the basis of previous scales developed in the Indian context; while several other problematic indicators were excluded due to validity issues.

The EFA results revealed that 12 factors structural dimensions could be retained. Nevertheless, by performing the CFA, out of those 12 factors, three factors corresponding to *privacy*, *recursion*, and *alienation* were deleted. Nine factors encompassing, *entrustment*, *salience*, *security*, *mood modification*, *problems' resolution*, *social insurance*, *conflict management*, *withdrawal*, and *social responsibility*, were

then maintained indicating the perspectives of an appropriate model that could fit the substantive theory. The obtained OSBS was outlined on the basis of prior reputed similar scales, such as those already suggested by Morahan-Martin and Schumacher (2000), Edward (1993, Compulsive Buying Scale), Montag et al. (2015), and Bergen (2015, shopping addiction scale; Cited in Andreassen et al., 2015). Convergent and discriminant validity were then checked and established, revealing that OSBS items and factors were highly correlated with the scale after performing the EFA and CFA.

Furthermore, modified measurement model loadings and factor loadings of the new obtained scale along with Cronbach's alpha coefficients were acceptable (as shown in Table 7.1). Consequently, the OSBS scale could be considered as a valuable, reliable, and relevant one, as compared to previous similar scales. It also revealed that out of nine factors, salience and entrustment factors are the two main strong predictors of the online shopping behavior.

## 5 Conclusion and Managerial Implications

This study adds new insights to the body of knowledge in terms of investigation and identification of the essential factors that might influence consumers' online purchase behaviors in specific cities of India. It revealed that the existing developed scales and their relevant constructs are not exclusively applicable in the Indian context, which leads us to reconsider and adapt them to the present investigation. Hence, an OSBS was proposed. Consistent with prior researches and drawing on the most reputed similar online shopping scales, the present study implemented a rigorous scale development procedure for establishing a strong psychometric structure of an OSBS, including nine factors with 38 statements (which are the most likely to affect the consumer behavior towards online shopping).

This study has several theoretical and managerial implications derived from the obtained results. Indeed, it offers academics and managers a validated OSBS, which can be employed by them to evaluate and in-depth-understand their shoppers' online behaviors. Such a basic tool could also be helpful for online retailers' decision makers whenever they are looking for formulating and implementing appropriate and recent business strategies.

Furthermore, this research emphasizes the importance of the interplay between various determinants of online shopping that may lead to the success or the failure of an online business. Consequently, online retailers are conveyed to put a special focus on entrustment, social responsibility, and salience issues. For instance, entrustment could be improved by securing online transactions and offering multi-payment options. Similarly, online social responsibility may involve adopting socially responsible elements in marketing strategies and redirecting online communication towards communitarian purposes. Finally, brand salience could be upgraded by implementing correspondent emotional stories, attractive figures, and facts that create strong and long-term memories about online products.

## 6 Limitations and Future Research Avenues

Although the present research yields several interesting insights and practical contributions for specific regions of the Indian context, it has quite few limitations that should be recognized. First, its primary objective was to understand a new phenomenon related to the behavior of online shoppers who are especially located in the four major cities of India (Delhi, Mumbai, Chennai, and Bangalore). The exploratory study that was carried out purposely could then have some social desirability issues. Moreover, the convenience sampling technique used in this research could generate biased or skewed data, and the obtained results could not be generalized to other retail shoppers located in different geographical areas.

Future investigations may be conducted by adopting other scientific sampling methods for the development of similar scales related to the same domain. They could be performed by including heterogeneous samples spread across different geographical regions of India and even other emergent countries.

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# Chapter 8

## Are StartUps and Small Businesses Ready to Adopt Digital Branding Strategies? A Critical Assessment



Aman Sharma and Bhuvanesh Kumar Sharma

**Abstract** It is expected that every working professional must have the idea of Digital Branding to sustain in the growing digital era, approximately 170 million people are on digital media platforms. Digital branding involves the promotion of products as well as services on the internet or other forms of electronic media. The advancement in the digital world has been gradually reaching the clouds. Irrespective of size, every business is trying to cope with branding challenges to sustain itself in the market. Startups and small businesses have limited resources hence they need to think twice before investing in any branding strategy. The furious growth in the access of digital media platforms gave opportunities to businesses for spreading their brand to their target audience. Startups and small businesses face problems in choosing the strategy due to a lack of awareness and knowledge. Businesses are still not fully aware of the benefits and use of digital branding hence when it comes to their intention to adopt digital branding, many questions raise in their minds regarding cost, time requirement, benefits/drawbacks, return on investment, safety and privacy, etc. The current study has the aim to analyse factors affecting the intention of startups and small businesses for digital branding adoption. The study adopted a quantitative approach. To better formulate the problem, 15 small business owners from different industries were interviewed to understand their perspectives regarding independent digital branding. After that quantitative approach followed in translating the interview finding into a structured questionnaire for determining the readiness of small businesses and startups by addressing their concerns such as return on investment (ROI) from digital marketing, cost of digital branding, the time required for digital branding, benefits from digital branding, promotional strategies and privacy policies of digital branding. 61 responses have been received from the entrepreneurs having businesses in major cities of Maharashtra such as Mumbai, Pune, Thane, and Nagpur. Collected data cleaned, sorted, coded, and further

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analysed by applying the PLS-SEM technique with SmartPLS software. The research brings the need for independent digital branding for small businesses and startups. The study will also help the digital marketing professionals in understanding the factors that can affect the behaviour of adoption of startups and small businesses to come on digital platforms. Many studies are done on Digital Marketing but not particularly on Digital Branding as Digital branding mainly focuses on promotion and brand recognition strategies. The research area lacks the study on pre-sales factors that affect the decision of startups and small businesses to step into digital branding platforms, and this research fills that gap.

**Keywords** Digital branding · Startups · Social media · Small business

## 1 Introduction

India has become one of the fastest-growing economies and shows a bright future for emerging startups and small businesses (Sheth, 2004). To sustain in such a highly competitive market, these businesses must be innovative not only for their products and services, but also for their branding strategies to spread their word a wider reach. Branding is a new and least known concept for small- and medium-sized businesses (Inskip, 2004). Branding basically means “differentiation of products/services” or “creating a different and unique image in customer’s mind” (Knox & Bickerton, 2003). Digital branding is referred to as a brand management strategy which combines digital marketing with internet marketing to build a brand across  $n$  number of digital platforms, like social media, mobile apps, websites, etc. (Jaiswal & Upadhyay, 2018). Like any other branding, Digital Branding is the process of informing customers about products/services to get their attention, expand the customer base, and increase revenue (Narver & Slater, 1990; Silk, 2006). When digital branding is done properly and in accordance with the needs of the sector, the Internet provides companies with a unique way to reach out to new markets. Also the opportunity to offer new products/services through the Internet network and allow them to compete in the same market with larger companies (Teixeira et al., 2018). For small and new businesses, branding is very critical to survive, develop, and grow in the market. Businesses that adopt such advanced technologies of branding get varying viewpoints and goals for the implementation, and this is considered the learning phase of digital branding which takes time (Hall & Khan, 2003). The primary purpose of digital branding gives users the best techniques which they can execute in their business plan to get benefits and allowing the businesses to interact with prospective customers more successfully (Patil et al., 2022).

Digital branding consists of many strategies and one of the most efficient strategies is Social Media Branding, which has totally transformed consumer buying behaviour (Kaplan & Haenlein, 2010). Socially connected media is a hub of online platforms which integrate technology with the internet that transforms communication into an interactive conversation which also includes feedback and a support

system (Ratnamulyani & Maksudi, 2018). Budding small and medium businesses are increasing their budget toward social media branding because their interest is significantly increasing in building the brand on social media due to its popularity (Latiff & Saifee, 2015). Social media branding is very cost-effective because it is believed that the audience gets more engaged by a viral campaign as compared to a television advertisement (Gilin, 2007). It does not mean businesses should shift their traditional way of branding completely to digital branding, it is very necessary for them to understand all the digital attributes before stepping into digital branding platforms (Herbst et al., 2012). Businesses have started understanding the value of digital branding and hence they started investing in planning and execution (Zhao & Zhu, 2010).

For startups and small businesses, digital branding is very beneficial as well as challenging, as they cannot handle it without understanding its aspects. Like any other branding, digital branding also requires guidance, handholding, and expertise. Many professionals and digital branding agencies handle digital branding for organisations but small businesses don't put it on their plan as a priority due to limited funds (Akeel & Gubhaju, 2020) but the reality is, even after involving these agencies, it requires less investment than any other traditional way of branding (Tiago & Verissimo, 2014). Branding mostly relies on advertisements which basically need to be updated as per trends and taste. The specialised digital branding agencies assist businesses in identifying their distinct culture and values, trends and taste, which requires curiosity, creativity, reliability, professionalism, and expertise (Ruzzier & Ruzzier, 2015).

There are a few reasons why startups and small businesses are still reluctant to adopt digital branding. Except for branding, almost anything we buy comes with a satisfaction guarantee. When we pay at store, we actually know what we will get. When such small companies invest in any other operational activities they set their risk level by predicting the market history. When startups and small businesses think to adopt digital branding, they don't get any guarantees or expected return commitment from digital branding professionals. Hence, businesses get precarious about expected leads from branding activities, which make it very difficult to trust digital branding. According to Chopra (2015), businesses fail in measuring the result of digital branding which eventually leads to the exemption of digital branding from their plan. Chopra (2015) also mentioned the major reason for not adopting digital branding is that businesses treat digital branding as some very hard and technical operation, which is not true. Intrigued by the fascinated figures linked with digital branding platforms and gradually increasing e-businesses, raise the expectation of startups and small businesses for overnight success, which later becomes a disappointment. Digital branding is a time-consuming process, but when it starts giving results businesses achieve lucrative success.

Previous studies have been done on digital marketing for startups and small businesses but lack specifically for digital branding by adopting a quantitative approach. Teixeira et al. (2018) did a brief analysis in their study about digital marketing adoption with a qualitative approach. Many studies have found the needs, advantages, and limitations of digital branding but overlooked the preadoption mind-set of

startups and small businesses. Yasmin et al. (2015) findings give a brief insight into the effectiveness of digital marketing in the competitive market. The current study aims at determining and critically assessing the factors influencing the startups and small businesses to go on a digital platform independently. This study also proposes the moderation impact on the intention of startups and small businesses to adopt digital marketing. This study has its application in assisting startups and small businesses in building their individual digital brand by merging their existing way of branding with minimal investment. This study will also assist the digital branding companies in analysing the pre-purchase mind-set of startups and small businesses. In this study, a few approaches will be mentioned for adopting digital branding with guidance and mentoring strategies in providing solutions for startups and small businesses.

### ***1.1 Objectives of the Study***

- To analyse the perception of startups and small businesses towards the implementation of digital branding strategies into their business plan.
- To find out the moderation factors and the impact they can create on the intention of startups and small businesses for digital branding adoption.
- To find out the antecedent factors that are affecting the decision of startups and small businesses to adopt digital branding strategies.

## **2 Literature Review**

### ***2.1 Startups and Small Businesses***

With the name startups, the first thing that comes to mind is “innovation” (Colombo & Piva, 2008). Startups at the early stage bring out innovative ideas that come to the market and are converted into financially sustainable businesses. New businesses are tools for converting entrepreneurial judgement into profit (Spender, 2014). Startups face many challenges like they have to face scarcity of resources and funds because of their smallness (Pangarkar & Wu, 2012). A startup is a set of individuals who can think of a plan to create a different future. The most crucial strength of a startup firm is creative thinking: perhaps more vital than nimbleness, the modest size allows for liberty to think (Thiel & Masters, 2014). Small businesses mean businesses running with few assets and on a small scale (Alvarez & Barney, 2001). Any startup starts with a smaller scale hence it can also be called a small business, but it is not compulsory to call every small business a startup, because a business can run at a smaller scale for going concerned and sustaining with stable profitability like an old sweet shop, old barber parlour, an old general store, etc. Small

businesses are described as those that are independently owned and controlled with no dominance in their sector and have fewer resources than large companies in their market (Street & Cameron, 2007). Planning and execution of branding are very compelling for the survival of these startups and small businesses. The most common issue for such businesses is their dissolution rate, only 50 out of 100 startups make it through their first 3 years (Praag, 2003). To compete in today's market pressure, it is now more important than ever for small businesses to enter the market with unique and different techniques of designing their branding strategies at globalised and competitive standards (Aaker, 1991, 1996; Baumgarth, 2010; Kapferer, 2004). Branding is a strategic tool for small businesses to survive in the market that has been continually driven by the dynamics of socioeconomic globalised standards (Urde, 1999).

## ***2.2 Need and Benefits of Digital Branding for Startups and Small Businesses***

Small businesses and startups do not have the same tools and methods for strategy development for business/market development as large corporations. Branding is one of the weakest areas where small businesses and startups face problems (Sudhakar et al., 2017). Adoption of digital branding technologies in today's fast-paced information era is considered the key to increasing a business's competitive edge (Sudhakar et al., 2017).

The main benefit of digital branding sources is that it offers plenty of ideas regarding innovation, particularly for startups with low cost for wider reach (Smith & Chaffey, 2008). A successful digital branding strategy not only increases profit and reduces cost, but also brings out many more important benefits, like customer loyalty which is very important for startups and small businesses (Estialbo, 2021). The use of web-based media to convey and execute branding plans assists businesses in expanding their reach and meeting the expectations of their consumers more efficiently (Chinje, 2015). The execution of digital branding not only provides profitability to the business but also makes them competitive up to globalised standards by making them rich and knowledge-wise in the area of information and data (Abimbola & Vallaster, 2007). Lack of governance and efforts have been found as the most important causes of the failure of a large number of startups and small businesses. Furthermore, digital branding is viewed as a secondary concern by small businesses when it comes to expanding their operations (Estialbo, 2021). Digital branding is crucial to sustain in the market, because startups and small businesses need to understand and spot the market opportunities by adapting to the dynamics of the competitive market environment rather than restricting themselves to a limited customer base and market (Carson, 1985), despite having limited resources (Aldrich & Auster, 1986). An affluent startup not only requires a unique product or service, but also needs an efficient branding approach (Sharma et al.,

2023). As a result, we have formulated the below hypothesis for empirical testing of the relationship between perceived utility and perceived value (PV) of digital branding:

*H1: Perceived Utility significantly impacts the Perceived Value of digital branding.*

### **2.3 Social Media Promotion (SMP)—Most Convenient and Widely Accepted Digital Branding Strategy**

The widespread use of social media platforms has given rise to a new branding channel known as social media branding (Sharma et al., 2023). Digital branding consists of many dimensions like SEO, Email Marketing, Content Marketing, Pay-per-click, Inbound Marketing, etc. The most widely accepted source of digital branding is social media branding which attracts the consumers way more than any other source of digital branding. Social media's reach plays a key role in delivering information from any place to anyone in seconds. Social media refers to a set of digital technologies, most usually manifested as websites and applications (Appel et al., 2020), that enable individuals to exchange information through various modes of social internet networks social networks such as Facebook for sharing memories, Twitter for tweets (microblogging), Snapchat and Instagram for shorts and stories, and YouTube for entertaining videos, which are examples of social media sources or applications. On these social networking services, users may create profiles and make connections. Engagement, as well as entertainment, takes place through uploading photos, linking media, and commenting on posts (Phua et al., 2017). Branding through social media allows businesses to interact and engage with the targeted consumers in an efficient way that traditional branding was not able to, due to time and geographic constraints (Yasmeen & Khalid, 2016). Businesses can use social media branding to reach their target demographic without spending on the intermediaries that are common in traditional marketing (Chaffey et al., 2012). Social media branding is becoming increasingly popular among both big businesses and startups (Chi, 2011; Collier, 2012). Branding is a difficult task for startups due to its high cost and competitiveness. Social media branding is an excellent option for a startup. Startups can run their ads on social media platforms with a limited budget and reach out to their focused audience through effective social media branding (Collier, 2012; Jefferson & Tanton, 2015). To be successful, businesses will need to employ both the internet and conventional methods (Bala & Verma, 2018). Thus, the following hypothesis has been proposed for empirically assessing the link between social media promotion and digital branding PV:

*H2: Social Media Promotion significantly impacts the Perceived Value of digital branding.*

## 2.4 *Perceived Return on Investment from Digital Branding*

Digital Branding is getting gradually importance among large- and medium-sized businesses as the strategies of digital branding are getting evolved (Nikhil, 2021). Startups and small-sized businesses face difficulty in handling and preserving data in substantial amounts (Holmlund et al., 2020). Return on Investment (ROI) is very crucial in digital branding since it provides data to startups and small businesses so that they can plan their future branding campaigns accordingly (Nikhil, 2021). There are various ways from which businesses can ensure a better return on investment from digital brandings, like machine-learning approaches should be combined with digital branding strategies (Miklosik et al., 2019). Machine learning promotes the development and enhances decision-making process by extracting the ideas from a large amount of data (Miklosik et al., 2019). The primary hurdles for startups and small businesses in terms of launching any innovation are intense competition, rising transaction costs, and scarcity of resources. Digital branding with effective strategies gives quick results like a viral campaign which can get you your targeted customers within a very short timeframe. Digital branding might give a boost in terms of ROI, but better and more reliable outcomes can only be seen in the long run. Thus, the following hypothesis has been framed for empirically testing the relationship between perceived return on investment and PV of digital branding:

*H3: Perceived Return on Investment significantly impacts the Perceived Value of digital branding.*

## 2.5 *Cost of Digital Branding Adoption*

There are several reasons why startups are hesitant to invest in digital branding platforms on their own. Startups and small businesses have limited funds; hence they need to be very sure about any investment. They need handholding and guidance for digital branding like any other way of branding. Startups and small businesses are not yet completely aware of the importance of digital branding. Today's entrepreneurs have access to digital media, but many are unsure of how to make the most use of it. Startups and small businesses must be aware of all digital branding channels in order to make the most use of them (Sivasankaran, 2013). Effective understanding and integration of the digital branding methods and patterns can ensure startups' sustainable success. Startups and small businesses still consider digital branding is costly and not worth investing in it. Most startups and small businesses do not consider digital branding investment compulsory when putting their business plans into action and they feel dicey to spend money on it (Akeel & Gubhaju, 2020). Investing in advertising entails uncertainty that is proven by the fact that advertising is a wager which is totally dependent on the reaction of the audience. Thus, the following hypothesis has been framed for empirically testing the relationship between the cost of digital branding and the PV of digital branding:

*H4: Cost of Digital Branding has a significant impact on the Perceived Value of digital branding.*

## **2.6 Time Consumption for Digital Branding**

Digital Branding involves technology learning for utilizing platforms of branding which involves many tools to be learned. Businesses look for other companies which handle technologies related to digital branding. They consider digital branding is very costly and time-consuming; thus they choose to engage with experts in the industry (Miklosik et al., 2019). The installation cost of tools required for analytics for branding is often high. Inaccurate data (measured wrongly) lead to waste of time. The implementation of analytical tools requires time and additional staff. The deployment of such tools is quite a hard and time-consuming procedure (Miklosik et al., 2019). Everyone on Internet has some sort of data that can be used as input for branding analysis. Data management and analysis are considered time-consuming and long-lasting processes (Cheng & Wang, 2018). Apart from social media promotions, there are a few digital branding strategies which give efficient results but take time like SEO (Search engine optimisation). Due to the unawareness regarding digital branding, people still find it very time consuming and uncertain for results. Thus, the following hypothesis has been framed for empirically testing the relationship between perceived time consumption and PV of digital branding:

*H5: Time consumption significantly impacts the Perceived Value of digital branding.*

## **2.7 Privacy in Digital Marketing**

There are several digital branding operations that have a negative impact on an individual's privacy. Privacy issues have spread beyond common incidents like junk mail or illegal Web cookie distribution (Weisband & Reinig, 1995), now the turmoil has reached a level that it has become a source of earning for some internet retailers by selling consumer databases the reason for direct marketing (Wang et al., 1998). The most significant issue is that online advertisements can produce the risk of copying the idea of an ad presentation or concept. Startups should focus on professionalizing their Internet branding campaigns; else, their target clientele would dismiss them (Yurovskiy, 2014). Digital branding means Internet and online which is directly connected with the frauds and risk of leaking data. According to a Marketing Sherpa poll, digital branding is still struggling for people's trust in the market. Private information should only be obtained, shared, and utilised in ways that protect consumers' privacy. Data should not be tampered with or damaged in any way, and it should be used for the only purpose it is provided (Wang et al., 1998). Thus,

the following hypothesis has been framed for empirically testing the relationship between perceived privacy and the PV of digital branding:

*H6: Perceived Privacy significantly impacts the Perceived Value of digital branding.*

## **2.8 Adoption of Digital Branding**

Past studies show that startups and small businesses require early adoption of digital branding strategies (Eriksson et al., 2008), but the business size is considered as one of the major reasons which affect the decision of adoption due to limited resources; hence startups and small businesses are the weakest adopters (Bordonaba-Juste et al., 2012). The commonly used resource-based theory (Grant, 1991) considers resources as the main factor which affects the decision-making process of startups and small businesses for adoption. Abilities, inspiration, background, and expertise of businesses owners or managers firm-specific are (Wiklund & Shepherd, 2005) considered the focal factors which affect the decision of digital branding adoption for startups and small businesses (Barbero et al., 2011) and the use of digital branding platforms (Dholakia & Kshetri, 2004).

Human, financial, and technological resources are among the major factors for the adoption of digital branding. These variables are connected to understand the benefits of new technologies in business, as well as adopters' attitudes about the channels. (Karjaluoto & Huhtamäki, 2010). According to Gilmore et al. (2001), startups and SMEs lack the resources and expertise required to fully optimise digital channels. The most significant variables for digital branding adoption in the industrial setting are a lack of funds, time, and experience in both startups and SMEs (Järvinen et al., 2012). External or mediator factors like the type of product/service, competition, industry sector, customer behaviour, and digital support, of them, also affect the adoption of digital branding indirectly (Taiminen & Karjaluoto, 2015). Thus, the following hypothesis has been framed for empirically testing the relationship between the PV from all the antecedents of digital branding and the adoption of digital branding:

*H7: Perceived value from all the antecedents of digital branding significantly impacts the Adoption of digital branding.*

## **3 Digital Support as a Moderator Between PV and Adoption**

After analysing all the antecedents, it has been found that there are still many myths about digital branding that exists in the market. Startups and small businesses are not yet aware of the real cost of digital branding, policies regarding confidentiality, and time management. Users need more information and support for optimum utilisation of all the digital branding platforms. Digital branding channels must be

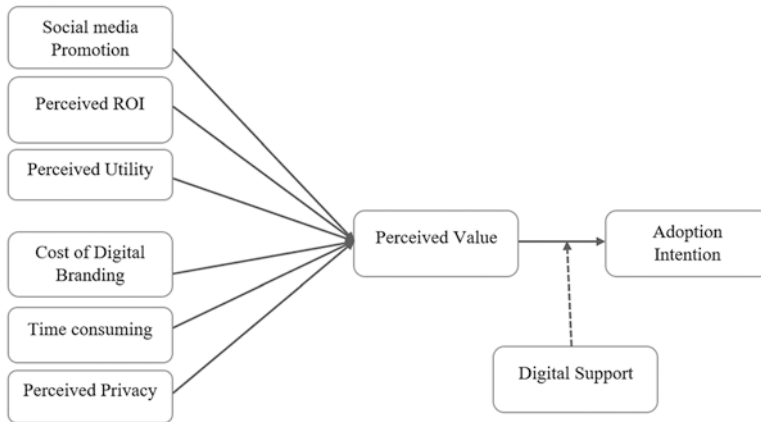


enhanced in order to support digital branding activities (Chaffey & Chadwick, 2012). Effective understanding, integration, and support for digital branding strategies can help startups and small businesses to achieve success. Managerial digital support is regarded among the most critical variables influencing the acceptance of digital branding. The effective implementation of innovation needs support from top management in order to incorporate innovation into business processes as well as other activities (Teixeira et al., 2017). As per the above literature, digital support provides a substantial influence on the process of decision-making regarding the adoption of digital branding. After getting the PV from the antecedents of digital branding, it may change the intention for the adoption of digital branding. Digital support can change that intention more towards the positive side. Hence digital support act as a moderator here. A moderating variable's effect is scientifically defined as the interaction, between a categorised or quantified variable that influences the direction and/or intensity of the relationship between the independent variables and variables. Thus, the following hypothesis has been framed for empirically testing the relationship between PV and adoption of digital branding under the moderation of digital support:

*H8: Digital Support moderates the relationship between perceived value and adoption of digital branding.*

## 4 Framework

Kim et al. (2017) proposed the model called the value-added model (VAM), Kim contended that the prior model called the technical acceptance model (TAM) presented by Warshaw et al. (1989) was restricted in understanding new Information Technology adoption, and the new IT users should be recognised as “consumers” rather than just technical users. VAM proposed updated and more reliable categories considered as major factors for PV and intention to adopt technology, these two categories are benefits (utility and satisfaction) and sacrifice (technical aspects and costing), VAM is also based on the cost-benefit concept, which represents the decision making process while deciding whether or not to employ new technology, by comparing cost and benefits (Lin et al., 2012). However, TAM looked at usefulness and convenience to explain the willingness to adopt a technology. The proposed framework has adopted the VAM model with an extension of moderation. After the impact of PV on Adoption Intention (ADI), there can still be a possibility of unsurety of the adoption if the part of the sacrifice has more weightage. The moderation effect can moderate the impact of PV on ADI positively and make the decision more towards adoption (Fig. 8.1).



**Fig. 8.1** The extended value-based digital branding adoption model

## 5 Research Methodology

Digital branding adoption by startups and small businesses is critical since this technology may perform as a communications platform that can be employed at low cost and with minimum risk (Teixeira et al., 2017). Digital platforms have become very important to extend and develop a business in the era of the internet and technology (Taiminen & Karjaluoto, 2015). Digital branding is relatively a new concept, particularly when applied to startups and small businesses (they have limited resources and are unable to invest in risky operations), there is a growing demand for studies with respect to the adoption of such technologies by startups and small businesses, to gain a full insight about the challenges and factors in the adoption process (Teixeira et al., 2017). Therefore, this study determines the need and factors affecting the decision of startups and small businesses to adopt independent digital branding. The researcher has adopted the quantitative approach, after analyzing the existing literature, it has been found that there is a gap in the research area of digital branding adoption regarding antecedent factors affecting the decision making process of startups and small businesses using a quantitative approach. Later, the author aims to prove the factors affecting the startups and small businesses to adopt digital branding through the Digital Branding Adoption Model with reference to the designed model VAM (value-based adoption model). Measuring factors and variables were collected from the existing studies and the author's self-observation with a few amendments to relate it to the context of the present research.

## 5.1 *Survey Element*

A comprehensive questionnaire was developed and used to collect responses from a sample of startups and small business owners/managers (irrespective of gender) through the face-to-face survey. The questionnaire contains 24 questions on Five-pointers Likert scale (1—Strongly Agree, 2—Agree, 3—Neutral, 4—Disagree, and 5—Strongly disagree). The questionnaire items were adopted from the previous studies with slight modifications done with respect to the context of the current studies. The scale adopted to design the instrument, such as perceived utility suggested by Estialbo (2021), social media promotion by Appel (2020), perceived return on investment by Nikhil (2021), and cost of digital branding, is adopted based on Akeel and Gubhaju's finding (2020). Miklosik (2019) stated time consumption as a construct which affects the intention of startups and small businesses to adopt digital branding and Perceived Privacy from Yurovskiy (2014). Subsequently, the constructs such as PV adopted from Walsh et al. (2008), ADI from Davis (1989), and digital support by Chaffey and Chadwick (2012). The instrument for survey was cross-checked and validated by the expertise in digital branding and the professors. Furthermore, the constructs of the questionnaire have been adopted from existing literature and the author's self-observation. The construct related to the perceived utility of digital branding is developed on the basis of Estialbo's (2021) findings, which emphasize on consideration of business's benefits from the adoption of digital branding. The construct of social media promotion has been taken from the study done by Appel (2020) which is considered the most efficient and affordable mode of digital branding suggested for startups and small businesses. According to Nikhil (2021), perceived return on investment is considered one of the major constructs which emphasise the ADI of digital branding. All of these constructs are antecedents of digital branding adoption and are considered benefits with reference to the VAM. The construct related to the Cost of digital branding is adopted on the basis of Akeel and Gubhaju's (2020) finding which is considered the major reason startups and small businesses hesitate to adopt digital branding. Miklosik (2019) stated time consumption as a construct which affects the intention of startups and small businesses to adopt digital branding, On the other hand, Privacy is also a major construct and reason why businesses give double thoughts before implementing such technologies into their operations (Yurovskiy, 2014)). The above constructs are considered under sacrifice with reference to the VAM. Lastly, according to the literature and the findings of the study, it has been found that digital support is a construct which affects the impact of PV on the adoption of digital branding. Hence digital support proposed the moderation effect on the relationship between PV and ADI.

## 5.2 *Sampling Element and Sample Size*

Respondents are from major cities of Maharashtra such as Mumbai, Pune, Thane, and Nagpur. These cities are emerging hubs of businesses (Bharath et al., 2018). It has been found that owners of startups and small businesses in Mumbai and Pune are from different places in India. The researcher only targeted the startups which were not more than 5 years old and small businesses having not more than five employees. The judgmental sampling method was used to pick the sample respondents and a total of 61 businesses were responded from among total approached businesses. As the conducted study is field research, a paper-based questionnaire is needed to be circulated along with in-person guidance on how to fill out the questionnaire in Hindi, English, and Marathi as per the requirement among selected locations to collect responses. The researcher approached almost 211 businesses and received 61 valid responses due to constraints like the unavailability of owners and lack of knowledge among caretakers or managers regarding digital branding. The collected data is analysed with a Structural Equation Model (SEM) to measure the relationship between latent variables with the help of Smart PLS software. Later, for better presentation, the data have been presented in the form of statistics.

## 6 **Data Analysis**

The research world has recently accepted the partial least squares structural modeling method (PLS-SM), particularly in social science (Ken, 2016). Because the outer model (Measurement) and inner model (Structural) are examined together, this is referred to as 2nd generation statistical technique. The model's main benefit is that it allows researchers to visually examine the constructs and simplify the study so that they can evaluate the relationship between indicators and their variables for testing the hypothesis (Urban & Mayerl, 2013). The model illustrates causal factors, confirms theoretical hypotheses empirically, and employs predictive measures (Sander & Teh, 2014). The main advantages of this method are it can be applied in case of small sample size, lack of distributional assumptions. and the variables can be at any scale, i.e., normal, ordinal, and interval (Fuchs, 2011).

### 6.1 *The Measurement Model*

The latent or composite variables get measured using a measurement model (Hoyle 1995, 2011; Kline, 2010). The measurement model examines the relationship between latent variables and their measurements. The measurement model gets examined using Discriminant validity, Reliability, and AVE.

The reliability of the instrument is measured using Cronbach's alpha, which validates the internal consistency of the items, although it is not greater than composite reliability. It is a test to see if all of the variables are consistently assessing what they are supposed to be measuring (Sekaran & Bougie, 2010). Taking the experience of different researchers as a base, we may say that the instruments are generally dependable as the alpha values are more than 0.6 and range between 0.704 and 0.851. The above results indicate that the model has strong construct validity as well as reliability (Table 8.1).

The evaluation of internal consistency reliability is often done with composite reliability given by Jöreskog (1971). Values which are higher indicate higher reliability levels. It may be calculated as the whole amount of actual score variance divided by the total amount of score variance (Brunner & Süß, 2005). The composite reliability values vary from 0.767 to 0.899, indicating that the measurement is consistent (Table 8.1).

The average variance extracted (AVE) is the measurement of the values of variances collected by the constructs in proportion to the number of variances due to error in measurement (Fornell & Larcker, 1981). A suitable level of convergent validity is shown by an AVE result of 0.50 or above. The AVE value falls between 0.620 and 0.753, meeting the criteria (Table 8.1).

Campbell and Fiske (1959) proposed the idea of discriminant validity in their discussion of the over-evaluation of test validity. The concept of "discriminant validity" comes from theoretical validity methods that concentrate on the constructs (Cronbach & Meehl, 1955). Discriminant validity evidence's main purpose is to be able to distinguish between measurements of distinct constructs. Discriminant validity values should be lesser than the convergent validity values. A satisfactory discriminant validity evaluation demonstrates that the test of constructs is not substantially linked with other measuring constructs, hence this is validating the discriminant validity of all constructs (Table 8.2). Diagonal values from the table come from AVE square root which should be higher than the correlation values of inter-construct, hence the discriminant validity is proven (Malhotra & Dash, 2011).

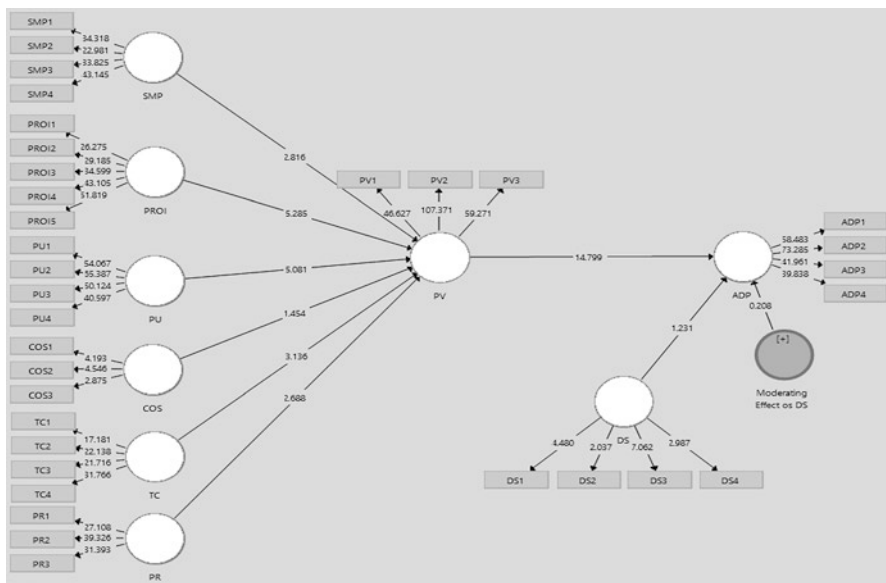
**Table 8.1** Cronbach's alpha, composite reliability, and AVE analysis

	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
ADP	0.837	0.891	0.671
COS	0.782	0.874	0.701
DS	0.704	0.767	0.753
PR	0.750	0.857	0.666
PROI	0.849	0.891	0.620
PU	0.851	0.899	0.691
PV	0.804	0.884	0.718
SMP	0.814	0.877	0.640
TC	0.748	0.840	0.568

*SMP* Social Media Promotion, *PROI* Perceived Return of Investment, *PU* Perceived Utility, *COS* Cost of Digital Branding, *TC* Time consuming, *PR* Perceived Privacy, *PV* Perceived Value, *DS* Digital Support, and *ADI* Adoption Intention

**Table 8.2** Discriminant validity

	ADP	COS	DS	PR	PROI	PU	PV	SMP	TC
ADP	0.819								
COS	0.041	0.837							
DS	0.151	-0.026	0.594						
PR	-0.020	0.215	-0.060	0.816					
PROI	0.061	0.260	-0.073	0.334	0.788				
PU	-0.020	0.273	-0.062	0.232	0.359	0.831			
PV	0.055	0.200	0.122	0.260	0.364	0.358	0.847		
SMP	-0.068	0.195	0.022	0.095	0.227	0.212	0.237	0.800	
TC	0.040	0.308	-0.014	0.246	0.223	0.292	0.279	0.207	0.754



**Fig 8.2** Bootstrap SEM model

## 6.2 The Structural Model

An inner (Structural) model evaluation is performed to determine the function of the independent variables in the model by calculating the *T*-value and *P*-value, which refers to the model's predictive significance. The author has used the Bootstrap SEM Model for checking the path significance of the hypothesis. PLS-SEM doesn't really presume that the data is normal (distributed), hence parametric significance tests cannot be used to determine the significance of coefficients like path values, outer weightage, and loadings. Rather, in PLS-SEM, the significance of predicted network coefficients is tested using a non-parametric bootstrap approach (Efron & Tibshirani, 1986; Davison & Hinkley, 1997) (Fig. 8.2).

**Table 8.3** Path analysis

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
PU -> PV	0.203	0.202	0.040	5.081	0.000
SMP -> PV	0.117	0.118	0.042	2.816	0.005
PROI -> PV	0.198	0.198	0.037	5.285	0.001
COS -> PV	-0.152	0.058	0.036	1.454	0.113
TC -> PV	-0.123	0.124	0.039	3.136	0.002
PR -> PV	-0.107	0.109	0.040	2.688	0.000
PV -> ADP	0.520	0.518	0.035	14.799	0.000
Moderating Effect of DS -> ADP	0.448	0.449	0.040	0.208	0.251
DS -> ADP	0.245	0.061	0.037	1.231	0.224

The bootstrapping results (Table 8.3) suggested that the constructs such as perceived utility, perceived return on investment, and social media promotion significantly influence the PV with  $T$  value of more than 1.96 and  $P$  value of less than 0.05. Hence, hypotheses H1, H2, and H3 are accepted. Similarly, time-consuming and perceived privacy also significantly influences the PV of digital branding; hence H5 and H6 are also accepted. However, the cost of digital branding doesn't influence the PV. Therefore, H4 is not accepted. The  $T$ -value is measured to get the difference between the means of the population. The  $p$ -value is considered as the possibility of getting a  $T$ -value at least as high as the one researcher finds in the sample if the hypothesis is correct. The path is significant if the  $T$ -value is more than 1.96 which shows the  $p$ -value as 0.00 (Table 8.3).

### 6.2.1 Moderation Analysis

The model also includes a moderating construct which indirectly affects the path between two constructs. The moderation analysis is performed to see if the significance of the digital support influences (moderated) the connection between the PV and ADI, as shown in Table 8.3. By integrating theory-driven concepts with empirical facts, the moderation effects seek to strengthen path execution (Fairchild & MacKinnon, 2009). Examining moderation effects help the researcher to find variables that may increase or limit the path's capacity to alter mediating variables, as well as to assess the model's validity (Hoyle & Robinson, 2004). The result of moderating effect from bootstrapping method shows that digital support does not mediate between PV and ADI. Hence, hypothesis H8 does not hold true (Table 8.3).

## 7 Hypotheses Testing

Hypothesis testing is a method for determining how accurately one can draw conclusions from observed findings by the sample taken for the study. It is used to assess the accuracy of responses from the sample and helps in making the framework for population-related decisions (Nettleton et al., 2006). Hypothesis testing is used to analyse the significance of path coefficients. The null hypothesis will be rejected if the coefficient's  $p$ -value is lesser than 0.05 (5%). This proves that independent variables have a significant impact on the dependent variables (Tables 8.3 and 8.4).

**Table 8.4** Hypothesis testing result

Hypotheses	Result
H1: perceived utility is significantly impacting the perceived value of digital branding.	As shown in Table 8.3, the $p$ -value of this path is 0.00 ( $p < 0.05$ ), which shows a significant impact. Hence, Null hypothesis: Rejected Alternative hypothesis: Accepted
H2: social media promotion is significantly impacting the perceived value of digital branding.	As shown in Table 8.3, the $p$ -value of this path is 0.00 ( $p < 0.05$ ), which shows a significant impact. Hence, Null hypothesis: Rejected Alternative hypothesis: Accepted
H3: perceived return on investment is significantly impacting the perceived value of digital branding.	Table 8.3 shows a significant impact with the $p$ -value of this path of 0.00 ( $p < 0.05$ ). Hence, Null hypothesis: Rejected Alternative hypothesis: Accepted
H4: The cost of branding is significantly impacting the perceived value of digital branding.	It is shown in Table 8.3 that the $p$ -value of this path is 0.00 ( $p < 0.05$ ), clearly showing a significant impact. Hence, Null hypothesis: Accepted Alternative hypothesis: Rejected
H5: Time consumption is significantly impacting the perceived value of digital branding	In Table 8.3, the $p$ -value of this path is 0.00 ( $p < 0.05$ ), which shows a significant impact. Hence, Null hypothesis: Rejected Alternative hypothesis: Accepted
H6: Perceived privacy is significantly impacting the perceived value of digital branding	It is shown in Table 8.3 that the $p$ -value of this path is 0.00 ( $p < 0.05$ ). Hence, Null hypothesis: Rejected Alternative hypothesis: Accepted
H7: Perceived value is significantly impacting the adoption of digital branding	As shown in Table 8.3 the $p$ -value of this path is 0.00 ( $p < 0.05$ ), which shows a significant impact. Hence, Null hypothesis: Rejected Alternative hypothesis: Accepted
H8: Digital support moderates the relationship between perceived value and adoption of digital branding	With the reference to Table 8.3, the $p$ -value of this path is 0.00 ( $p < 0.05$ ), which shows a positive impact as a moderator and it enhances the path of H7. Hence, Null hypothesis: Accepted Alternative hypothesis: Rejected



## 8 Discussion

The methodology used in the current study has helped us to prove that all the formulated hypotheses are significant and accepted. This implies that all the included factors perform a significant impact on the PV of digital branding and its adoption of intention. The current study aimed at understanding the various factors affecting the decision of digital branding adoption for startups and small businesses. To understand those, the study adopted the VAM model as this model follows the rational approach for consumer decision making and understanding the adoption of technology. This model categorizes various factors into perceived benefits and perceived sacrifices, and their impact driving on the PV which further influences the final adoption of technology. The current study is an attempt to extend the VAM model as the perceived benefits are social media promotion, perceived utility, and perceived ROI, whereas perceived sacrifices have been classified as cost of investment, perceived privacy, and time consumption. These factors have been widely discussed in the previous literature and adopted in the context of the present study. According to the analysis of variables, social media promotion, perceived utility, and perceived ROI are significantly influencing PV. Time consumption and perceived privacy have also a significant influence on PV. Whereas the total cost of investment does not have any impact on PV. This implies that the organisations are convinced that adopting the digital branding for their businesses, not only allows promoting their businesses but also increases the overall ROI and utility for their businesses. However, the small businesses are very much anxious about the overall cost of investment, immediate outcomes and their data privacy or safety, these are some of the variables which affect the PV negatively which further impact their final adoption. The current study also analyzed the moderating effect of digital support between PV and ADI and it has been found that the availability of proper digital support enhances the impact of PV over ADI. Hence, if proper digital support is provided to small businesses and startups, it will overall enhance and speed up the adoption of digital branding. The current study is also attempted to identify the antecedents and factors affecting the adoption of digital branding.

The study suggested that the perceived benefits and sacrifices as proposed by VAM model rightly measure the PV of digital branding. It has also suggested that the perceived utility, perceived return on investment, and social media promotion are important antecedents of perceived benefits with respect to digital branding adoption. However, the same is not in the case of sacrifice because only perceived privacy and time consumption are the only antecedents measuring sacrifices but not the cost of digital branding, which further needs to be explored. PV has been widely discussed and proved as an important predictor of ADI. Hence, the same is validated in the case of digital branding adoption.

The study has been conducted on the startups and small businesses which are very small in size and relatively new hence it is perceived that these startups and small businesses don't have enough resources to spend on additional branding despite knowing that there are several benefits associated with it. Therefore, their

concerns reported under this study if addressed will help them to create their brand and generate additional footfall for their businesses which finally increase the revenue and overall profitability of startups and small businesses. For making the adoption process effective, it is better to address reliable determinants, as the adoption of digital branding by startups and small businesses can be a complex process.

## **9 Implications**

This study has proposed strong implications at both theoretical and practical levels for researchers and businesses. The current research will add to the field of knowledge regarding digital branding as there is a gap in the field of research done on digital branding from the pre-purchase perspective. This study will also assist the digital branding professionals to analyse the perception of startups and small businesses toward digital branding.

### ***9.1 Theoretical Implication***

The current study adds to the existing literature by showing how digital branding contributes to the growth of startups and small businesses in brand exposure, trust-building, and customer awareness. Digital branding and its antecedent factors have been carefully evaluated. The research done in the area of digital branding adoption for startups and small businesses is limited. This research mainly adds value to the previous finding on digital branding by investigating the perspective of startups and small businesses on the ground level. Previous studies focused on the area of digital marketing which is an umbrella term but this research analyses the factors, especially for digital branding which is significantly related to more brand awareness.

### ***9.2 Practical Implication***

The findings of this study suggest practical implications that startups and small businesses could apply. This report gives startups and small businesses an insight into how crucial digital branding is to sustain in the competitive market and, more significantly, how digital branding can enhance their growth. Also, this study will provide startups and small businesses with the most effective and affordable digital branding strategies which they can incorporate into their operation plan. Furthermore, the recent study will help the digital branding experts/professionals in approaching the businesses to adopt digital branding with the help of analysing of the findings of the antecedent factors.

## 10 Limitations and Future Scope

The primary findings are done on startups and small businesses in cities of Maharashtra with small sample respondents, which can be different from the probable outcomes if done on a larger level. The respondents' time limitation to engage in a questionnaire-based interview was also one of the major constraints faced by the authors while collecting the data. Also, the limited availability of the owner of the startups and small businesses at the venue and the lack of information among caretakers or managers led to the response rate of only 30%. Due to the size of data collected from respondents, it is quite difficult to draw broad generalisations that apply to all types of small businesses and startups, but the recent study demonstrates the perception of the startups and small businesses regarding digital branding, which were mainly common in all sectors we surveyed.

Future studies in this field are strongly required due to the gradual growth of digital branding among businesses. In the coming time, researchers may collect data from a larger number of startups and small businesses and investigate both pre- and post-adoption factors. There are many more factors which can be addressed in future studies like trust in digital branding agencies and suitable strategies for promotion and recognition. Another proposal is to do the research at the international level for the comparative analysis of the adoption and perception of digital branding among startups and small businesses.

## 11 Conclusion

The purpose of the study was to investigate the significant factors affecting the decision of startups and small businesses to adopt digital branding. It has been found that many startups and small businesses are still uncertain about adoption due to concerns like cost, time consumption, and privacy. The study proposed a framework adapted from the VAM model to understand the ADI and what all factors affect the PV in a negative or positive way. As per the finding of the study, factors categorised under benefits, i.e., social media promotion, perceived utility, and perceived ROI, are affecting the PV in a positive manner. The factors categorised under sacrifices, i.e., cost, time consumption and perceived privacy, are affecting the PV in a negative manner. This path effect could still show the ADI in a negative manner if the weightage of sacrifices would be higher. Hence, the authors proposed an extension to the VAM model with a moderation effect. Digital support affects the ADI positively which moderates the path of PV toward ADI. This study confirms that the extension to the VAM model with a moderation effect can increase the path effect of PV towards ADI in a more certain manner. The proposed model can be useful for future studies to analyse the ADI of any technology and verify the change in the impact after moderation. According to the results of this study, it is concluded that most startups and small businesses are ready to adopt digital branding if they will be provided with the support and required knowledge.

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# Chapter 9

## Perceived Service Quality of Mobile Providers Through the Lens of Indian Young Adults



Gouranga Patra , Sumona Datta , Amina Omrane ,  
and Prithvish Bose 

**Abstract** Assessing customers' expectations and experiences is a strategic lever for service providers. Especially for mobile service operators, it is highly significant to stabilize the market. In this perspective, a comparative study was undertaken on 617 young adults of West Bengal and Chhattisgarh to evaluate their perception regarding the service quality of their mobile providers. To address the six various dimensions regarding customers' expectations and experiences, the SERVQUAL model was considered. The statistical analysis (including descriptive and ANOVA analyses, as well as Kruskal Wallis, Wilcoxon Signed Rank, and paired Sample t-Tests), uncovered significant findings. This research provides then several directions to mobile providers to improve their service quality and their users' satisfaction. It also reveals interesting trends and outcomes for academics and offers them insightful opportunities to delve deeper into future investigations.

**Keywords** Perceived service quality · Young adults' expectations · Young adults' experiences · Mobile service providers · Quality assessment

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## 1 Introduction

Marketing is a societal process that fulfills the human and social needs of citizens, aiming at satisfying them. Nevertheless, to do so, it seems that the production perspective, which is founded on the development of products and services before searching their corresponding market, does not fit the purposes of the marketing orientation. Indeed, according to Belás and Gabčov (2016) and Chavan and Ahmad (2013), among a variety of factors influencing customer satisfaction, service constitutes an important criterion that should be taken into account and it is gaining a growing importance day by day, as compared to products. For this reason, marketers are conveyed to develop their USP by providing a superior service value to customers. For instance, in few industries like telecommunication, banking, health care, or hotel industry, the focus has been mainly put on service, and customers' satisfaction has been usually assessed through the provided service. Moreover, whenever customers' experiences exceed their expectations, the positioning of the provider company grows in the market, given the fact that customers feel so satisfied. Service quality improvement is then a critical success factor for any organization and it denotes its development or failure (Thompson et al., 2000). For the service-oriented firms, customer retention and market growth are mainly ensured via the quality of services offered to customers (Hassan et al., 2013; Lee & Moghavvemi, 2015). In this perspective, we can cite SERVQUAL, which is a popular model used by service firms to assess the interplay between service quality and customer satisfaction (Zeithaml et al., 1988). This model depicted that, to highlight the difference between customers' expectations and their perceptions, firms need to consider some important criteria related to service quality, such as tangibility, reliability, responsiveness, assurance, and empathy (Bitner 1990; Parasuraman et al. 1985).

After liberalization and business internationalization, and during the digital era, significant changes have occurred in the telecommunication sector, which becomes an essential field, stressing the importance that should be paid to service quality at a very high level, in order to enhance customer satisfaction needed for the success of any organization. In this perspective, most companies are using the SERVQUAL model to assess their customer satisfaction in terms of provided services (Yavas et al., 1997). For instance, in India, it is noteworthy that mobile service sectors have witnessed a significant growth in terms of users and revenues, so that their development goes beyond the urban market to spread over the rural market with a high volume. That is why, with the increasing demand related to this competitive sector, all the competitors are struggling to increase their customers' base and their long-term relationship with them. In this regard, it is of tremendous importance to measure the service quality to minimize the gap between customers' expectations and their real experiences. It is also noted from various former studies that, among the dimensions taken into account by firms to evaluate the performance of their service quality, marketers are giving a growing interest to 22 criteria. Those encompass reliability, responsiveness, competence, accessibility, courtesy, communication, credibility, security, understanding, efficiency, fulfillment, privacy, empathy, and

convenience (Parasuraman et al., 1985; Zethamal et al., 2002; Yang & Fang, 2004; Liu & Arnett, 2000; Riel et al., 2001; Joseph et al., 1999).

More particularly, in fields like banking or hospitality, mobile service providers are giving a high priority to the services they are offering to their consumers and stakeholders to respond to their everyday problems and preferences in the present context of mobile service.

The rapid growth of information and communication technologies, as well as the shifting of market conditions from the traditional to the modern viewpoint and its moving to the digital age, has generated an increase in Internet, Wi-Fi, and mobile services' users and providers (Wu & Wang, 2005). Moreover, the technological progress engendered the development of the mobile commerce, which is actually considered the most lucrative trade for marketers and customers as well (Lu et al., 2009). Most of the companies providing e-commerce services depend mostly on mobile service providers who could help them gaining competitive advantages in the market and developing a good market response by enabling customers to shift themselves from traditional to digital methods and tools. Such a process is facilitated through mobile communication services (Turel & Serenko, 2006).

Therefore, it appears from the above discussion that mobile service quality is an important lever for every business operations. In fact, it is pursued as a prerequisite element taken into consideration by both service providers and non-service operator firms and strongly associated with all other services and non-service operators while managing their business operations. Such a service is gaining an increasing importance from both customers and marketers. Hence, the present study seeks to assess the service quality offered by major service providers who are located in two high-cultural Indian zones: Kolkata and Chhattisgarh.

## 2 Literature Review

Marketers evaluate their service quality on the basis of customers' assessment of the service they benefit from and the way it is utilized by them as service quality is directly associated with customer loyalty (Slack et al., 2020; Slack & Singh, 2020). For this reason, most companies do their best to deliver a high-quality service, which is in an integrated form, covering various aspects required by customers who search to fulfill their needs. It also develops customer retention with all-round satisfaction towards service providers (Ghylin et al., 2006; Poulouse et al., 2018). Besides, it is commonly known that a high level of service quality reduces customers' switching tendencies and increases the possibilities of their retention (Rahul & Majhi, 2014; Aslam & Frooghi, 2018; Jacob & Subramoniam, 2021). Marketers consider a few important criteria like intangibility, heterogeneity, and inseparability to assess the service quality (Parasuraman et al., 1985; Ladhari, 2009). Those criteria serve to improve customer satisfaction, which is of tremendous importance for sustaining a business. To be more precise, customers are currently attracted by high-quality services whose performance is greater than their expectations. Therefore, the level of

trust and commitment act as powerful mediators between service providers and users (Nelson & Kim, 2021; Purwanto et al., 2020; Yousaf et al., 2020) and marketers should draw considerable attention to the quality of service offered to customers (Asubonteng, 1996). Marketers are also appealed to unveil the customer needs and preferences before designing their service quality parameters. When it comes to the mobile service sector, this tendency becomes quite higher because customers evaluate instantly the performance of service providers in comparison with their own expectations (Parasuraman et al., 1988). According to Gronroos (1982), perceived service quality refers to the service outcome assessed by customers on the various proposition of the service provided by the company (Kang & James, 2004). It is assimilated to a psychological dimension deriving from the comparison between customers' expectations and their overall evaluation of their own experiences with the corresponding service providers (Jones & Suh, 2000). If the experience of customers is greater than their expectations, then they become satisfied with the service offered to them by providers (Cronin & Taylor, 1992). Accordingly, customers' satisfaction is based on their experience with service providers and their satisfaction levels are related to the outcome of services offered to them. For this reason, organizations, which constantly evaluate their service quality and satisfy their clientele, enjoy a higher level of customer retention and loyalty, which turns into a better return on investment in terms of sales and profitability (Wicks & Roethlein, 2009).

By considering the prior research on service quality assessment, it appears that measuring service quality has been a common practice followed by service firms as well as product-oriented ones. Additionally, marketers have been employing mainly two common approaches to measure their service quality corresponding to the SERVQUAL and the SERVPERF models. However, most of telecommunication and mobile service industries are essentially using the SERVQUAL model in a regular mode to evaluate their service quality. Indeed, their recourse to such a model has usually been explained by the fact that their customers' base has a higher tendency to change from a service provider to another one (Leisen & Vance, 2001; Negi, 2009; Van der Wal et al., 2002; Wang & Lo, 2002; Ward & Mullee, 1997).

The SERVQUAL model was developed by Parasuram et al. (1988) who implemented five important dimensions to access service: tangibility, reliability, responsiveness, assurance, and empathy (Li & Shang, 2020; Slack et al., 2020). In this model, the assessment of service quality was based on the difference between customers' expectations and their experience (Parasuraman et al., 1985; Brady & Cronin, 2001). In other words, the young adult evaluates the service in view of the degree of his involvement towards his corresponding service provider. His perceived service quality corresponds to the result of attitudinal changes coming from his own experience and his expectation with regard to the performance of service providers (Angell et al., 2008; Kahn et al., 2002; Parasuraman et al., 1988), which could turn to superiority or deficiency.

On the other hand, the SERVPERF model developed by Cronin and Taylor (1992), was originally derived from the SERVQUAL model, then amended by dropping customers' expectations and measuring their service quality perceptions that derive from their overall feelings toward the service. Implicitly, the SERVPERF

model assesses customers' experience based on the same attributes as the SERVQUAL emanating from the related attitude literature; and closely concurs them with similar satisfaction implications (Cronin, 1992, p. 64). Later, Teas (1993, p. 23) developed the evaluated performance model (EP) in order to overcome some of the issues associated with the research gap in this area dedicated to the service quality conceptualization (Grönroos, 1982; Parasuraman et al., 1985, 1988). This model measures the gap between perceived performance and the ideal amount of customers' expectations. The same scholars argued that the P-E (perception–expectation) framework is of a questionable validity due to its conceptual and definitional problems involving the conceptual definition of the expectations' component and its theoretical justification, as well as its measurement validity.

When it comes to mobile services, customers generally manifest a quite higher degree of contact with their service providers and their buying intention depends on their degree of satisfaction with the services offered to them (Stan et al., 2013). If they are unsatisfied, they can effortlessly switch and turn to an alternative mobile service operator, as the switching costs are very low. However, whenever they are satisfied, their retention becomes easier (Cronin & Taylor, 1992). Indeed, consistent with the new principles of the Telecom Regulatory Authority of India-TRAI, it is quite easy for the customer to switch to another service provider without changing the basic content. For those reasons, mobile service operators are constantly following their customers' trends and changing accordingly their service operation procedures looking into various segments (Leisen & Vance, 2001). Moreover, they are accustomed to design different paths of services in different periods to attract and retain their customers (Kim et al., 2004).

Therefore, it appears that the SERVQUAL model would be the most appropriate and important tool that could be helpful in the current research, which seeks to measure the perceived service quality for mobile service providers and operators of West Bengal and Chhattisgarh (Wang & Lo, 2002; Van Der Wal et al., 2002).

Owing to the aforementioned observations, it appears that assessing perceived service quality had received an increasing importance because of its considerable effect on retailers' sales and profits. Nevertheless, a scant attention has been dedicated to measuring perceived service quality among young adults who intend to buy mobile phones in specific Indian areas. For this purpose, the present study seeks to assess the difference between expectations and experiences of young Indians of West Bengal and Chhattisgarh regarding mobile services offered to them by their correspondent providers. It aims also at examining the influence of gender and location of young Indian adults on their expectations and experiences.

### 3 Research Method

In the present study, a quantitative research method was adopted. For this purpose, our sample encompasses 221 adults living in Chhattisgarh and 400 adults located in West Bengal, in India. To gather the required data, a questionnaire was

administrated to respondents. It was organized into two sections, containing respectively 24 items for the expectations' assessment of adults and 24 others related to their experiences. After their collection, data were scored and cleaned and complete responses were gathered from 617 young adults using mobile phones at least for the last 2 years (Mean age = 23.21, SD = 2.70; Men = 67% and Women = 33%).

Finally, data were analyzed using parametric and non-parametric techniques; and Indian adults' expectations and perceptions were assessed via the SERVQUAL Model. Accordingly, the statistical analysis included the descriptive statistics, Paired Sample t-test, One-way ANOVA and Two-way ANOVA, Kruskal Wallis, and Wilcoxon Signed Rank tests.

## 4 Results' Presentation and Discussion

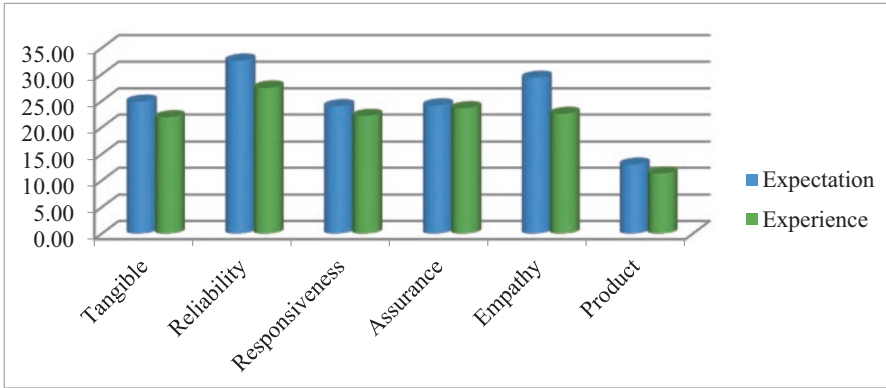
### 4.1 Differences Between the Expectations of Indian Adults and Their Experiences with Mobile Phone Providers

A paired sample t-test was performed to examine whether there is any significant differences between the expectations and experiences of Indian young adults regarding their mobile service providers. Results revealed that there are significant differences between the expectations of Indian adults and their experiences, as indicated by a significant t-value [ $t(420) = 24.16, p < 0.0001$ ]. In fact, mean values indicated that the experience of Indian young adults is much less than their level of expectations from the service providers (see Table 9.1).

For more precision, the domain analysis also revealed significant differences for all the domains encompassing: Tangibility [ $t(420) = 16.70, p < 0.0001$ ], Reliability [ $t(420) = 20.41, p < 0.0001$ ], Responsiveness [ $t(420) = 8.67, p < 0.0001$ ], Empathy [ $t(420) = 22.98, p < 0.0001$ ], Products [ $t(420) = 16.12, p < 0.0001$ ], and Assurance [ $t(420) = 2.54, p < 0.01$ ]. In other words, customers' expectations and experiences significantly differ, not only with respect to their respective perception of tangibility, reliability, responsiveness, and empathy of their service providers; but also depending on the insurance and product quality provided by them. In all cases, it was found that Indian adults' expectations are higher than their experiences, as indicated by the mean values (in Fig. 9.1 shown below); which means that the corresponding service provider was unable to fulfill the expectations of the young clientele.

**Table 9.1** Descriptive statistics and Paired sample t-test statistic for assessing the differences in expectations and experiences of Indian young adults ( $n = 421$ )

	Mean	SD	t-value	df	p-value
Expectations	147.82	15.82	24.16	420	0.0001
Experiences	128.86	17.14			



**Fig. 9.1** Mean values of young adults’ expectations and experiences with respect to the SERVQUAL sub-domains ( $n = 421$ )

#### 4.2 Differences Between Expectations of Indian Young Adults and Their Experiences with Respect to Their Providers’ Service Quality Perception

The significance regarding the differences between the expectations of Indian young adults and their experiences was examined for each parameter of customer satisfaction via the Wilcoxon Signed-Rank Test. This test was performed after applying a Bonferroni correction by using the  $(\alpha/24)$  formula, being the fact that those differences were checked for the 24 parameters of customer satisfaction. Thus, the alpha level was decided to be 0.0002 ( $0.05/24$ ) and the confidence interval was fixed at 99.80%. Following recommendations related to the alpha level, it could be deduced that a significant difference exists between the expectations of Indian young adults and their experiences as regards their satisfaction parameters ( $p < 0.0001$ ), except for the ‘employees’ knowledge’ parameter ( $p = 0.622$ ).

Furthermore, results revealed that for almost all the parameters, Indian young adults’ expectations were higher than their experiences, as shown below in Table 9.2.

#### 4.3 Differences Between Expectations of Indian Young Adults (West Bengal and Chhattisgarh) and Their Experiences Regarding Mobile Service

A variance analysis was conducted to assess whether the expectations of young adults of West Bengal and Chhattisgarh and their experiences regarding mobile services were similar or different. To do so, the entire data were obtained equally from a randomly selected sample comprising 200 Indian young adults living in West Bengal and Chhattisgarh. Findings supported significant differences existing

**Table 9.2** Wilcoxon signed-rank test with Bonferroni corrections assessing differences between the expectations and experiences of Indian young adults regarding their satisfaction parameters ( $n = 421$ )

Young adults' satisfaction parameters	$p$ -value	Significance level
Modern equipment of service provider	0.0001	"Significant"
Visually appealing physical facilities	0.0001	"Significant"
Appearance of employees	0.0001	"Significant"
Clean physical environment	0.0001	"Significant"
Execution of promises within deadline	0.0001	"Significant"
Sincerity in solving problems	0.0001	"Significant"
Consistency in service	0.0001	"Significant"
Keeping promises	0.0001	"Significant"
Maintaining records	0.0001	"Significant"
Information easily accessible	0.0001	"Significant"
Prompt service	0.0001	"Significant"
Willingness to help	0.0001	"Significant"
Promptness to respond	0.0001	"Significant"
Good behavior and instilling confidence	0.0001	"Significant"
Safety in transactions	0.0001	"Significant"
Polite behavior	0.0001	"Significant"
Knowledge acquired by young adults	0.622	"Significant"
Providing individual attention	0.0001	"Significant"
Convenient operating hours	0.0001	"Significant"
Giving personal service to customers	0.0001	"Significant"
Prioritizing customers' welfare	0.0001	"Significant"
Catering to specific needs of customers	0.0001	"Significant"
Variety of services	0.0001	"Significant"
Good quality service	0.0001	"Significant"

**Table 9.3** Descriptive statistics and  $F$ -values for assessing the differences between expectations and experiences of Indian young adults from West Bengal and Chhattisgarh ( $n = 421$ )

		$N$	Mean	SD	$F$ -value	df	$p$ -value
Expectations	Chhattisgarh	200	141.56	19.91	69.26	1, 419	0.0001
	West Bengal	221	153.48	7.18			
Experiences	Chhattisgarh	200	122.51	21.42	59.68	1, 419	0.0001
	West Bengal	221	134.62	8.71			

between the experiences of young adults and their expectations in both places, as indicated by significant ANOVA results, [ $F_{\text{Expectation}}(1, 419) = 69.26, p < 0.0001$ ;  $F_{\text{Experience}}(1, 419) = 59.68, p < 0.0001$ ]. In both cases, young adults from West Bengal scored higher in comparison to those from Chhattisgarh with respect to their expectations and experiences with their mobile service providers (for more details, see Table 9.3).

Furthermore, the one-way ANOVA applied to each domain revealed that a significant difference exists in all the expectation domains with respect to customers

residing in Chhattisgarh and West Bengal. This is why customers from both places differ significantly with respect to their expectations concerning tangibility [ $F_{\text{Tangibility}}(1, 419) = 85.86, p < 0.0001$ ], reliability [ $F_{\text{Reliability}}(1, 419) = 163.18, p < 0.0001$ ], responsiveness [ $F_{\text{Responsiveness}}(1, 419) = 8.60, p < 0.004$ ], empathy [ $F_{\text{Empathy}}(1, 419) = 13.11, p < 0.0001$ ], and products expected from service providers [ $F_{\text{Product}}(1, 419) = 168.48, p < 0.0001$ ], except for assurance in service [ $F_{\text{Assurance}}(1, 419) = 3.17, p = 0.07$ ].

Similarly, for the domains related to experience, there is a significant difference between customers residing in Chhattisgarh and those located in West Bengal. It implies that customers from both places differ significantly with respect to their experience with service providers' tangibility [ $F_{\text{Tangibility}}(1, 419) = 63.63, p < 0.0001$ ], reliability [ $F_{\text{Reliability}}(1, 419) = 83.45, p < 0.0001$ ], responsiveness [ $F_{\text{Responsiveness}}(1, 419) = 178.61, p < 0.0001$ ], assurance in service [ $F_{\text{Assurance}}(1, 419) = 211.67, p < 0.0001$ ], empathy [ $F_{\text{Empathy}}(1, 419) = 187.65, p < 0.0001$ ], and products expected from their service providers [ $F_{\text{Product}}(1, 419) = 82.62, p < 0.0001$ ].

#### ***4.4 Differences Between Expectations of Indian Young Adults and Their Experiences with Respect to Their Different Service Providers***

To check whether there is a difference between the expectations of Indian young adults and their experiences with respect to their different service providers, parametric testing could not be carried out as the number of users for each service provider was not equal. For this reason, a non-parametric Kruskal Wallis test was performed and results revealed that there is a significant difference among users of different service providers with respect to their expectations and experiences, as shown below in Table 9.4. Thus, customers' expectations and experiences differ significantly as regards their service providers.

The obtained mean rank indicated that, for all the service providers, there has been a difference between their expectations and experiences with respect to their different service providers. As depicted in Fig. 9.1, this difference is the highest for "Idea, Reliance, and Jio", for all the customers; while it is the lowest for "BSNL and Vodafone" (Fig. 9.2).

#### ***4.5 Differences Between Expectations of Indian Young Adults and Their Experience with Respect to Their Gender***

The one-way Analysis of Variance was conducted to examine whether there is any difference between the expectations and experiences of Indian young adults with respect to their gender. Results revealed that there is no significant difference



**Table 9.4** Kruskal Wallis test examining the differences between the expectations and experiences of Indian young adults regarding their different service providers

	Service providers	N	Mean rank	Chi-Square value	d	p-value
Expectations	Airtel	104	212.37	13.93	5	0.02
	BSNL	23	221.28			
	Idea	54	162.40			
	Reliance Jio	186	219.70			
	Vodafone	43	239.21			
	Tata Docomo	11	160.82			
Experiences	Airtel	104	216.43	20.60	5	0.001
	BSNL	23	248.00			
	Idea	54	161.50			
	Reliance Jio	186	212.61			
	Vodafone	43	252.63			
	Tata Docomo	11	135.36			



**Fig. 9.2** Differences between expectations and experiences of Indian young adults regarding their different service providers

regarding expectations [ $F_{\text{Expectation}}(1, 198) = 3.34, P = 0.07$ ] and experiences [ $F_{\text{Experience}}(1, 198) = 0.045, p = 0.83$ ] of both male and female customers. Thus, male and female customers have approximately equal levels of expectations and experiences with their mobile service providers.

However, the one -way ANOVA analysis carried out for all the domains demonstrated that there is a significant difference related to the expectation domains with respect to customers’ gender. It implies that both male and female customers differ significantly with respect to their expectations concerning tangibility [ $F_{\text{Tangibility}}(1, 419) = 3.87, p = 0.05$ ], reliability [ $F_{\text{Reliability}}(1, 419) = 6.85, p < 0.009$ ], responsiveness [ $F_{\text{Responsiveness}}(1, 419) = 4.73, p = 0.03$ ], assurance [ $F_{\text{Assurance}}(1, 419) = 4.13, p = 0.04$ ], and products expected from service providers [ $F_{\text{Product}}(1, 419) = 6.97, p < 0.009$ ],

except for empathy in service [ $F_{\text{Empathy}}(1, 419) = 0.15, p = 0.69$ ]. Thus, gender differences are highly significant for reliability, and products expected from service providers; but they are weakly significant for tangibility, responsiveness, and assurance of service providers.

ANOVA results supported the non-existence of significant differences between male and female customers regarding all the domains of experience. Besides, findings indicated that both male and female customers have similar experiences according to their service providers' tangibility [ $F_{\text{Tangibility}}(1, 419) = 1.19, p = 0.27$ ], reliability [ $F_{\text{Reliability}}(1, 419) = 3.03, p = 0.08$ ], responsiveness [ $F_{\text{Responsiveness}}(1, 419) = 3.35, p = 0.07$ ], service assurance [ $F_{\text{Assurance}}(1, 419) = 3.67, p = 0.06$ ], empathy [ $F_{\text{Empathy}}(1, 419) = 1.14, p = 0.29$ ], as well as products expected from them [ $F_{\text{Product}}(1, 419) = 2.50, p = 0.12$ ].

#### ***4.6 Interaction Effect of Gender and Location on Expectations and Experiences of Indian Young Adults***

To check the interaction effect of gender and location on the expectations and experiences of Indian young adults, a ( $2 \times 2$ ) two-way analysis of variance was conducted by considering gender and location as independent variables and each of the domains related to customers' expectations and experiences as a dependent variable.

On the one hand, and as shown in Table 9.5, hereafter, results supported that no significant interaction effect could be found for both expectations and experiences of young Indian young adults regarding all service providers' domains, including respectively tangibility in service, reliability, assurance, responsiveness, and empathy. In fact, adjusted R-squared indicated 18% of the variance in the expectation of tangibility and 13% of the variance in the experience of tangibility (explained by gender and location of customers); 30% of the variance in the expectation of reliability and 17% of the variance in the experience of reliability; 3% of the variance in the expectation of responsiveness and 30% of the variance in the experience of responsiveness (explained by gender and location); 2% of the variance in the expectation of assurance and 34% of the variance in the experience of assurance; 3% of the variance in the expectation of empathy and 31% of the variance in the experience of empathy; 30% of the variance in the expectation of products and 16% of the variance in the experience of products.

On the other hand, findings pointed out that when both gender and location are considered together, a significant main effect exists only for the location of young adults, but not for gender, in the expectation and experience of customers regarding tangibility in service, assurance, products, empathy, responsiveness, and reliability of their service providers.

**Table 9.5** Two-way analysis of variance applied to check differences between expectations and experiences of Indian young adults regarding different service providers' domains ( $n = 421$ )

Domains	DV	IV	<i>i</i> value	<i>p</i> -value	Partial eta square ( $\eta^2$ )	Adjusted R square
Tangibility of service	Expectation	Gender	1.06	0.30	–	0.18
		Location	72.92**	0.0001	0.15	
		Gender*Location	4.90*	0.03	0.01	
	Experience	Gender	0.001	0.97	–	0.13
		Location	59.45**	0.0001	0.12	
		Gender*Location	0.031	0.86	–	
Reliability of service	Expectation	Gender	1.82	0.17	–	0.30
		Location	144.66**	0.0001	0.26	
		Gender*Location	1.90	0.17	–	
	Experience	Gender	0.41	0.52	–	0.17
		Location	75.14**	0.0001	0.15	
		Gender*Location	0.48	0.45	–	
Responsiveness of service providers	Expectation	Gender	3.67	0.06	–	0.03
		Location	5.55*	0.02	0.01	
		Gender*Location	1.96	0.16	–	
	Experience	Gender	0.02	0.88	–	0.30
		Location	171.93**	0.0001	0.30	
		Gender*Location	0.78	0.18	–	
Assurance	Expectation	Gender	3.82*	0.05	0.01	0.02
		Location	1.41	0.23	–	
		Gender*Location	2.68	0.10	–	
	Experience	Gender	0.06	0.79	–	0.34
		Location	197.21**	0.0001	0.33	
		Gender*Location	0.07	0.78	–	
Empathy of service providers	Expectation	Gender	0.000	0.98	–	0.03
		Location	11.10**	0.0001	0.03	
		Gender*Location	1.32	0.25	–	
	Experience	Gender	0.43	0.51	–	0.31
		Location	176.77**	0.0001	0.30	
		Gender*Location	0.46	0.50	–	
Products	Expectation	Gender	1.94	0.16	–	0.30
		Location	148.44**	0.0001	0.26	
		Gender*Location	2.90	0.09	–	
	Experience	Gender	0.16	0.68	–	0.16
		Location	76.82**	0.0001	0.16	
		Gender*Location	0.00	0.98	–	

Note: \*=0.05; \*\*= 0.01

## 5 Results' Discussion

The present research offers the opportunity to revisit the SERVQUAL model and yields some interesting and practical implications related to the assessment of quality service of mobile service providers serving Indian young adults, who are located in Chhattisgarh and West Bengal, in India. It offers significant results issued by carrying out parametric and non-parametric techniques. By mingling and analyzing the findings of the collected data, this study has attempted to provide researchers, marketers, and customers with meaningful knowledge of the subdomains related to the assessment of the perceived quality of service providers. Several important conclusions could then be derived from the results' analysis and interpretation as follows:

- This research gives a detailed overview of the significant gaps existing between young adults' expectations and their actual experiences regarding their mobile providers' quality service (including responsiveness, empathy, assurance, tangibility in service, and products offered by them).
- Furthermore, this study underlines that young adults from West Bengal had higher expectations as well as experiences with respect to their mobile service providers, compared to those from Chhattisgarh. Besides, young adults' expectations and experiences differ significantly for all the service providers. However, the difference was found to be the highest for Idea and Reliance Jio for all the customers, while it was lower for BSNL and Vodafone.
- There is a significant gender difference in the expectations of Indian young adults, but not in their experiences with respect to the tangibility, reliability, responsiveness, assurance, empathy, and products of their service providers.
- When both gender and location are considered together, a significant main effect exists only for location in the expectations and experiences of young adults. Moreover, no significant interaction effect was found for any of the domains of expectations and experiences with respect to service providers.

Overall results indicated that none of those young adults located in both locations covered by our survey meet his own expectations. However, the findings of the present study can enlighten the extent and reasons behind such a problem. Indeed, young adults' dissatisfaction extends across all the domains, except for the domain of employees' knowledge. It implies that whenever the personnel involved in delivering services to their clientele have the basic required knowledge, the actual service delivered across all the service domains is below customers' expectations. This is indeed an alarming matter that should be taken into account by service providers. Such a finding is similar to those of Nurysh et al. (2019) who already explained that the perceived value and service quality are positively correlated with customer satisfaction. However, it was found that the interaction of those two variables with the attractiveness of alternative customers does not improve clientele satisfaction.

Furthermore, it is noteworthy that all our respondents were Indian young adults who pertain to the most critical age group, as they are considered the heaviest users

of mobile services. They are also expected to dominate the customer base in India for the next decade. Accordingly, service providers are conveyed to address those young adults' requirements in order to survive. In the same orientation, some prior studies carried out by Sharma (2014); Sharma et al. (2012); Chen et al. (2017); as well as Misra (2012) have supported the same statement.

One of the most interesting findings of this study is that both expectations and actual experiences among young adults located in West Bengal are higher than those of respondents belonging to Chhattisgarh. This could be explained by the fact that service providers have a better infrastructure in metro areas, and could then provide better services to customers who might experience higher expectations. It could also be explained by significant cultural differences between the citizens of Chhattisgarh and those of Kolkata. These reasons could be explored with greater depth in subsequent studies.

The present study also revealed that, apart from the customers' perception of the overall service quality, significant differences exist with respect to young adults residing in Chhattisgarh and West Bengal. Thus, respondents differ significantly with respect to their expectations and experiences with service tangibility, reliability, assurance, as well as with their providers' empathy and products. The differences in every single service domain, including people-oriented domains such as empathy and responsiveness could be explained by differences in the quality of service provided and by the infrastructural support existing in the two areas (Kolkata, the major metro city and Raipur in Chhattisgarh, which is a much smaller city). This statement was already supported by Yousaf et al. (2020); Zubair et al. (2019); as well as Nelson and Kim (2021).

Additionally, it was found that one of the largest service providers in terms of customer base, and located in Reliance Jio, did not have the highest service quality, which means that various latent factors are possibly coming into play. Thus, further studies could be undertaken to fully understand the issues involved.

Another important finding revealed by the analysis underlines the differences between male and female respondents while analyzing the various domains of service quality including tangibility, reliability, responsiveness, assurance, empathy, and products of service providers. These differences were highly significant for reliability, and products in service; but weakly significant for tangibility, responsiveness, and assurance in service providers. In the same perspective, Jhamb et al. (2020) reported the same idea and mentioned that customer perception toward telecom services is significantly prompted via five service dimensions, i.e. tangibility, reliability, responsiveness, assurance, and empathy."

On the other hand, this study emphasizes that gender could affect customers' purchase behavior. Such a statement is supported by past researchers including Meyers-Levy (1989) and Zeeshan (2013) who found out gender differences in mobile purchase behavior and preferences related to mobile service. Thus, the results of our study conform to the past understanding in this area. However, results supported that these differences are highly significant when the focus is made on expectations; but the distinctions vanish when the actual experience is taken into

consideration. This effect may be caused by the fact that all the respondents involved were young and well- educated and gender-related socio-cultural factors did not cloud their judgment of actual service proved. Thus, while young adults' expectations may have been different, their assessment of the reality of the service quality was not colored by any extraneous influence. Then, mobile service providers are appealed to segment the market by gender and provide appropriate services to each gender segment, so that their market position could be enhanced.

Overall, the current study uncovers significant issues related to young adults' perceptions regarding mobile services offered to them. It provides directions to service providers who seek to improve their offerings to the attractive significant segments of their mobile users. It also reveals several interesting trends and findings for academicians and researchers; and dedicates them meaningful opportunities to delve deeper into several areas through additional research.

## **6 Practical Implications, Limitations, and Future Research Directions**

Customers' expectations and experiences should be taken into account by providers who seek to upgrade their service quality in order to satisfy their clientele, and increase their market shares and profitability. In this perspective, this study has attempted to offer service providers meaningful insights and knowledge on the perceived service quality issues. It gives an overview of the most important criteria that may influence its assessment by customers. This research may help marketers as well as service providers to design the appropriate business strategy for capturing better markets. For this purpose, this paper pointed out which areas marketers should focus on to minimize service-related issues and problems that might occur. This study is also meaningful for new entrants who should understand how to meet customers' expectations in a new market setting.

Like any other research, ours also have some limitations that should be recognized and discussed. First of all, the number of young adults subscribing to the different service providers was not equal since it could not be controlled. A more or less equal number of young adults subscribing to different service providers could have helped to make a comparative analysis. Second, the present study focused only on Indian young adults who live in two main cities. A variation in the age group considered in the sample could have provided a better comparison of the expectations and experiences of adults. Third, the socioeconomic status of young adults was not taken into account in the present study. Nevertheless, considering this parameter could also give a better picture of the assessment of perceived service quality. Finally, the data did not permit the application of multivariate modeling due to the lack of normality in most cases. Nonetheless, parametric univariate techniques could be used as long as the sample size is quite large.

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# Chapter 10

## Contextualising Intersections Between Digitalisation and Education: Post-Pandemic Psychosocial Insights from Indian Classrooms



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**Abstract** The advent of COVID-19 has led to a paradigm shift in pedagogy and learning. While digital technology was already present as a supplementary source of knowledge in the pre-pandemic time, the pandemic ushered a new lease of life to use technology as the primary means of disseminating education. This of course becomes tricky in developing and under-developed countries where issues of digital access and literacy are paramount and comes with implied socio-economic-cultural privileges and capital. As a result, a large section of students is cut off from mainstream education in such countries, raising important questions on affordability, equity, educational justice and rights. The present conceptual review tries to highlight the intersections of digitalisation, technology and education from a post-pandemic worldview, with a special focus on the psycho-socio ramifications of e-learning in third-world countries, taking India as a case in point. The challenges and effectiveness of using online platforms of learning in the long run shall be critically discussed, taking into consideration the Indian educational scenario and the glaring issues evidenced in imparting online education that the country grapples with. The long-term psychological effects of being physically absent from the school space and having homes turned into classrooms will be discussed at length. Digital education also becomes a gendered issue in Indian households, where

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women's education is particularly less prioritised giving a way for unique contextual insights in this regard. Educational curriculum in India was barely adapted to the digital format before the pandemic stepped in and basic technological infrastructure for the same is lacking in many educational environments. Even as the post-pandemic world is in the process of materializing itself, gaps still exist in the curriculum development for the online platform, especially, for individuals with disabilities. This further accentuates the divide in digital learning. The author/s would dwell on the intersections of mental health of students and digitalisation of education, and the neurocognitive correlates of unlimited screen time on academic functioning and general well-being.

**Keywords** Pandemic · Digital education · e-learning · Psychosocial impact

## 1 Introduction

### 1.1 *Changes in the Wake of Covid-19*

The outbreak of the COVID-19 pandemic in the year 2020 brought with it a massive change in the lives of billions across the world. This massive change had to be ushered into the lifestyle of adults and younger children and adolescents. With the advent of the pandemic, the world underwent an overnight shift in its living and working styles. Humans had to adapt to a new lifestyle, most of which involved limiting themselves to the four walls of their houses and working from behind a screen. The sudden digitalisation of almost all aspects of people's lives had severe psycho-social ramifications that would lead to irreversible changes in the long run. Digitalisation refers to a digital transformation of our day-to-day lives, about the alterations related to the application of technology in almost all aspects of human society. It involves transforming existing products and services into digital variants, thus offering an edge over the tangible product (Parviainen et al., 2017).

Digitalisation has impacted society, education, business, and culture. Today, more than ever, the field of teaching relies heavily on technology. Teachers and students can now access many technological devices and resources, using collaborative digital platforms to improve teaching and learning. Digital accessories and learning resources play a crucial role in achieving the global educational objectives, enhancing and adding value to the learning and teaching processes.

The globalisation of the Indian economy in 1991 brought a revolution in the field of Information Technology; the teaching and learning method changed from traditional classrooms and blackboards to smart boards and e-books, along with audio recordings and video clippings. With the pandemic of COVID-19, we are moving towards the digitalisation of the Indian education system at a faster rate. Hard copies of books are now being replaced with e-books, paper assignments, and e-assignments. The pandemic altered teacher-student relations to a great deal; students are now sometimes taught via websites and with the help of various other applications.

However, several challenges exist despite the various benefits of incorporating technology and digital resources into the education system. In a developing country like India, where 25% of the population lives in poverty (NitiAyog, MPI Report, 2021), it is challenging to integrate digital technologies and resources into education, and there is a significant gap in the integration of digital technologies between the urban and rural populations. The pandemic acted as a catalyst in escalating the digitalisation of education in the country, but only for a particular section of the population were these resources available. Novak et al. (2018) stressed the formulation of public policies in this area. Several areas require government actions so that every sector of society can benefit from digitalisation, collaborating with other stakeholders, especially with businesses, individuals, and NGOs pushing for change.

## ***1.2 Social Divide in the Context of Digitalisation***

The beginning of 2020 saw 1.6 billion children and youngsters being displaced out of schools in over 190 countries. This had significant consequences on their learning progress, nutrition, psycho-social development, and subsequent employment opportunities (UNESCO, 2020). The last 2 years saw a jump in digital education in India. Nevertheless, it introduced a spectrum, where on one end are students who are making use of and benefitting in multiple ways from the introduction of technology in education. On the other end are many students who have had to drop out of schools and colleges because of a lack of resources and inability to access the technology. This situation leaves a gaping hole in our education system, where the overall development gets halted. Despite countries using digital education as a backup response to ensure the continuity of learning at all levels of education (Selim, 2020; Lennox et al., 2021; UNESCO, 2015), the current digital divide (World Bank, 2020) proves that digital resources for education were very poorly deployed especially in vulnerable environments. Students with less access to technical resources had more significant challenges in attending classes, following up with lessons, and submitting assignments. More than two-thirds of children aged 3–17 years worldwide lack proper internet access (UNICEF, 2020). For a vast country like India, which has several social differences, geographical constraints, and linguistic and cultural diversities (World Bank, 2018), it is even more challenging to increase the accessibility of digital resources and establish multilingual platforms. Due to the lack of infrastructure in terms of internet connection in rural areas, the existing digital divide is causing a significant number of Indian citizens to have unequal access to digital resources (Telecom Regulatory Authority of India, 2019). Children attending the schools in rural areas (Wang et al., 2019) are the most disadvantaged section of the population. The closure of schools, unavailability of smartphones, lack of a proper study space, and poor internet connectivity halted their real academic progress. On the other hand, the privileged children were equipped with an internet connection, a quiet place to study, and a device for school assignments, which are

essential factors for smooth digital learning. (Ikeda, 2020; Muthuprasad et al., 2021; Meena et al., 2021).

As psychologists, while working with children and adults, addressing their mental health needs, the authors often came across clients who narrated similar woes post-pandemic.

A similar incident is that of S.B., a 7-year-old boy hailing from a village in South 24 Parganas, West Bengal, who had visited the outpatient clinic at the University of Calcutta with his parents. The child's parents reported a sudden drop in his academic performance, how he was not interested in his studies like before and how he refused to go back to school after it reopened. The clinical interview and assessments revealed that S.B. was an intelligent young boy; he was aware and receptive to his surroundings and actively participated in his daily activities. He used to attend a local school along with two older brothers. At the start of the pandemic, S.B. was in the second standard. S.B.'s father was a small carpenter in his village. With no source of sustenance during the pandemic and only one smartphone in the house, it was difficult for the family to sustain his education. S.B. missed many of his classes as, on most days, his father left home for work with the phone, and on some other days, his brothers used it for their classes. He had to undergo online schooling for 2 years with minimal access to resources. As a result, when schools finally reopened, and he returned as a fourth-standard student, he could hardly comprehend what was being taught in class. It was a big jump for him, and he felt he could not cope with the pressure of his offline schooling and assignments. Hence, he started missing his classes and became uninterested in his studies.

S.B.'s experience was an experience shared by thousands of other Indian kids. Lack of proper study space at home, the presence of one smartphone/digital device shared by many family members and limited internet connectivity were significant hurdles to online schooling. No matter how good the e-learning process is, digitalisation cannot deliver equal learning opportunities for all without equitable access to digital tools to provide society members with a stable online presence.

### ***1.3 Digital Gender Divide***

A report released by the Organisation for Economic Co-operation and Development (OECD) states that many hierarchies exist across societal groups (Borgonovi, 2016). Several individuals in society are in a more disadvantageous position than others. The existing gender bias in Indian society makes it more difficult for women to have proper access to technology and digital resources, leading to gender-based digital discrimination, also known as the digital gender divide (DGD). Furthermore, DGD has been present in the education field for some time now but has been brought to the surface by the pandemic. Despite having the necessary skills to use such platforms, women face many socio-cultural limitations that confine them to gender-specific roles and expectations. General apathy towards women's education and the subsequent lack of support from family members compared to that enjoyed by men

act as significant barriers to their learning opportunities. Financial constraints leading to lesser opportunities for young girls than boys, the expectation to get married at a young age and the burden of more household responsibilities affected women even before the pandemic (McLaren et al., 2016). The move to online platforms worsened the situation as women were tasked with the simultaneous management of both study and household chores.

A study undertaken by Mathrani et al. in 2021 revealed that many girls faced difficulty accessing suitable internet-based devices and Wi-Fi services, thus further affecting their technological capabilities and overall confidence to access digital media successfully. Therefore, societal powers consistently fail to transform digital goods into their desired products (Srivastava & Shainesh, 2015). The study also recorded young girls reporting how their brothers and other men received more opportunities at home and how they were treated more favourably by the family members, especially in terms of academic opportunities, for instance, not having access to devices that were similar to those used by the men in their families. Women also reported managing household chores and educational responsibilities simultaneously, leaving them no time to focus on academics. Factors like these adversely impact learner agency and put women on the less privileged side of all three levels of the digital divide- such as digital access, digital capability, and digital outcome. Developing countries face some technology diffusion issues that affect their online educational delivery. Unable to afford a computer or a laptop, most suburban or rural families depend on mobile phones for their online schooling. The mobile phones are sold across a range of prices and associated functionalities. Literature reports that many young women use mobile devices that belong to the lower end of the mobile product and price range, limiting their usage. Small screen size, low processing speed, low device storage, and small data package hinder a smooth learning process (Mathrani et al., 2021).

The authors of this chapter observed similar instances amidst their daily clinical work. A 17-year-old student, R.S hailing from Durgapur in West Bengal, reported how her brother's education was prioritised, and hers had to take a back seat. She claimed she spent most of her time helping her mother complete the daily household tasks, leaving her with no time to focus on her studies. With all family members being present at home during the lockdown, it increased the amount of household work. R.S. reported how she had to serve her family members and meet their demands simultaneously while listening to her online lectures, thus unable to concentrate on her course. On the other hand, when her older brother returned to stay at home from the hostel during the pandemic, he was given a room and a laptop of his own, where he spent most of his time studying. The client reported how this disturbed her mental well-being and led to conflicts between her and her parents.

Another client, A.P, a 26-year-old woman hailing from Sonarpur, West Bengal, who was at the time of her counselling sessions pursuing her B.Ed course, reported how her husband refused to recharge her phone with an adequate data package. She often got disconnected from her online classes midway, and she had to wait for him to return from his work to share the hotspot and access the study materials from her classmates. She reported how she suffered academically during the pandemic and

could not keep up with her peers' coursework, which affected her self-esteem and confidence.

Even though it had a significant impact on all parts of the population, the pandemic took a worse toll on some individuals compared to others.

#### ***1.4 Malady of Digitalisation for Children with Disabilities***

The closure of schools and institutions has led to a paradigm shift in pedagogy. The pandemic and the subsequent imposition of lockdown and movement restrictions have disproportionately affected individuals with disabilities. Children with disabilities require routine support for their psycho-socio-emotional development and learning. An almost total shift in online education accompanied by the rise of EdTech and e-learning platforms has thrown a host of challenges for these children and undone their progress. It also highlighted the impact of the growing digital divide leading to unequal access to education. Parents' primary concerns involve a lack of experience supporting their children with remote learning, poor accessibility to technology, and economic constraints (UNESCO, 2020). Teachers' concerns involve a lack of familiarity and skills to implement online education and restricted access to technology (UNESCO, 2020).

Children with pre-existing mental and physical disabilities were at utmost risk during the pandemic. Most online platforms are incompatible with assistive technology used for teaching children with visual and hearing impairments (Hills, 2020). The challenges of online education and a lack of recreational activities at home proved frustrating for children with such physical disabilities. Also, acquiring social skills and social interaction is one of the most challenging problems for children with Autism Spectrum Disorder (ASD). Social distancing and having no access to outdoor activities deteriorated their development. A lack of routine and the attached uncertainty made children with Autism Spectrum Disorder (ASD) feel more anxious, irritable, agitated, and unpleasant feelings. Diverting classes online leads to a lack of special education assistance to children as parents cannot replace special education teachers, and there is a lack of assistive technologies. This influences the development of children with Specific Learning Disabilities (SLD), Down Syndrome, and the like (Patel, 2020).

A.M., an 8-year-old girl hailing from urban Kolkata, West Bengal, was referred for a psychometric evaluation in 2020 due to delayed speech development, lack of eye contact, and age-appropriate reciprocal social interaction with peers and other individuals. Her parents had already enrolled her in speech therapy classes. However, the imposition of lockdown stalled her evaluation process and speech therapy classes, thereby delaying admission to an inclusive school. They revisited the clinic for an evaluation a year later, when physical movement restrictions were relaxed. They reported that those initial speech therapy classes had helped the caregivers interact with the child appropriately. The lockdown also allowed the mother to change the child's tendency to adhere to a routine and adopt a more flexible approach

to scheduling her activities. The child did not attend any online school within that year due to the lack of online class facilities in most special schools in Kolkata. The psychologist provisionally diagnosed the child with Autism Spectrum Disorder during the evaluation.

A.M. is among the many children with disabilities who could not avail the luxury of online classes due to the inability of certain schools to adapt the curriculum as per individual needs.

As per the State of the Education Report 2019 for Children with Disabilities by UNESCO based on Census 2011, about 2.21% of India's population was differently-abled. There are seven million eight hundred sixty-four thousand six hundred thirty-six children in India, making up 1.7% of India's total child population. Five million five hundred seventy-two thousand three hundred thirty-six of them were up to 14 years at the Census 2011. Presently, this is likely the group in schools and colleges and is directly affected by pandemic-induced educational disruptions. The report highlighted poor education rates among specially-abled children. Of the total six million five hundred seventy-two thousand nine hundred ninety-nine children in the age group of 5–19 years, only 61.18% (approximately four million) have attended any educational institution. The figure was below the national average of 70.97% for children in all categories. Some 26.68% have never participated at any educational institute, compared to the national average of 17.21%. About 12.14% attended one but dropped out later.

India is a signatory of the Convention for the Rights of Persons with Disabilities (CRPD) and is committed to implementing the Sustainable Development Goals (SDGs) and the UNESCO Salamanca Statement. This makes India obligated to introduce inclusiveness for individuals with disabilities in all spheres of life. Additionally, to foster inclusivity in education, domestic legislation such as the Right to Education Act, 2009 (RTE), Rights of Persons with Disabilities Act, 2016 (RPWD), and National Trust Act, 1999 mandates the government to accommodate children with disability in mainstream schools. However, such is the reality that these children fall through the cracks in the system, which explains why approximately only 50% of individuals with disabilities are literate (Rajaraman & Krishna, 2021).

A survey conducted by a community-based organisation Swabhiman in 2020, working for the rights of persons with disabilities, stated that across India, around 43% of children with special needs might drop out of school due to difficulties faced in the online mode (Press Trust of India, 2020).

Few studies have been conducted in the Indian context over the past 2 years focused on assessing the difficulties in accessing education faced by children with disabilities. The probability of persons with disabilities completing education is less likely than others and more likely that they shall be excluded altogether from schooling. Students with disabilities face barriers to permitting them to follow online school programs. As a result, many such students, particularly students with intellectual disabilities, are left behind. Furthermore, other dimensions of school closures also negatively affected them, such as access to school meals and opportunities for peer-based engagement in plays and sports. Many children reportedly had



to drop out of school or stop attending online classes because they could not manage the pace of online education. Children with special needs are dependent on their teachers to receive one-to-one guidance, which does not happen on the online platform. The gravity of the problem is even more severe in rural areas where the means to afford devices and accessibility of online connectivity serve as barriers to a nurturing environment for such children. Many children have lost the academic and therapeutic advancements they had made over the months, thus exacerbating their distress. Social isolation or social distancing has widespread ramifications for a child's well-being, including elevated levels of stress, anxiety, depression, and concern about aggravation or relapse of pre-existing mental health problems. Children with disabilities are also exposed to the increased risk of discrimination and violent discipline methods in the household due to the constraints imposed by quarantine and the overall burden faced by families (UNICEF, 2021).

A collaborative research study titled *A Strategic Analysis of Impact of COVID-19 on persons with disabilities in India* (Murthy et al., 2020) was conceptualised by CBM and Humanity & Inclusion (H.I.) and the Indian Institute of Public Health Hyderabad (IIPH-H), Public Health Foundation of India (PHFI), and conducted by IIPH-H. The study found that an overwhelming proportion (73.3%) of children were distressed by school closures, which affected their learning at the school level. School closures profoundly impact academics, school meal programs, special education, psychotherapy, counselling, peer group support, and kinship.

The spread of COVID-19, associated with home isolation and social distancing, has affected the lives of children with disabilities and their parents. Among the main difficulties are changes in daily routines, including the prohibition of regular activities, lack of socialisation, and changes in learning formats, including a lack of services, which are also emphasised as having affected their emotional state. Low parental competence and low education levels served as a challenge for supporting children's learning during the pandemic. Parents' additional responsibilities in caring for their children during the pandemic have made them feel overwhelmed. Furthermore, parents are often afraid that their children will regress during this period, which has affected their emotional well-being. Isolation at home and lack of services have also affected parental stress and practices and deteriorated marital relationships, negatively impacting children.

### ***1.5 Intersection of Parenting, Teaching, and E-learning***

Augmented parental involvement is required in online learning, particularly for children with disabilities (Smith et al., 2016). This is primarily due to the transition in roles that designates the parent as the primary individuals supporting their children's education activities (Smith et al., 2016). However, while parental involvement has been demonstrated to have many benefits for children's education, several potential challenges can hinder effective parental engagement in remote (online)

learning. Some parents appear to lack comprehension of their added role as a teacher, their duties, and their level of engagement (Borup et al., 2015; Smith et al., 2016). This level of engagement may be more demanding in large households and those with lower incomes (Harper et al., 2013; Cluver et al., 2020). Additionally, this role entails a more significant time commitment and considerable expertise in supporting children, which some parents may not possess (Currie-Rubin & Smith, 2014; Smith et al., 2016). Adding the role of an instructor to parenting may also affect family dynamics, leading to frustration for both parents and children (Smith et al., 2016) and subsequent conflicts (Borup et al., 2015).

Certain parental factors have been said to play either a protective or an exacerbating role in screen viewing. Factors such as having more children and exhibiting a restrictive type of parenting were said to act as a protective factor, whereas parenting where parents co-viewed the screen time or were more permissive was related to more screen time in their children (Fitzpatrick et al., 2022). Similarly, even amongst the children studied, it was noticed that children who had better emotion regulation capacity or had a more easy temperament had less pathological screen-usage.

Vrinda et al. (2021) had deduced from their study an interesting finding that it is not only screen time but also whether it happens to be interactive or non-interactive that can have a differential effect. They also accounted for the lack of interaction during the screen time, which can make a difference. According to another research study, when verb learning was studied in toddlers within the age range of two to two-and-a-half years through different methods, namely interaction training which was live, socially contingent video training over video chat, and non-contingent video training, then it was discovered that most learnings were done by children when they had live interactions with others and video-chat (Roseberry et al., 2014).

There is a lack of assessments regarding the level of inclusion and benefits for students with disabilities during online learning. The Indian government released Comprehensive Disability Inclusive Guidelines for the protection and safety of persons with disabilities during COVID-19 in 2020. However, the guidelines did not provide the practical modes of providing educational services to children with disabilities during the pandemic.

Hyseni, Duraku, and Nagavci (2020) reported that the involvement of children with disabilities in online education was low. However, the lack of inclusion might vary depending on specific groups of students with disabilities. Students with disabilities do not have equal participation during virtual sessions between teachers and students because teachers often do not invite them. Furthermore, only children whose parents can help them with school commitments were reported to participate. The notions that a few teachers have towards children with disabilities also shape their attitudes in terms of viewing these children as individuals who have a deficit in them. Teachers, thus, have low expectations of the potential and performance of the children with disabilities. On the other hand, when the teachers are aware about the flexible and supportive approach in teaching them, children with disabilities do reach their potential (Taneja-Johansson et al., 2021).

Some factors that influence the low-involvement level of children with disabilities in online education are the inadequacy of online learning and the lack of implementation of individualised educational plans for the individual needs of children with disabilities. Moreover, there are poor recommendations and guidelines for lessons and tasks for children to support teachers and parents. The lack of instructors for special education and low parental awareness about the importance of their children's inclusion in online learning also affect online learning for children with disabilities. Regarding this low level of inclusion, some other contributing factors related to students and their parents were identified, including lack of understanding of children with disabilities and their parents in utilising technology, financial impediments, insufficiency of access to technology and internet services, having a more number of family members, and parental burden of housework (Hyseni Duraku & Nagavci, 2020).

Enhancing the accessibility of education in technologically and economically convenient forms can ease the parents' pressure to buy smart devices. School authorities must provide online education for children in accessible formats. For example, parents might be trained using phone or school website podcasts to deliver individualised education plans to children at home that special educators have designed. Pondicherry-based Satya Special School has been developing and utilising content designed for digital devices for children with different disabilities. For the children from nearby villages, the school for special needs has come forth with the initiative of a digital lending library. The gadgets have preinstalled software for children's sensory activities and speech therapy. Their mothers function as primary instructors and act as resource people or librarians who help other caregivers understand the usage of the software. Internet connections are not mandatory for operating these devices and are lent to the children on a turn-wise basis. The Public Health Centre in the village acted as the library. However, another study (Rajaraman & Krishna, 2021) reported that most parents could not teach their children during the lockdown due to a lack of necessary training or time (due to the burden of work and household commitments). It burdens most parents with orchestrating their children's education, vocational training, and therapy, leaving them feeling helpless, anxious, and exhausted due to their elevated responsibility caused by a shift to online education. Some students, however, flourished in online learning formats, and virtual individualised education program meetings made it easier for parents and educators to connect (Arundel, 2021).

During this stretch, children have had prospects to create new practices, enhance their health, become more engaged in collaborative activities with their families, and receive more attention and dedication from their family members. Further, the study reported increased parental responsibility and support for their children, and this period was considered a suitable time for parents to enable their children to acquire new skills (Hyseni Duraku & Nagavci, 2020). Nevertheless, staying at home with their parents was also advantageous for children with disabilities.

## ***1.6 Social Exchange in Light of Digitalisation***

It would, however, be unfair to say that COVID-19 has only affected children with disabilities or children from a lower socioeconomic status. The pandemic and series of lockdowns in the country took their fair share of a toll on the mental health of the average child. Having their homes turned into schools was not only monotonous but also severely stressful after a certain period. Inability to interact face-to-face with their friends, inaccessibility to open grounds and parks, and constant exposure to digital screens had severe psychological consequences on students. Even before the storm of the COVID-19 pandemic took the world, excessive time spent on screen proved to be a significant barrier to face-to-face communication and general social exchanges. It is perhaps not uncommon to encounter a room full of people known to each other, all busy looking down upon their phones and not engaging in a proper face-to-face interaction or not catching up with one another even when they meet after a long time. The same sight is also acknowledged to be quite common in public transport. What is most concerning, though, is that children mimic the behaviour of adults that they see around them. Hence, these behaviours are mirrored by children, which may lead to significant deterioration in the acquisition of their interpersonal skills, empathy, or even the development of social connectedness to others.

Interestingly in a related premise, a group of researchers has recently found that those children, or more precisely speaking pre-schoolers, who engaged in excessive time spent onscreen would have a lesser nuanced theory of mind as compared to those who did not spend as much time spent onscreen (Konok et al., 2021). Another pathway through which lesser time spent interacting with others may have a harmful effect is adversely affecting children's language skills (Conboy et al., 2015).

In a study conducted by Aristovnik et al. (2020), it was noted that students engaged in online learning were more likely to interrupt their academic progress and felt more socially isolated compared with students receiving traditional education (Guo et al., 2019). Factors such as social isolation and loneliness increased the risk of depression and anxiety. This becomes worse in the case of teenagers. Adolescence is when youngsters seek the company of their friends and peers more than their family members. Teenage years are often spent trying out new activities, engaging in extracurricular, exploring feelings, and intimate relationships with friends and partners. These are often the formative years of an individual's life, especially in terms of their identity and self-concept. The last 2 years took away this opportunity from them. Being limited to their households with parents often led to continuous conflicts, leading to feelings of anger, resentment, sadness, and distress. The only escape from this was their phones and other digital devices. This, in turn, increased their social media addiction and overall screen time, restricting them to their phones and reducing actual communication with the people around them, thus increasing their social isolation and emotional distress that arises from it. When the same device is used for schooling and recreation, children start lacking a variety in their lives, increasing their monotony, leading to frequent emotional outbursts, feelings of loneliness, and a depressed mood state. Low emotional stability, disrupted

relationships, and low self-control have been implicated in more significant morbidity and mortality (Graham et al., 2015). Similar observations were made by the authors when a client, C.S, 16 years old, hailing from Kolkata, presented herself with the symptoms of severe depression. C.S reported how more than 16 hours of her day were spent staring at her phone screen, attending classes, completing her assignments, or interacting with her friends. She reported feeling so low and unmotivated that she stopped attending classes altogether, which affected her academic performance and attendance at school.

### ***1.7 Neurocognitive Correlates of the Effects of Excessive Screen Time upon Well-Being***

Over the last couple of years, ever since the emergence of the COVID-19 pandemic, more evidence has surfaced that points out how much of a harmful effect excessive exposure to screen time has upon the developing brains of children and adolescents. Perhaps, the health woes associated with excessive screen time were a cause of concern prior to the pandemic too. However, health professionals worldwide have now expressed added concern over having to spend a considerably higher number of hours on screen.

Even prior to the emergence of COVID-19, the upper limit of screen use set as per The American Academy of Pediatrics was that exposure should be less than 1 hour in children aged from 2 to 5 years (American College of Pediatricians, 2016). Moreover, the same authority had also implied that engaging in excessive screen time in children may negatively affect their cognitive functioning, attentional focus, and capacity for learning in the future. Furthermore, now significantly more amount of time being spent on screen by children and adolescents, this has become more of a mammoth task for both parents and teachers to balance online education and ensure that children do not engage in excessive screen time. The Indian Academy of Paediatrics (2021) has described screen time as the cumulative time spent in front of various screens like phones, computers, tablets, television, or any hand-held or visual device. While the authors attempted to delve deeper into understanding the ramifications of excessive screen time in children and adolescents, they could not help but notice the neurocognitive correlations and the endless alarming future possibilities that arose from this situation.

Before arriving at an Indian context, it may be helpful to look at the worldwide scenario. Even earlier, that is, in the pre-pandemic era, increased use of screen time (including television time) was associated with neurocognitive changes such as changes in memory for digit span assessment, poorer performance in reading recognition, reading comprehension, delay in the development of age-appropriate speech (Zimmerman & Christakis, 2007), and attainment of motor functions (Lin et al., 2015). Nathanson et al. (2014) had also previously studied the role of excessive television time on preschoolers' executive functioning. They had chosen to study

this very pertinent variable as an individual's executive functioning profoundly affects a person's social and academic life. It refers to higher-order cognitive functioning like planning, organising, sequencing, etc. The results of their study had, even back then, indicated that the higher the number of total hours spent on screen, the poorer the executive functioning of those children. It can only be assumed that post the beginning of the pandemic era, with the total number of hours of being onscreen being disproportionately higher, it would have an even more harmful effect on the executive function of these children.

Coming to the present situation, more recently, in a study conducted in Russia, Veraksa et al. (2021) had tried to explore the association between the screen time of children (both active screen time like using touch phones as well as passive screen time like watching television) and phonological memory in children belonging to preschool age. The study was done after enrolling 122 preschool children between 5 and 6 years of age. The results of this study had concluded that onscreen time, when spent passively, was more negatively associated with verbal information processing. There were no such stark effects when children engaged in more interactive screen time.

Even Neophytou et al. (2021) arrived at a similar conclusion from their scoping review, which focussed on the association of cognitive functioning and development with screen time. An even more alarming discovery derived from the study was that the detrimental effects of excessive screen time and the consequent chronic sensory overstimulation that arises from it in early life might go on to persist into later years. This might have the potential to enhance the risk of dementia in those later years of life.

Repeated research conducted over time has pointed out that the rate of brain growth is the fastest during the childhood years. During this period, the absence or presence of adequate exposure can make a difference in neurocognitive functions even in later life (Fitzpatrick et al., 2022). Researchers have formerly also highlighted the critical role of pruning in the brain of developing children and adolescents, whereby the brain tends to do away with infrequently used neuronal connections (Blakemore & Choudhury, 2006).

For instance, Hutton et al. (2020) noted from their recent study that preschool children exposed to excess screen time had exhibited lowered microstructural integrity of white matter tracts. These tracts are considered to be especially important in the development of language and literacy skills in the earlier years of brain development. Thus, this finding may help explain some of the prominent literature related to delayed language acquisition associated with excess screen time, mentioned earlier in this chapter.

Owing to the exponential increase in screen exposure time for children over the last couple of years, Santos et al. (2022) also conducted a systematic review to study the relation between children's attention with typical development and time spent on screen. Their review used the search keywords like "screen time," "children," and "attention," mainly from search engines like PubMed and PsycINFO. The findings derived from the review suggested that spending excessive time on screen in

children can harm children's attention, and teachers and parents may have an integral role in controlling excessive time spent on screen.

Even prior to the pandemic, a host of researchers had emphasised on the deleterious effect of the internet on cognition and discovered that sustained attention can get seriously affected by consistent and simultaneous exposure to multiple online windows simultaneously (Firth et al., 2019). It was hypothesised that this continuous access and perhaps the influx of information might even necessitate a change in how information is processed or stored in the brain. A similar line of findings has been echoed by most recent research evidence that has shown excessive smartphone use can significantly interfere with different domains of attention like focussed as well as divided attention, reduce the capacity for inhibition, negatively affect working memory as well as interfere with the ability of numerical processing (Wacks & Weinstein, 2021).

In a study by Hoehe and Thibaut (2020), the authors had tried to address the perennial question of how technology may influence the human brain as well as their behaviour. Perhaps the concept of neuroplasticity is not a novel topic anymore, and by now, enough researchers have highlighted how the human brain has an uncanny ability to adapt itself to new situations by incorporating structural as well as functional changes in response to environmental changes. This phenomenon of neuroplasticity as well as pruning are found to be more common in the earlier years, and thus, it comes as no surprise that engagement in excessive screen time has been found to be associated with discernible morphological as well as functional changes in the brain, as demonstrated by brain imaging techniques. Other researchers have also pointed out how frequent or excessive usage of smartphones or screen time may be correlated with changes in cortical activity (Korte, 2022). Speaking of neuroplasticity, another finding that has come to the interest of researchers is how excessive use of a certain part of the body may lead to an enlargement or reorganisation of that part of the cerebral cortex that is related to it. For instance, repetitive touching of the phone screen may lead to a hike in the cortical potentials dedicated to touch receptors situated in the fingertips and consequently lead to a subsequent enlargement of the sensory-motor cortex. Similarly, functional magnetic resonance imaging (fMRI) studies have revealed that excessive engagement in video games like pokémon for children has also been found to be associated with changes in the visual cortex, which is hypothesised to persist into later life as well.

Weinstein and Lejoyeux (2022) had, in fact, attempted to review various studies that had studied neurobiological correlates of internet gaming disorder with an intent to understand the impact of technology on the mechanisms of the brain. They had found out that the changes in neurobiology that happen in the internet gaming disorder are very similar to that of other addictions, such as the activation of the reward centre and dopamine-related reward pathways. Additionally, it was also found that those areas of the brain that are implicated in impulse control and decision making may also show decreased activity, and lastly, brain networks that are found to be related to executive function, motivation, and reward perception may show less functional connectivity. Structural changes such as a discernible decrease

in grey and white matter density were also found in the brains of individuals with internet gaming disorder.

In a more recent Indian context, John et al. (2021) had conducted a cross-sectional study in Kerala, where they had tried to ascertain the association of cognitive delay (as per parental report) with screen time. The study involved giving self-administered questionnaires to the parents of 2–5-year-olds along with a screening tool, namely, Werner David Development Pictorial Scale (WDDPS), for assessing cognitive development. Their study had made some interesting observations, such as out of the total sample ( $n = 189$ ), a majority of them (84.9%) engaged in excessive usage of screens. Also, it was found that almost half, that is, about 45% of parents, would use supervision in an inconsistent manner, which was found to be associated with more suspected deficits in attention as well as social skills or, to say more simply, with suspected cognitive delay.

### ***1.8 Concomitant Digital Impact on the Indices of Health***

Other related but definitely relevant factors related to excessive screen time that could influence neurocognitive functions and cause overall distress to children and adolescents are overall changes in physical and psychological health. In the last couple of years, the changes that have been most frequently reported in physical health in relation to excessive screen time are factors like deterioration in ocular health, emergence of obesity, headache, migraine, and also changes in an individual's musculoskeletal health. For instance, Serra et al. (2021) had attempted to study smartphone use and addiction amongst Italian children and adolescents during the COVID-19 pandemic. The researchers had found from their study that the use of smartphones had increased considerably during this time, as opposed to before it. The study had also found that smartphones were mainly used with the intent of entertainment, learning, maintaining social connections, or providing mental support. However, the ill effects arising due to it may have resulted in various health risks like sleep, eye as well as musculoskeletal disorders, along with social isolation as well as psychological after-effects like distraction and loss of interest.

Along similar lines, a group of researchers found out that being exposed to longer hours onscreen has ushered in more frequent ocular problems like myopia and dry eyes in most individuals (Alabdulkader, 2021; Agarwal et al., 2021). Even before the pandemic had started, postural pain and injuries in wrists due to excessive typing were reported by those who engaged in excessive screentime. And now, with the number of hours increased, owing to poor posture and continuous looking down at smartphone screens, other complications like higher cervical disc degeneration in many young patients having chronic neck pain have also been reported (Zhuang et al., 2020). It is an acknowledged fact that posture can have a serious effect on the mental status of an individual. In a recent cross-sectional study done on Physiotherapy students in Maharashtra, India, it was noted that those students who engaged in enhanced onscreen time with poor posture would frequently report



pain in the neck, lower as well as the upper back, along with shoulders (Akulwar-Tajane et al., 2021).

Another pertinent factor that could be affecting neurocognitive functions in this population of children and adolescents is the quality of sleep, which is affected by excessive screen time. Recent research undertaken has shown that those who engaged in an enhanced time of screen exposure showed a poorer quality of sleep, had a shorter duration of sleep, increased latency of sleep, and worse symptoms of insomnia. They also tend to stay up late in lockdown, which could disrupt their circadian cues (Salfi et al., 2021). Previous research has shown that a lack of adequate REM sleep can lead to disturbances in the attention and consolidation stage of memory. Hence, this could be another route through which neurocognitive functions can get adversely affected.

Other researchers have formerly shown that the blue light, which is released by smartphones and computers can also interrupt proper sleep, as it suppresses the melatonin hormone, which has an important role to play in sleep regularity. Also, this blue light emission is also said to adversely affect circadian rhythm maintenance, which can lead to further neuropsychological problems and in the theory of mind in some individuals (Nathanson & Fries, 2014).

Lack of adequate physical activity due to restrictions imposed as well as increased engagement in screen time has also been associated with poorer physical as well as mental health outcomes during this pandemic (Xiang et al., 2020; Zhou et al., 2021; Tandon et al., 2021).

Perhaps, the picture of neurocognitive correlates of excessive screen use will be clearer if a Case-vignette of a child brought for evaluation to a Government hospital during the first lockdown could be illustrated for further reference.

R.B., a 9-year-old male child belonging to middle-socioeconomic status, nuclear family, and urban background, was brought to the hospital with the complaints of excessive time spent on screen (over 4 hours per day) along with irritability when not allowed to be onscreen and generalised academic problems, in terms of difficulty in sustaining attention and poorer academic performance in-class tests. He would also report having difficulty recalling materials taught in online classes. The informants of the child, in this case, his parents, had also noticed that he would also chat secretly while classes were going on in the chat window and tabs of other social networking sites were also open whilst class was going on. The changes came to the notice of the parents sometime from Late August and demanded professional assistance only when he refused to attend classes altogether if he was not allowed to be on screen for at least a couple of hours daily. When investigated further, it was found that when he would spend most of the time on screen, he would mostly watch videos on YouTube, and he would play mostly offline and sometimes online video games. Earlier, he would be most excited about going to the children's park in the evening after his classes, where he said he would get a chance to play with other children; however, his play with other children had been stopped due to the norms of social distancing. He also mentioned that sometimes he would play cricket online to make him feel that he is playing cricket with his friends like before. His parents also noticed that as compared to the scenario before the pandemic, now he would have

less productivity of speech, and the rate of learning of new words (both English as well as vernacular) was also noticeably lesser. This was considered a major change too by his parents, as earlier, they had noticed the index child to be quite interested in learning new words and in using them in the context of proper sentences.

Eventually, after the presentation of symptoms, the child had to be assessed in detail through psychological assessment, and adequate intervention was provided thereafter. Thus, the above-mentioned Case Vignette may serve as a crucial example of how unlimited screen time exposure can begin to manifest some serious changes in a child's behaviour and how important it is to adhere to limit-setting regarding the same.

### ***1.9 Initiatives Taken by the Stakeholders***

Provisions for providing subsidised or free internet services for persons with disabilities who require access to the Internet for education must be explored. For example, the Delhi-based National Association for the Blind (NAB) provided laptops to its students from class 6, equipped with a screen reader. They provided their internet plans so that it could curtail the issue of affording internet packs to avail online education facilities. Students with disabilities had lower engagement and attendance levels in remote or hybrid learning formats.

When it comes to offering digital access to study materials, the Department of School Education & Literacy under the Indian Ministry of Education has developed a digital rendition of *Barkha: A Reading Series for 'All'* as a part of the Digital India Campaign. All the inclusive features of the print version were retained in the digital version. The greater flexibility and a greater scope of the digital version for appealing to all the readers renders a unique functionality to it. All the 40 story booklets can be accessed through a single device by the children. It also gives them space to revisit any book as per their convenient place and time. The privacy offered to readers to read on their computer or tablet allows them to read comfortably and at their own pace, fostering reading in non-threatening circumstances with a purpose and pleasure. A foreword to each story is available in an audio-video format, both in sign and common language formats. It helps to familiarise sign language as a common form of communication at an early age for all minors in an inclusive setting.

An integrated framework of the Indian legal mandates allows for achieving the goal of inclusive education for children with disabilities. The *Samagra Shiksha Abhiyan (2018)* has the provision for enabling all students with disabilities to complete 8 years of elementary school education and 4 years of secondary schooling in an inclusive environment within the general education system. Introducing compensatory educational plans to make up for the lost or denied opportunities to such students in tutoring, physical and occupational therapy, summer educational services, and small group instruction can help provide essential academic support to such children. The Supreme Court of India recently directed the state governments to initiate more appointments of special educators, in a move to protect the rights of

children with special needs or disabilities. The Court mandated to follow the 2019 recommendations of the State Commissioner for Persons with Disabilities, Delhi, to adopt “stop gap” arrangement for the recruitment process (IANS, 2021). The Rehabilitation Council of India has structured and professional training courses available in the field of special education like Diploma in Education-Special Education (Intellectual and Developmental Disability), that may help in reducing the gap of availability of special educators in schools.

In a study, it was reported by the experts and employees working with students with disabilities that to enhance the participation and inclusion of students with disabilities in online and traditional learning environments, the curricula and working methodologies need to be adjusted to suit individual student needs. Teaching units need to be simplified whereby it should emphasise an increase in the use of technology and illustrative image throughout learning. Additionally, providing services for children with disabilities within schools, including psychologists, speech therapists, pedagogues, and support teachers, is necessary to increase the inclusion and implementation of individualised educational plans. Further, it would be required for children with disabilities to participate in the traditional teaching method, improve the capability of teachers to work with children with disabilities, and raise parental involvement and aid (Hyseni Duraku & Nagavci, 2020).

### ***1.10 Concluding Thoughts***

To summarize, childhood and adolescence are like the stepping stones for the rest of their lives, and it happens to be a crucial time for the overall development of cognition, social skills as well as coping skills that are deemed to be necessary for later life. People’s lives across the globe have been severely affected due to COVID-19 and are more likely to disproportionately impact children with pre-existing vulnerabilities. Amidst this, it has become even more crucial to keep children with physical and mental disabilities physically safe and look after their psychological and emotional well-being. Although digitalisation has its fair share of benefits associated with itself, however, one needs to be extra careful in order to keep in check the drawbacks of this method. Ensuring equal access to digital resources for all sections of society, keeping in mind the hindrances faced by individuals with a disability, and ensuring that excessive screen time does not end up leading to long-term neurocognitive as well as social-skill related deficits are important factors to be kept in mind when incorporating the process of digitalisation in our day-to-day living. Also, owing to the enormous changes in the current educational scenario associated with digitalisation, more studies need to be conducted in the Indian subcontinent so as to derive a clearer picture of what ramifications these changes could mean for the coming days. Lastly, this has given rise to the need of the moment to come up with effective measures that require to be undertaken to seek immediate and long-term solutions to battle this issue.

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# Chapter 11

## Online Training in Present-Day Conditions: Opportunities and Prospects



**Olga Banit**

**Abstract** Education and training are moving to an online format. More and more educational service providers are offering a variety of online learning activities: online lectures and online courses, online marathons and intensive courses, online trainings, web conferences, webinars, etc. Organizationally, online training courses may be the greatest challenge. Online trainings are different from traditional ones. Therefore, many unresolved issues arise in practice. First, not all classroom training topics are suitable for distance learning. Second, time and space need to be organized differently. Third, group work organization may be rather tricky. Fourth, online training provides for no physical or emotional contact, which may be a challenge for trainers. These issues have received no theoretical substantiation yet. The author describes possible ways to solve the above problems based on practicing trainers' experience. A goal of this study was to identify opportunities and prospects of online training in present-day conditions. The tasks of the study were as follows: to identify challenging aspects of planning and conducting online training sessions; to analyze online training opportunities and advantages; and to outline future development prospects of online training.

**Keywords** Online training · Online training topics · Group work · Virtual groups · Virtual platforms

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*Note:* The current chapter is a revised and an enhanced version of a paper entitled “Transformational processes in training technologies. *Strategic imperatives of modern management*”, already presented at a KNEU conference on “*Strategic Imperatives of Modern Management*” held in Ukraine (October 21, 2022), available on <https://simm.kneu.edu.ua/ua/>

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## 1 Introduction: Relevance of the Study

Intensive development of information and communication technology is making it more crucial than ever to improve teaching and learning in order to make students more active and independent when learning professions. As teaching and learning are being transferred online, more and more educational service providers are appearing on the Internet, offering a variety of online learning forms: single online lectures and online courses, online marathons and intensive courses, online training sessions, web conferences, webinars (Zoominars), etc. Researchers from different countries agree that in organizational terms online training sessions may be most challenging (Mishraa et al., 2020; Lederman, 2020). At that, online trainings have certain advantages. A study by Andreas Gegenfurtner and Christian Ebnerb (2019) found that online trainings (webinars) could be more effective than online asynchronous learning and offline face-to-face classroom instruction.

An online training session is a session that takes place on a monitor display rather than in a classroom. The participants are required to have specialized software installed on their computers, register themselves, and connect to a meeting at a set time. While trainers are conducting a session, attendees are listening and asking questions in a chat box. The questions can be answered by both trainers and moderators.

It used to go like that, at the first stage. The term “online training sessions” was often used to denote a wide range of webinars. However, nowadays it has become clear that there are fundamental differences between online training sessions and traditional ones (Kumari et al., 2021; Alsaaty et al., 2016; Mishraa et al., 2020). When trying to make the best of their training environments, many trainers face a lot of challenges at the preparatory stage, during training sessions, and at the follow-up stage. It should be noted that these issues have not been theoretically justified yet. That is why below we will detail the possible ways of meeting these challenges through the prism of practitioners’ experience and the results of our research (Smith & Brame, 2014).

## 2 Background of the Study

This study is a continuation of the research we conducted earlier with students (Banit et al., 2022) and graduate students (Lukianova et al., 2019a). A goal of this study was to identify opportunities and prospects of online training in present-day conditions. Key tasks of the study were as follows:

- Identify challenging aspects of planning and conducting online training sessions
- Analyze online training opportunities and advantages
- Outline future development prospects of online training

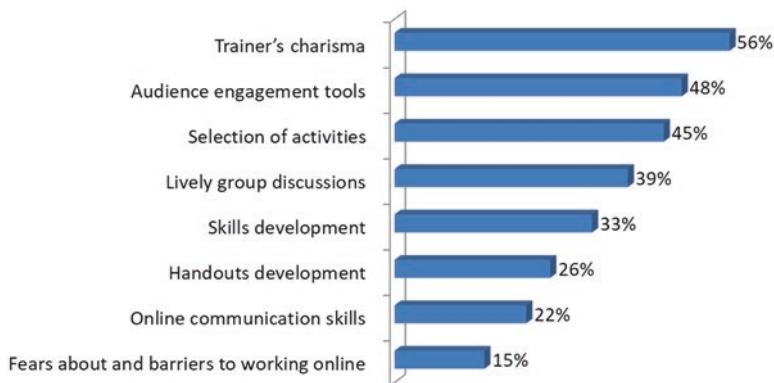
The used methods included observation, surveys and interviews, analysis of theoretical studies, systematization and generalization of practitioners' experience, and description and visualization of the analyzed data. Most sources used are open data sources. We also collected data by interviewing business trainers, faculty of universities and business schools, human resources specialists, and managers of companies that train their staff. The data was collected in Kharkiv, Odesa, and Lviv oblasts of Ukraine as well as the city of Kyiv. This approach enabled us to cover different geographic areas of Ukraine thus providing for a representative sample. To perform the planned tasks, we developed two questionnaires. Most questions in the questionnaires were about online training structure and timing, selection of engagement tools and activities, skills development, organization of group work, technical support, and feedback. We gave particular attention to the methods of overcoming barriers to and fears about working online, development of communication skills, trainer's charisma, etc.

Having collected the data and analyzed them, we singled out a range of the issues related to planning and conducting online training sessions in present-day conditions. This study is of importance as we will use its results to develop online trainers' competencies, raise their professional effectiveness, improve availability of new features offered by online platforms and services, and develop mechanisms to improve the quality of teaching services.

### 3 Identifying Challenging Aspects of Online Training Sessions

*Online training session includes a lot of challenging aspects: training courses that include a lot of physical activity, physical practices (e.g., art therapy), online occupational training sessions focused on practical skills and the use of real systems and new technologies, rehabilitation and medical training courses that require a direct contact with the human body or mannequins under the live guidance of a trainer can be conducted only in specially equipped rooms. Group work is rather difficult to conduct. An advantage of group work is the opportunity for all participants to simultaneously read the information and work together on tasks, to interact with each other. However, it is a problem in online space. Technical support of online training sessions is totally different from that of traditional sessions. There are no classrooms, chairs, and participants sitting in a circle. The trainer can see his/her screen and video tiles. Participants can interact with the trainer and each other using their webcams and microphones.*

At the first stage of the study, we conversed with trainers and interviewed them. We asked them to share their online training experience: the challenges they faced, the mistakes they or their colleagues made. As a result, we have identified a range of various difficulties, misunderstandings, and inconsistencies they faced (Fig. 11.1).



**Fig. 11.1** Challenging aspects of planning and conducting online training sessions. (Source: Generalized by the author)

Having generalized the data collected, we divided them into four interrelated groups:

- Topics and structure of online training sessions
- Time and space
- Group work and trainer's position
- Technical support and feedback

Key features of each group are briefly described in the following text.

1. The author reported at conferences that online sessions are not perfect for the sessions which include a lot of physical activity. The vast majority of the forms and methods used during traditional training sessions—warm-ups, games, energizers, etc.—have no effective online analogues yet. Body practices (e.g., art therapy) appear not effective enough too as it is difficult or impossible for the trainer to monitor participants. The same is about corporate team building sessions that are often brought out into nature: group environment and live communication are learning components of such sessions. Various rehabilitation and medical training sessions that require direct contact with a human body or a mannequin as well as live supervision can be conducted only in specially equipped premises. It is also a challenge to conduct online training sessions for professionals in the course of which they learn to use new mechanisms and new technologies, and develop their practical skills (Banit, 2022).
2. As a rule, traditional classroom sessions are conducted on weekdays and are off-the-job or take place on weekends and last for 6–8 hours a day. Training programs generally last from 1 day to 1–2 weeks. These schedules are impossible for online sessions since participants are unable to spend long hours in front of their screens. When taking online courses, participants have no chance to have coffee, dinner, or supper together. At that, often one of the goals of training

sessions is to encourage participants to get to know each other, communicate informally, and establish contacts.

As of space, traditional training sessions require thorough preparation: trainers have to find the premises that meet all their requirements, prepare training rooms, purchase all the necessary equipment, print handouts, etc. And participants have to get to the premises on time and find lounges if the premises are far from their home. Online training requires none of these. However, it may give rise to other problems. When preparing their sessions, trainers have to choose a suitable online platform, study how to use it and the tools available, check their devices, and customize their webinar rooms. It is also important to prepare breakout rooms, warm-up tools, and the tools that may help to keep session attendees focused. Few beginning trainers can cover all these issues by themselves. Most of them may need technical support.

3. An advantage of group work is that all the participants have a chance to get acquainted with data simultaneously and work on tasks together, closely interacting with each other. During traditional group sessions all the participants find themselves in one and the same room, and a goal of trainers is to facilitate and control their work. A key issue of online sessions is software capability. However, no existing online platform enables trainers to monitor all breakout rooms simultaneously. They have to join them one by one. But less time of personal contact means lower interaction energy.

As a matter of fact, presenters talk to the small tiles they can see on their screen rather than the audience. Moreover, trainers should not look in the eye of the meeting participants. Instead, they should look in the camera's lens that finds itself above the participants' faces on the screen. In this situation it is much more difficult to maintain a balance between the entire group and single participants. Online meeting participants have restricted live communication opportunities and almost no body or emotional contact. Besides, during online sessions all the participants can turn their webcams and sound on or off anytime they wish, or get distracted even without turning their webcams and sound off. This may make training sessions less effective for the participants.

4. Instructors transiting from traditional to online sessions may find it difficult at first to accept the fact that their professional skills and experience are not the only success factors. While during traditional sessions highly competent and charismatic presenters can hold their audience spellbound, during online sessions they may be unheard (if the microphone is off), or unseen (if the webcam is off), or misunderstood (as a result of connection problems experienced by either the trainer or the participants), or unperceived (because of their poor position in front of the screen), etc. If presenters use online training tools not masterly enough, they may feel less confident, and when the participants see their trainers' mistakes and confusion, they may be less engaged. It means that trainers should be simultaneously focused on content and presentation, maintain communication, and keep an eye on computer equipment.

The revealed problems prove online training to require a unique approach. It is impossible to keep traditional training sessions unchanged when conducting

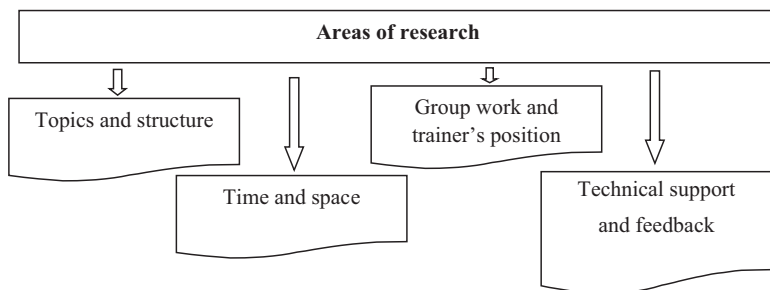
them online. It is worth noting here that online training has become an integral part of teaching and learning at all levels and is sure to be widely used in the foreseeable future. So the best option is to accept its challenges and take the best of the opportunities it offers (Banit, 2022).

## 4 Overview of Online Training Opportunities and Advantages

*Online training has a range of advantages and offers numerous opportunities. The online format is perfect for theoretical presentations and self-development of skills: time management, management (organization, staff, projects), personal development, leadership, communications, negotiation, sales, training courses, etc. Corporate team building courses that used to be outdoor are successfully moving to virtual platforms too. Online training courses may include several short parts or modules, which is a learner-friendly approach. Two- or three-hour sessions may be held several times a week, and periods between the sessions are long enough for the self-development of skills. It allows participants to develop their skills gradually, which is a significant advantage. In case of online training, all the participants interact from their own spaces. They can choose a comfortable environment, informal clothes, and have coffee breaks when they need them. At that, online training sessions feature a single space too—a virtual platform where participants can see each other, and can communicate with each other and the trainer. Online platforms enable the trainer to instantly combine participants into virtual groups and then with a single click to get everyone back together and continue a session wasting no time. The author gave an overview of this at the conference (Banit, 2022). These issues will be analyzed in detail in this section.*

Online training is a type of training that enables participants to obtain new knowledge and skills via the Internet. It is highly important that all the participants are engaged in training. Participants become part of their group and join efforts to solve particular real-world tasks. For online training sessions to be successful and fruitful, both trainers and participants should work hard. There are no ready solutions or universal guidelines—each training program requires a unique scenario. The situation is complicated by the fact that no science of successful online training has been developed yet. And since online training has received no systemic scientific and theoretical justification yet, we are mostly basing ourselves on responses of the training practitioners we interviewed. Over the past years they have accumulated extensive theoretical and practical experience in this field and are ready to share their expertise and give advice (Developing a Strategic Plan and Organizational Structure, 2020).

To keep our research clearly structured, we present our findings in the above-mentioned succession of four areas (Fig. 11.2).



**Fig. 11.2** Areas of research. (Source: Author's own elaboration)

### 4.1 Topics and Structure of Online Training Sessions

Training sessions can be conveniently divided into educational and psychological ones. And it may be a challenge to present some educational training topics online so far (as mentioned before). However, as evidenced in practice, most educational training topics have already been transformed and adopted to the online format. In particular, these topics include the following:

- Achieving corporate goals, increasing sales and customer base
- Business, personnel, project management
- Time management
- Development of communication skills, both oral (negotiations, interviews, etc.) and written ones (writing CVs, motivation or cover letters, etc.) (Banit, 2022)

Most psychological training sessions perfectly suit the online format. A goal of this type of sessions is to help participants to master the theory and self-develop their skills. These sessions are mostly about personal development and leadership as well as participants' emotional states (confidence, self-esteem, overcoming fears, self-acceptance and acceptance of circumstances, etc.).

Successful online trainings require thorough preparation. In the first place, trainers should think of their audience. For sessions to be interactive (rather than monologic), there should be up to 10–12 participants. However, in many respects it depends on the topic. Sometimes a group of as many as 20 participants can be quite effective. However, the trainer should make sure that he/she can see everyone and keep them focused, and that everyone has their say. To make meetings more engaging, trainers can send reminder emails, use social media, include invitations in the involved companies' bulletins, publish visuals or create videos, that is, use every avenue to promote their events.

The preparatory stage requires a "route chart" too. For instance, a one-week training course can include three 2-hour online sessions (Monday, Wednesday, Friday) and three self-study sessions. For each training program, the trainer should create the description of its format, topics, the roles of the individuals involved, etc., and each module description should include timing, links to all the materials used,

and an action list for the presenter, co-presenters, or moderators (pasting links in the chat box, turning on videos, desktop sharing, etc.). This detailed scenario and a session script make it easier for trainers to prepare all the materials they may need. The scenario should cover all key issues but allow for live interaction with the audience, including question and answer sections, comments, etc. The session script should detail the images, music, and other resources to be presented.

Any training session structure should develop from analysis to synthesis. The presenter should move from the tasks that analyze separate activities to those integrating them into a single action algorithm, a behavioral pattern. There should be no difficult tasks at the beginning of a session. Instead, the trainer should present the materials that participants need and answer their questions. When introducing theoretical materials, the trainer should begin with the training program overview. At the next stage, the session participants may be offered to work on typical tasks and then complex tasks enabling participants to transfer the acquired theoretical knowledge into practice and develop their skills. These can include modeling tasks that help participants to master new skills, case studies, and interactive assessments that help the trainer to measure the participants' understanding. Long role-playing games, tournaments, management, and negotiation simulation battles should be conducted in the second half of sessions or even at the very end of them.

Successful online training sessions always contain visual materials to improve participants' understanding and skills acquisition. For instance, it is a good idea for the trainer to present a visual related to the topic during the fifth minute of the session. The visual can present a task structure or the skills needed. It can include pictures, diagrams, and analytics that help participants to improve their knowledge.

Information acquisition is different for online and traditional training sessions. Many trainers are unaware of the fact that their talking time is much longer than their listening time. They may talk much to share as much information as possible or because they are not good enough in using online platform tools. But theoretical information overload is not good for participants. It makes them tired, disengaged, and reluctant to participate in group work. That is why trainers should be quite laconic and specific, do know the material they present, divide it into small sections and keep their audience engaged by asking questions.

In online sessions, theoretical and practical sections are not integrated into each other, unlike traditional ones. The 35-to-65 ratio between theoretical and practical sections is both desirable and achievable. If a trainer's goal is to help participants to not only acquire knowledge but also develop (or at least start developing) their skills, the practical section of both online and traditional sessions should be at least 50% or even 70%. When planning practical tasks, trainers should break up the content into smaller chunks at earlier stages and bigger ones at advanced stages, moving on from analysis to synthesis.

Online training session structure suits almost every major stage of traditional sessions: establishing rules, brainstorming, grouping, working on case studies, independent work, etc.

Establishing rules is an important part of both traditional and online sessions. As a rule, they are negotiable, which enables participants to have input. When

conducting an online training session, the trainer can come up with several basic rules, for instance for live participation, for example, live cameras, muted microphones, hand-raising, etc.

Brainstorming can be organized in two ways—participants can either share their opinions in the chat box or appear on video. It depends on the time available and learning goals. When participants use their video features, the discussions are longer and livelier but both options are effective enough, in our opinion. As evidenced in practice, it is a good idea to use statistics to initiate a discussion. The Believe It or Not game suits the online format too. Almost each text can be transformed for this task. Participants can respond to an offered statement in the chat box and then discuss it or comment on it.

The key rule about the trainer-to-participant and participant-to-participant interaction is the same for both traditional and online training sessions: trainers should first focus on themselves and trainer-to-participant interaction, and then gradually move on to the activities focused on participant-to-participant interaction. To engage participants, trainers can use the chat, tests, surveys, or encourage participants to speak up.

An advantage of online training is that the trainer can directly interact with the audience and engage them in learning. But participants should be ready to get engaged. There is a range of various methods practitioners use to achieve this goal. Two of them are optimal for the online format. The first option is to ask interesting questions to spark a debate on a given topic and personalize it. For instance, the trainer may ask whether the participants have learned anything new about the topic lately or whether their recently gained skills have helped them to become more productive. Another option is to test participants' knowledge and give them a chance to become aware of their priorities. Testing is a great method to make the training more valuable for participants and help them to learn from their mistakes. For instance, when a participant gives a wrong answer, it may encourage them to find a way to improve their knowledge. Quizzes can serve as an alternative to tests. Trainers can offer them as a single task or use the results to initiate a discussion.

Independent work perfectly suits online training sessions. However, the tasks should be interesting and quite small. For instance, the trainer may ask participants to watch short videos related to the topic. It is advisable to assign this task before the session starts or between sessions. An advantage of online training is that participants can take more time to think and reflect on such tasks before communicating. It may help them to better formulate their ideas and encourage them to share these ideas, which results in more vivid debate during online sessions.

Trainers should constantly remind participants that the harder they work—not only during sessions but also after them—the better results they can achieve. Attending sessions enables participants to gain new knowledge and receive advice and expert opinions. But it is the post-session period when they are expected to develop and improve their skills. It is a good idea for participants to practice the new techniques or skills they learned for 100 days. This is the time required for a skill or technique to become a part of everyday life. Apart from performing the tasks assigned, participants should search for new information on the topics studied to



enrich their knowledge, and encourage themselves for the tasks performed and the results achieved. It can help training session participants to stay motivated and focused on professional success and business victories.

## **4.2 Time and Space**

As mentioned before, there is no use conducting online training sessions for 5–6 hours a day. Long sessions make participants lose concentration. And poor concentration results in poor attendance and disengagement. An advantage of online training—for both trainers and participants—is that sessions can be conducted in small chunks. Sessions can be divided into modules, last for 2–3 hours per day, and be conducted several times per week. Participants can use intervals between sessions to self-develop their skills. Unlike traditional training, it allows for stage-by-stage development of skills, which is another major advantage of online training.

Online training sessions require careful timing. Trainers should plan the duration of each part of the session beforehand. For instance, the introduction should last for up to 10 minutes. The main part can be as long as 1.5 hours or even longer but there should be a break during it. Participants of intensive online training programs are often offered long breaks (e.g., 30-minute coffee breaks and 1-hour lunch breaks).

Trainers should remember that people tend to forget what happened a day or a couple of days before, that is why it is always a good idea to start each session (and a training program may include from one to eight sessions) with a 10-minute review of the rules and algorithms learned during previous sessions, and then move on to new topics and case studies.

Sometimes, online training can change participants' time perception. As a rule, they are focused on the trainer, and the session dynamics is up to the trainer. The pauses that may happen during online sessions seem longer than they are. That is why to divide roles clearly is a key to success. Where possible, trainers should work in a team of two or even three: two trainers and a moderator—a person who pastes links, splits participants into breakout rooms, launches quizzes, etc. However, if the trainer can use online platform tools easily, he/she can work alone. But it is important to have a file prepared beforehand with all the links placed in the order participants may need, or include all the links needed in the presentation.

Sometimes, online session participants are offered to watch pre-recorded videos, and it takes time. It is also important for trainers to estimate the time participants may need to complete homework assignments, based on the average pace of learning.

In online trainings, participants connect from various places. They can choose the environment that suits them best, informal clothing, and they can decide themselves when to have a coffee break. However, simultaneously they are sharing a common space—the virtual one where they can see each other and communicate with each other and the trainer. At that, all the session participants are limited to a

view of only each other's faces and upper bodies or even just profile pictures when webcams are off.

A great advantage of online trainings is that participants can receive all the materials in a digital format. Moreover, the materials can contain what is impossible for traditional sessions—video recordings. Session participants can download and save all the resources, presentations, and recordings the trainer shares, which enables them to watch them as many times as they need to develop and improve their skills.

### ***4.3 Group Work and Trainer's Position***

The trainers we interviewed divided on group dynamics. Some of them believe that there are actually no groups in online trainings. There are people's faces or pictures instead. These trainers agree that they gradually build relations with participants during sessions but often they are unstable, dotted, and not durable. In an even greater degree, it is true about relations between participants. While some of them do remember several other participants, others may be unaware of even the total number of attendees and their names. That is why it is open to question whether online session participants can be considered a group. Answering this question requires the development of a new section of social psychology and the field theory.

However, a lot of trainers identify online session participants with a group. The group is equal to every participant and the participant is equal to the group. When running an online session, the trainer is addressing everyone who is listening. He/she is talking to a generalized participant and looking at an imaginary person on the other side of the screen. Even when participants ask questions, the trainer can see them only while they are speaking. As soon as the trainer begins to answer the questions, he/she is looking at a generalized session participant on the screen.

Breakout rooms can serve as an exception as they enable person-to-person communication. Let us note that it takes time for participants to move in breakout rooms and start working there so the trainer should allocate enough time for the tasks planned. But even in breakout rooms, the trainer-participant communication is rather limited. Joining in to a breakout room, the trainer listens to participants for a while, monitors the group discussion, comments on progress, or answers questions—and joins in to another breakout room. If a group includes  $\pm 15$  participants, they can be split into 4–5 teams of 3–4 members each. In this a way, the trainer has up to 5 minutes for each of the teams, as long as they are engaged and independent enough, which is rare. Resistance to change occurs even during traditional training sessions. And it grows during online ones, which affects group dynamics. Unlike offline instructors, online ones have almost no instruments to reduce this resistance. And those available may be not effective enough.

For instance, if offline session participants are late or leave the room too often, the trainer can reprove them mildly, cast a meaningful glance at them, impose penalties for being late, etc. In online trainings, participants can leave by just turning their webcams off and muting their microphones. Or they may get disconnected from the

session for some reason, and the trainer is unable to follow them. And even if these participants rejoin, it would be a time waste for the trainer to ask for the disconnection reasons.

On the other hand, participants can exploit such situations. If they do not like the session or feel pressure from the trainer, they can stop listening, get distracted, say something like “Stuff and nonsense!” without being heard by the trainer because their microphones are muted, at the trainer’s request. In our opinion, such situations reveal the positive and humanistic approach peculiar to online training, which is an advantage of this type of training. The online format encourages trainers to make their sessions more interesting, captivating, artistic, democratic, and focused on interaction with participants.

To control participant-to-participant interaction is another challenge for trainers. When conducting a session, the trainer is following the scenario, keeping track of time, encouraging participants to speak up, commenting on what they say, asking questions, making conclusions. Meanwhile, the participants can be discussing some issues in the chat, sharing their opinions, or telling jokes. The trainer is unable to view every message. It would be a bad idea for him/her to stop to read and comment on every message—it may affect the session rhythm. And it would not be helpful to disable the chat or ask participants not to use it—they are sure to switch to other communication channel to share their emotions or switch to other issues. As practice shows, while attending a training session, participants can be playing a computer game or watching a movie. So it is a good idea to let participants discuss the training session rather than be distracted.

A co-trainer may help to solve this problem. Involving a co-trainer, a moderator, or just an assistant may help the trainer to better control training sessions. To keep their mind on the key task, the trainer can delegate subtasks to the co-trainer. The latter can manage the chat, moderate discussions, monitor participants’ engagement, answer questions, submit comments and observations, send reminder emails, etc.

Teaming up with a co-trainer gives the trainer the time to think of his/her style and image. Participants are known to be inspired by not only training topics and content but also the trainer’s charisma. The key character traits important for the trainer are as follows: professionalism (professional knowledge, expertise), the ability to motivate people (understanding motivation psychology and being able to get others motivated), strong leadership and pedagogical skills, and self-discipline. Trainers should be able to manage not only groups of participants but also session organization, preparation and promotion, as well as themselves.

When conducting classroom sessions, the trainer should be aware of his/her posture and movements, know the materials by heart, respond to questions quickly, present slides, manage physical activities, keep all participants engaged, etc. Requirements for the online trainers’ style and image differ. On the one hand, they can take advantage of sitting comfortably, using their notes, presenting slideshows, and having their time when answering questions. They do not have to manage any physical activities or keep all participants engaged all the time. Trainers understand that the participants who are absent can watch recordings and ask their questions

later. On the other hand, just being charismatic is not enough for online trainers to be successful. They should also be aware of their position on the screen.

The trainer talks to his/her webcam and microphone rather than session participants. The latter can see the trainer on their screens and hear through speakers or headphones. That is why it is important for the trainer to choose a comfortable sitting position, set up lighting, choose the background, and minimize background noise (street noise, other people's voices). Framing the shot is crucial. It is a good idea to position the webcam far enough away to capture the face and shoulders or the upper body with some room to spare. It is also a good idea to avoid being backlit. Having too much backlighting is a common mistake that may lead to losing eye contact with session participants. The background matters. The trainer should think of what participants can see behind him/her—shelves with business books on them, a roll up banner, or cluttered background.

In online trainings, the eye level is of special importance. The camera should be at the same height as the trainer's eyes. High camera angles make the trainer look dominating and putting pressure on participants, while low ones make the trainer look unconfident and ingratiating. If the trainer looks at the participants one by one, it may give him/her a bit odd look. So the trainer should look in the camera lens above participants' faces on the screen, for the audience to see him/her looking at each of them simultaneously. The advice of professionals is an effective help for the trainer (Burgess, 2016; Joey et al., 2022).

The only thing that does not change from classroom to online training sessions is the environment the trainer creates with thoroughly prepared materials and the content, well-thought examples, logical and clear presentation, the trust built on awareness of everyone's uniqueness, participant engagement, and avoiding personal criticism. This environment enables students to unlock their potential, feel they know, and they are able to do more than they thought.

#### ***4.4 Technical Support and Feedback***

In online trainings, technical support is completely different from that in a classroom. There are no physical premises, no desks put in rows or arranged in a circle—there are just faces on the trainer's screen. And participants can see the trainer's face and the screen on which he/she presents a slideshow or diagrams, adds arrows, etc.—like on a flipchart during traditional sessions. Participants can communicate with the trainer and the group using the chat or their microphones, and they can talk without turning their webcams on.

Effective online training sessions require reliable software that can help trainers to reach their goals and better engage the audience. The software should not restrict interactive communication or be an obstacle to using other resources or activities, for example, audio or visual effects. The technologies that the trainer chooses should support the formats needed and have in-built editing tools. Besides, it is a good idea for trainers to team up with IT professionals to make online training sessions more

effective. But it is worth noting that IT professionals have become some of the most in-demand members of today's labor force in many markets, and unfortunately there is a shortage of IT professionals in Ukraine (Lukianova et al., 2019b).

Trainers tend to use online training platforms that are customer-friendly and technologically simple—not only for them but also session participants. If it takes 10–15 clicks to join a meeting, the trainer may lose all the clients. People leave a website in 5 seconds if they find it too complicated or not interesting enough.

Currently there are a lot of online training solutions on the market. All online platforms offer such key features as trainer's video broadcasting, slideshow presenting, and chat boxes. A part of platforms enables session recording and using drawing tools. Fewer platforms support video and audio streaming, survey tools, downloadable content, breakout rooms, etc. Robust online training platforms include eTutorium, Pruffme, ClickMeeting, and Wiziq (English version). There are also nice free platforms, including Google Hangouts (GH) and Zoom. However, text chat is often delayed in GH, and registration and account confirmation processes take too long. And there is a time and participants limit in free Zoom sessions.

So there is a wide range of online training platforms from which trainers can choose. But in any case, they should study all the available features prior to use, test their sessions and become acquainted with the tools and techniques that can help to keep session participants engaged. Interactivity is a key to success in any training session.

Before launching an online course, trainers should also make sure they have a reserve channel of the Internet. Striking Internet providers, power cuts, and other unpleasant surprises may cause problems to both the trainer and participants. Besides, it is always a good idea to test all the devices used and all the tech issues involved: webcams, microphones, Internet connections, battery levels, etc. A sudden failure of any of the components may upset a session.

To attend an online training session, participants should use the link they receive from the trainer and join the meeting from a web-connected computer, laptop, or phone. Trainers may also ask participants to register for trainings on a landing page. Landing pages can redirect users to registration and payment pages. Using a mailing database is a good idea for groups of more than 100 participants, to prevent emails from going to spam. A professional registration tool is TimePad, and the simplest one is Google Forms. When joining a training course for the first time, participants may have to sign in.

Session participants do not have to be technical experts. That is why the trainer should explain to them how to use the platform, what keys to press, and where to click to enable particular features, how to fix audio and video issues, or what to do if a web browser stops while transmission is running. To save time, experienced trainers email user instructions to all the participants and provide them with virtual room screenshots beforehand. They can also explain how to use other tools and features that participants may need, for example, file sharing services, Google Drive, etc.

Most online platforms come with breakout rooms. They enable the trainer to split a session in several separate sessions and assign participants to particular breakout

rooms. When necessary, the trainer can close breakout rooms and return participants to the main meeting with a single click, without losing any time. However, some participants may appear not ready for group work or be slow achievers. For such situations, the trainer may use the feature that allows all the participants to watch one group working.

If there are no co-trainers, the trainer should be as focused as possible both during sessions and pauses between them. If the trainer forgets to turn off his/her microphone during a break, all the participants will hear what he/she is saying. Or when sharing the screen, the trainer may forget to disable email notifications or chat windows, which can be not only annoying and distracting, but also reveal personal information.

To improve group work, the trainer should be able to effectively sum up discussions and provide participants with meaningful feedback. Effective feedback is crucial for success of online sessions as a whole. The trainer should help participants to understand theoretical materials and give not only detailed but also quick answers to participants' questions. But during an online session the trainer may sometimes be unable to respond to what is happening in the group as quickly as in a traditional classroom.

During online sessions, interaction heavily depends on available feedback tools and channels. Below there are types of feedback most common for online training (Fig. 11.3).

There are features the trainer and participants can use to share files and use individual and group chats. Such features are available from Getcourse, Smartplatform, AntiTreningi, and other services. These are the most advanced and visually attractive communication and data storage solutions. Google ecosystem offers Google Classroom, which is free but a bit less user friendly.

A chat is a common space for all the participants to communicate with each other and the trainer. It is a key feedback tool used during online training sessions where participants are expected to work as a team and support each other. A private group chat is an example of a team chat that online training participants can use.

Social networks are perfect for giving feedback since most participants have social network accounts. Online training participants can use any social network to

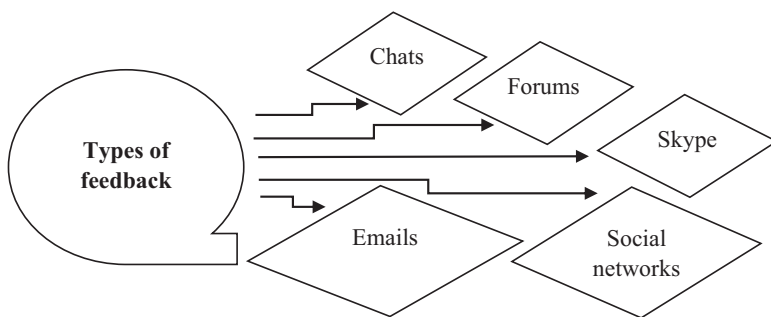


Fig. 11.3 Types of feedback. (Source: Generalized by the author)

create a private group to ask questions, share links, and exchange opinions. For instance, they can share topic-related resources they find on the Internet, discuss their experience and how they can use the skills gained. Very often, trainers conduct sessions on Facebook. Participants can publish links to their workbooks in their private groups and receive feedback there. When choosing this format, the trainer should be aware of the group size—a larger number of participants means a larger number of comments and thus a greater risk of missing some of them. Another effective tool to stimulate interaction is to create an online training hashtag.

Forums are good for giving feedback too. The trainer can create separate sections for all the modules and differentiate user access rights, depending on their role in sessions and packages bought. Participants can see general topics and their sections, where they can submit performed tasks, get feedback from the trainer, or ask questions. This approach allows participants to have the learning process accumulated in one place.

Emails can be used to give daily homework feedback. However, if there are many participants, trainers may miss some important emails. Besides, email software does not allow the trainer to store the group history in a single space. If participants are not numerous and make similar homework mistakes, the trainer can conduct a separate webinar to give group feedback and spend a couple of minutes commenting on individuals' mistakes.

Individual feedback formats are usually included in expensive packages or discussed individually. This feedback can include individual online consultations or Skype calls and is most common for long training courses that last for several weeks/months. An advantage of this feedback is that it can save time for both trainers and participants. They can ask questions and receive answers immediately. As a rule, participants consider audio feedback most substantial. Very often they are ready to pay more for it, that is why it is included in expensive packages.

As we can see, online training sessions are completely different from offline ones, from the point of view of technical support and feedback. As a matter of fact, these two types of interactions are poles apart.

## 5 Prospects of Online Training Development

*Key factors that influence prospects of online training development: the pace and areas of IT development, and online teaching and learning trends. The promising areas of online training development: gamification (virtual gamified tasks that require high-level interaction and give productive feedback), microlearning (where learning content is divided into short segments based on micro content), augmented, virtual, and mixed reality (which enables trainers to model real-world situations), smart assistants/chatbots (can significantly improve the quality of the trainer–participant interaction), and artificial intelligence (to predict participants' behavior and personalize training within the modules that participants choose). Development prospects of online training environment are designing brand-new training rooms*

*for online sessions: HIVE (Oxford Hub for International Virtual Education), Live virtual classroom (Harvard Business School), and branded 3D campuses (Stanford Graduate School of Business high school). In this way, online training development prospects and opportunities are based on ever-growing demand for online training.*

There is a range of the factors that may influence prospects of online training development. Two of them are considered key factors: the pace and areas of IT development, and online teaching and learning trends. The promising areas of online training development we can single out by integrating these key factors are as follows:

- Gamification
- Microlearning
- Augmented, virtual, and mixed reality (AR/VR/MR)
- Smart assistants/chatbots
- Artificial intelligence

Studies of modern scientists confirm this (Kharkovyna, 2019; Zakota, 2019).

Gamification is the strategy that allows participants to earn awards for each completed task or module. It motivates participants and increases engagement. Advanced online platforms offer a lot of new features and develop new systems of virtual gamified tasks that require high-level interaction and give productive feedback.

Microlearning is an approach to training where learning content is divided into short segments based on micro content—small chunks of information that focus on one specific concept at a time. These can include short videos, interactive videos, games, quizzes, or even interactive visuals. Microlearning is available to users of all types of devices, and ever-growing demand for smartphones is sure to feed this learning format.

Augmented, virtual, and mixed reality (AR/VR/MR) is replacing traditional presentations. While augmented reality is an enhanced version of the real physical world, a virtual one is a computer-generated environment, which enables trainers to model real-world situations. Using these technologies, trainers can raise the emotional and cognitive level of their sessions, gain participants' interest, and help them better develop their skills.

Chatbots and smart assistants are widely used in a lot of fields, including sales and marketing, social media, and CRM systems. In online trainings, they can significantly improve the quality of the trainer–participant interaction.

The online teaching segment is increasingly exploring the potential of artificial intelligence. Trainers can use AI to predict participants' behavior and personalize training within the modules that participants choose. Voice bots assist participants in finding key content in modules. In the future, AI can completely change the segment of education, including online training.

Development prospects of online training environment are worth mentioning too. Leading international universities are designing brand-new training rooms for online sessions. In autumn 2017, Saïd Business School, University of Oxford, opened a virtual classroom called HIVE (Oxford Hub for International Virtual Education). HIVE is a physical space that takes the appearance of a high-tech



conference facility, with high definition screens that form a U shape in a seminar room. In the HIVE, trainers can engage with up to 84 participants, who can access the session via Mashme.io. The technology is fully interactive. The trainer can address the participants individually, split them into groups and conduct real time polls, and participants can see and hear one another. The Oxford HIVE technology employs a wide range of IT innovations, including AI, simulations, big data analysis and visualization, robotics by Casual Robots (Spain), recognition technology and 4D high-definition projections, an advanced sound system, 360° videos, augmented and virtual reality, 2D and 3D simulations, life-size 2D and 3D holograms of the presenter, interactive images, virtual boards, a camera tracking the presenter, performance efficiency, etc. (The Oxford HIVE, 2017).

Harvard Business School designed the live virtual classroom where the trainer can see images of participants portrayed on a curved U-shaped screen in three lines. The screen is 4.5 m high and 8 m long. The studio can host up to 60 virtual students and 1000 viewers. It is equipped with a digital board and five fixed cameras. The audio from the live feed of participants is as loud and clear as if they were in the room (HBX Launches HBX Live, 2017).

Stanford Graduate School of Business high school business opened branded 3D campuses and used 3D avatars for online students. The avatars look like students, and they can dance, applaud, move on campus, communicate with others, attend lectures, etc. Virtual campuses offer everything students may need: meeting places, notice boards, classrooms, etc. (Why top business schools, 2015).

In this way, online training development prospects and opportunities are based on ever-growing demand for online training that arises from better performance of video transmitting systems and gradual adaptation of users to this type of communication.

## 6 Conclusions

This study of online training effectiveness has given a mixed result. Online training proved to have both strengths and weaknesses. Advantages and opportunities of online training are evident. They are due to the wide range of topics that can be covered (a lot of educational and almost all psychological ones), effective organization of time and space, a positive and humanistic approach to group communication and feedback, use of advanced interactive online training tools and software, platforms, and services. Key drivers of online training development include the rapid growth of distance teaching and learning; a wider use of AI and chatbots; augmented, virtual, and mixed reality; automated machine learning; and gamification.

Online training has developed from a trendy pastime to an essential training tool. Undoubtedly, online training can be an engaging and effective mode of study. Currently it is moving to a higher development level. A direct proof of it is the impressive results demonstrated by the educational institutions that have been investing in digital technology and online education for years. An indirect proof is

the position of investors devoting money to in-demand online education, digital services, and distance learning. They believe that in the near future, online training will win over even more followers, due to their innovation readiness and the advantages that high-quality online education can offer. In this context, further research may be focused on identifying effective methods of developing new competencies of digital trainers as members of the online teaching and learning community.

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# Chapter 12

## Effects of Evolving Applications of IoT in the Education Sector



**Kabirdoss Devi, J. Sabitha, and J. Sathish Kumar**

**Abstract** Change is the only word that does not change and the rest changes. Technology advancement has significant impact on the improvement of lifestyle in everyone's lifetime. There have been numerous studies conducted related to understanding the effects of the Internet of things in the education. This paper reviews each study and their significant contribution on revealing the effect of each evolving methodology of the Internet of things on education. This study on IoT primarily lists out all the technology pertaining to the digital and smart devices being used by the students and teachers in the educational institutions. Some of them are, e-books, smart boards, voice command system, speech- to text-based note-taking systems, smartphones with educational applications, automated attendance recording, and AR-equipped systems. These solutions for education have given tremendous support to enhance the quality of education around the world. This study will help in understanding its impact through the research conducted with the results on these evolving methodologies of the Internet of Things for its slice of contribution in the education sectors.

**Keywords** IoT · Internet of Things · Education · Smart boards · Edu apps

### 1 Introduction

Information communication technology (ICT) tools have become quite familiar among the teaching fraternity, who started exploring its benefits in the teaching-learning interaction. What once was a trial became part of the system whether liked or not, whether supported by the adequate infrastructure or not after Covid-19. Most of the theories under queries earlier were proven effective during this pandemic period. If these tools were not available, this pandemic would have left a significant scar on the teaching-learning process. Everyone observed that students can make learning through ICT tools, effectively replacing the traditional methodologies.

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Students digital involvement through IoT are eco-friendly because of the online sharing of study materials, submission of assignments and even online exams. This technology provided access to proctor the student during exam. This Internet of Things not only helped the teachers and students to complete the syllabus on time but also allowed students to view the recorded videos many numbers of times. Thus, it not only made everyone to communicate to each other but also to create, circulate, store, and carry off information.

The Internet of Things replaced the traditional classroom practices of chalk-boards with digital boards. Well-equipped pedagogical approaches, like flipped classroom using customized videos, help students to save time by watching the video lectures at home using their computers or smartphones and making use of classroom for the discussion and other topic-related exercises. However, this is possible only when the teachers are technically and digitally literate and trained to practice the information communication technology. Incorporating these techniques into the regular practice leads to higher-order thinking levels and provides a platform for one-to-one attention, where students can explicit their understanding individually. IoT exposure in learning environment makes students to deal with technology transfers even at their workplace boldly.

One of the benefits of exploiting IoT is providing smart cards to students, where it gives access to the labs, library, and classroom. This automatically records the attendance and saves the time of the faculty, which can be effectively used for the interaction. Some schools use smart ID cards, where the moment students enter the campus, it automatically records the attendance and triggers the parents in case their wards are not attending the school. This system helps both the parents and the school authorities to keep a tract of the student's presence in the school. In addition to this facility, students will also get information from the library for the availability of the books that has been reserved by them and immediate information, if there is any change in the schedule or change in the venue of classroom, and choose their preferred subjects for the current semester with the faculty of their choice under choice-based system.

Thus, the present study aims at:

- Identifying the IoT and its benefits in the education sector for the engagement of student-teacher learning process
- Understanding the emerging methodologies that enhances the learning environment more interesting and engaging

## **2 Literature Review**

### ***2.1 Evolving Applications of IoT in Education***

On an average, schools and higher education institutes use 10% of their total budget for their paper-based work. The use of IoT tools has shown evidence on how this digital transformation made them to reduce or go paperless and become more

eco-friendly. Students, especially at college level, are moving toward learning through tablets, smartphones, laptops, and desktops and away from paper books. We have witnessed how Kindle made their novel reading friendly through their apps. Application of 3D animation brought the wild animals to the class where the preschool toddlers had real-time learning through visualization. This virtual clarity makes them understand the wild life, giving a real-time experience as if they have been with them naturally.

IoT makes the students learn at their own convenient time at home through all the materials available digitally, giving them the sense of similar experience of being attended at the classroom. IoT also helps the professors when they want to test the understanding level of the topics being taught. The online forms that are created as multiple-choice questions, by the professor, which come with already fed answer keys, give the grading automatically soon after the student submits the form. This makes the teaching-learning process easy for both the students and the faculty. This prevents the manual grading for professors and assists them to concentrate on other routine activities.

What are the methodologies being adopted through the IoT? ICT makes the students upgrade from pedagogy to heutagogy, where the student decides what to learn and how to learn and the student is well connected to the resources, either through the outside sources or through the teacher. Because of this, the role of teachers changed from facilitators to consultative with great independency and self-directive learning inside the classrooms. So, it becomes imperative to bring out the various methodologies that support the teaching- learning process. Some of them are pen scanners, smart cards, loco drones, loco wears, document camera, interactive whiteboards, and VR headsets.

## ***2.2 Prospects of IoT in Education***

Reducing the cost and bringing forth an effective management right from the security to the storage require a sophisticated technology, which the IoT made possible. Cloud technology made it possible to store the data as much as possible. For example, when it comes to energy management, smart lights keep the classroom energy efficient through sensors, where it switches off automatically when no one is around. Safety cameras with face recognition ensures safety inside the institutions. The potential of IoT in the future is limitless. The improved and increased Internet dexterity, artificial intelligence, and automation with security outnumber the giving out situations. The cumulative outcome of all businesses creates billions of data. We name these as actionable data, which helps to diverse the business processes. In education, challenges are multifaceted, since it involves people of different ability, caliber, and motive. These IoT platforms help to overcome these challenges by offering varied networks, AI, and Web-scale markets.

### 2.3 *Need and Relevance of IOT Applications in Education*

Information technologies have entered and transformed the lifestyle of individuals to the extent where it is dominated by technology environments compulsively. Growing innovative technologies not only made our life easy but also brought everyone closer from any part of the world: Communication became priceless, virtual reality has become a hobby, kitchen hours have been brought down, and, last but not the least, smart devices with movement control or without remote control have replaced human at work through cutting-edge technology, known as artificial intelligence. Nevertheless, its presence in the education sector makes the students and teachers learn in a new way. E-learning has proved how students can continue learning without even coming to school during a pandemic. Teachers were able to continue teaching while remotely making the students access the materials and clear doubts like real-time learning. Teaching skills and learning abilities are enhanced by the IT resources. Audiovisual cue makes learning easy by interpreting the meaning by seeing and hearing. The Internet supports the online library access, which provides thousands and thousands of articles available, creating a conducive environment for research scholars.

Loss of sight due to disease or accidents demotivates the life of an individual who lived in the brightness suddenly made to live in darkness. This poses a great challenge to practice a new way of survival in this world. Information technology brought a promising support in those physically challenged group, who have become disabled either by birth or later accident. Various software and techniques provide a special training to equip them to perform better through these devices. Quality is the prime motto of the educational system, and integrating IoT ensures this quality is retained and sustained for all the forthcoming decades.

The Internet of Things has many incarnations when it comes to the contribution to the education sector. One such contributor among many is e-books.

*E-books or digital books* are quite famous now, and we have witnessed many companies who are involved in selling traditional books that have diversified to digital books. Kindle was successful in attracting many voracious readers for its many unique features. It was rated as the best reader-friendly app. Its displays are like the printed materials. However, unlike traditional books, e-books make it possible for the readers to adjust to the font size by zooming in and out. Kasim and Yildirim (2017) analyzed 41 articles that were published between the years of 2006 and 2016, comprising a total of 10 years of Web of Science database. They revealed that they could not elicit any common pattern, though there were increased number of e-books interactivity. They concluded that the e-books should include instructional design, which might promote the positivity in the change users. Staiger (2012) conducted a study reviewing more than two dozen articles, exclusively using members of academics. This study was conducted between the years 2006 and 2011 in colleges and universities. It brought out mixed results between users of humanities and social sciences in contrast to sciences and business. The users of humanities and social sciences found e-books less satisfied. Nevertheless, they also found two main

advantages of e-books from the study, such as searchability and round-the-clock availability. This notifies the positive outcome for the users of the e-books.

*Smart boards or interactive whiteboards* are one of the tool kits being used in the ICT. Glover et al. (2005) discussed about the evaluation of the ICT provision as teaching technology and methodology. This study focused on the three aspects, mainly – technology change management, learning process of the facilitator for adapting the technology, and outcome of the interactivity while implementing it as part of the pedagogy. This study confirmed that the interactive whiteboard requires understanding of the technology by both the encoders and decoders to demonstrate the enhancement at all levels of usage.

*Speech recognition software* works on a specific algorithm, which transcribes sounds into texts. Speech recognition is a technology that recognizes speech and serves as a main medium between the human and the computer. This facilitates the student learning, where the recorded notes can be converted into text, and they are protected from the important points being missed from the specific topics. Jon Pennington, Min Wook Ok, and Kavita Rao (2018) conducted a review on 13 empirical studies that were conducted between 1995 and 2018 on the use of speech recognition for the students of 12th standard and higher education. Their study suggested that speech recognition can facilitate students to improve their quality and proficiency in writing. Another important consequence of this study was that students could use this as an alternative medium for composing text.

We have witnessed the emergence of educational apps and how it penetrated the lives of everyone through the smartphone. Though it has some disadvantages when used properly, it results in a positive outcome. Most of the population, on an average, uses these apps at an early stage of their age. These apps are extraordinarily useful when it comes to research writings. The information is overwhelming on the specific topic being searched. Vásquez-Carbonell (2021) conducted systematic reviews of 119 published scientific papers to create a work that integrates all the latest data, mostly used keywords, journals, authors, etc., to evaluate the efficacy of the educational apps. Mustaffa et al. (2016) have shown the statistics, where millions of apps are downloaded in iOS and Android. They projected that among these millions, three quarters of them were educational apps. However, they also notified that those educators and student found it difficult to choose the authentic app from the huge numbers. Hence, they came out with the study where they could analyze this inclusiveness through rubrics.

### 3 Methodology

The literature on the IoT in the education sector and its benefits for the teacher-student learning process with the platform construed based on the tools provided by the IoT has been studied in this chapter through secondary data collected from magazines, newspapers, and research articles. This study also used a structured questionnaire and collected responses from the students of SRM Institute of Science and



Technology from different departments pertaining to the IoT being used in the teaching pedagogy. Samples were collected conveniently from the students and faculty who wanted to be part of the study. A total of 250 samples were collected, and statistical analyses were made.

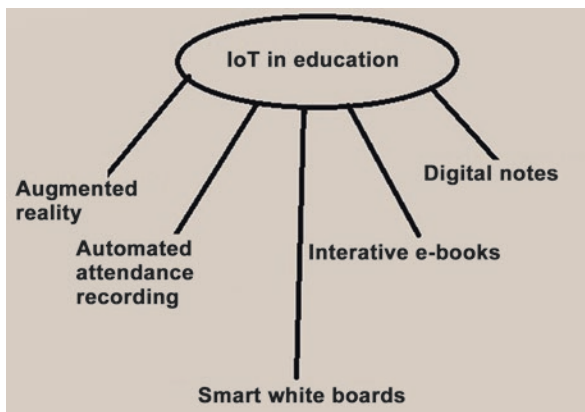
## 4 Results' Presentation and Discussion

The Internet of Things in Education has become cheaper and adoptable, and by building schools, higher education institutes use these platforms to leverage the technology for the benevolent of the learning communities. There are numerous trustworthy applications in education. Not only education but also smart building concepts are emerging in recent days in many industries, like healthcare, hospitality, production, retail, etc.

Progressive and dedicated research and development contribution results in the continuous expansion with unique features in the field of the Internet of Things. This discussion helps to explore the back information and the possibilities for IoT solutions in schools. IoT devices like smart pens, smartphones, tablets, and SR help the teachers to distribute learning materials to students, which not only save time and physical resources but also maintain the better standard of teaching.

### 4.1 Smart Boards

The traditional chalk and talk, paper-oriented learning may not be a preferred way of teaching for the millennials. Students are better tuned in when the lesson are taught with audio and visual effects than lecturing for hours without engaging them



**Fig. 12.1** Transformation of traditional tools to IoT tools

or forced to use only chalk boards. Interactive smart boards allow teachers to engage students with the lessons through short videos, graphical presentations, use of slides, etc. These electronic boards make teachers and students do discussions on the topic where this tool allows the images from the computer to be displayed on the smartphone through the projector focused on the smart board. This reflection from the computer when projected on the screen also enables the teacher to write on the smart board whenever needed during the lecture for the better clarity. In the process of reflective learning, students can be asked to label the parts of an image easily than using chalks to try drawing the image. Smart boards are connected to the Internet and give access to the entire world for the information up to date for the discussions. A review study, made on the interactive whiteboards, brought out evidence on the emergence of significant changes (Higginsa et al., 2007), happening due to the incorporation of smart boards and employing multi-model pedagogy and multi-model technologies, and significantly investigated the relationship between the teacher and student learning environment. It was also proved in the study that teachers and students' motivation increased for the period of study. Interactive whiteboard's impact on the teaching and learning interaction (Glover et al., 2005; Smith et al., 2005) was proven in their analytical study in the year 2005. They interpreted that IoT tools might alter the way that learning takes place.

## ***4.2 E-Books***

Readers never changed their reading pattern, whether books were given as printed ones or digital ones. The introduction of e-books, made people want to refer to them as digitalized versions of regular books. However, with the latest trends in the technology, e-book has taken different incarnation, where it could give learners the needed feedback, navigating to the entire information on clicking the hypertexted words and providing enriched content. E-books contents are easy to update very quickly, since it does not need to wait for the lengthiest process of the printing materials. The software available online makes it easy for the contents to be updated as quickly as possible with the current ones.

The literature review and case study done on the e-books and readers in the public library (Moyer & Thiele, 2012) had a Kindle lending program. The writer had a follow-up session with the libraries on the methods of including the digital contents to their collections and how they accommodate change management by adopting the new technologies that readers demand for; this research paper also gave the tools for libraries to start their own lending program for e-books and reaching to the resources. This study concluded that Kindle lending program was highly successful and confirmed that e-books would not go away that soon.

### ***4.3 Automated Attendance Recording***

Automated attendance recording systems are a welcoming move, since it saves time and helps the educational institutions to track the attendance efficiently. This tool helps the faculty to manage a classroom perfectly. Having an ERP, which enables automatic recording of attendance, helps not only maintain individual records for every student but also retrieve the data as and when required in the gist of time. It helps to avoid the manual error, since it provides the accurate data. Teachers can impart the learning process additionally with the earned hours by avoiding the manual entry of the attendance.

The manual attendance marking system is very challenging, time-consuming, and difficult to mark when the strength in class has more than 75 (Puthea et al., 2017) students. They discussed the real-time issues with the facial recognition and conducted the study comprising all the reviews, research articles, and discussions with respect to the effectiveness and efficiency of these system and the means of solving the challenges arising from incorporating this into the system (Puthea et al., 2017). They did not only provide the literature review on the previous related work but also the deep analytical perceptions in the PCP (Principal Component Analysis) and suggestions for the future.

### ***4.4 Augmented Reality***

Augmented reality is an enhanced computer-generated enduring information on the objects from the real-world environment. It is also an excellent IoT tool used in the learning process. Its working components use camera, sensors, processors, projectors, and reflectors. These give a real-time experience for the learners during the learning process. For example, this augmented reality is considered being useful in dental and other general surgical learning procedures. In schools, teachers can use these AR tools to teach students some of the abstract contents.

Virtual site visits are considered one of the major breakthroughs in the construction industry, and comparing the different project phases with visual representations is found to be effective (Rankohi & Waugh, 2013) for finalizing the projects. This research provided statistical review of augmented reality technology in AEC industry. It conducted review of literatures of 133 articles narrowing its focus on industry sector, target audience, maturity phase of the projects, etc. This study reported that all the reviews demonstrated high visualization and simulation applications.

Augmented reality has been gaining attention and growing new technologies through research and development. The exiting literature reviews do not provide a support to depict its growth and evolution over the particular period of time (Avila-Garzon et al., 2021), and hence, they conducted the study using metadata from articles for the period of 25 years from 1995 to 2020. They considered a total of 3475 articles for the study analysis, which was based on the metadata, author,

content, and information from the citations taken from the data. They concluded that the USA, Spain, and Taiwan were the three main leading countries in the AR publication in education.

## 5 Case Study: Empirical Analysis of IoT Usage in SRMIST

A case study was also conducted in this campus because of its institutional enterprise resource planning being integrated with important operational activities. The books and the other physical resources in the library as well as the user ID cards contain RFID tags, which possess the details of the bibliographical data and are synchronized with each other. These are very useful in tracking the user data regarding the check-ins, checkouts, overdue, fine payment, and bookshelf management. SRMIST has enabled Online Payment System for students to pay tuition fees, examination fees and minute to minute updates on students' enrolment process and performance progress.

### 5.1 Smart Boards

The most widely use of the smart board is the ability of the interaction, with the content being projected in the given (Table 12.1).

Smart board helps the classroom learning to be effective by projecting the content and thereby making the session more interactive. The study collected the information related to the features being used in the smart boards, both from the faculty and the students. The main reason being the students using the smart board for their presentation also. This study reveals that 22.8% of the students and faculty used the whiteboard for their day-to-day learning and 40% being used for writing and erasing points. This was observed in the study that smart boards provided tools for making the teaching-learning process in the engineering concepts. Only 10% used the Web browser and the wireless screen sharing, and 43% used the integrated speakers while displaying the graphical content.

**Table 12.1** Analysis showing availability and use of smart boards in SRMIST

Availability and use of smart boards	Total number of respondents	%	Cumulative %
Whiteboard	57	22.8	22.8
Wireless screen sharing	25	10	32.8
Web browser	25	10	42.8
Writing and erase points	100	40	82.8
Integrated speakers	43	17.2	100.00
Total	<b>250</b>	<b>100%</b>	

## 5.2 *E-Books and Digital Notes*

E-contents are the most available online materials being used in the IoT. It's easy to carry in the portable devices, and the simple mobile device helps the students to get access to it (Table 12.2).

In this study, nearly 40% respondents felt that e-books were more convenient, and 28% responded positively for its accessibility. Nearly 52% of the faculty and students registered said that e-books were one of the best learning sources and mode for the latest updates. In Further, 6.80% said that e-books provide facility to navigate the page for deeper learning. Furthermore, 12% pointed out its ability for multiuser access and 18% on their advantage of space saving and avoiding carrying printed materials.

## 5.3 *Attendance Recording*

Institutional ERP in SRMIST gives the facility of marking the attendance through online. The entry of attendance through the ERP makes the students and parents know the students' records of attending the class and for the faculty to have the backup of the attendance records. ERP in SRMIST sends the periodic attendance messages to the parents and students.

## 5.4 *Online Portals*

In this institution, 85% of the faculty and students use online portals, like Swayam, NPTEL, Coursera, Udemy, and IIT for their learning. The faculty also create videos for the flip classroom and upload in YouTube and the institutional LMS. The institutional LMS provides access to the registered students for the courses enrolled with the faculty. Students get access to the curriculum, lesson plan, videos topic-wise, e-materials, MCQs, frequently asked questions, and information on assignments and provide appropriate platform for the conducting assessments.

**Table 12.2** Analysis showing E-books and digital notes and its perceived benefits in SRMIST

Features	Total number of respondents	%	Cumulative %
Convenience	105	42.00	42.00
Accessibility	28	11.20	53.20
Learning resource	52	20.80	64.00
Navigations	17	6.80	70.80
Multiuser access	30	12.00	82.80
Space saving	18	7.20	100.00
Total	<b>250</b>	<b>100%</b>	

## **5.5 *Augmented Reality***

Departments like mechanical engineering, civil engineering, robotics, and dental college at SRMIST use augmented reality for the dissemination of knowledge in reality through the IoT. Approximately 80% of the respondents (30 dental students) supported the 3D augmented curriculum which gives an access to the real-time experience and avoid cadaveric dependent learning. They said that it gave them the clear vision of anatomical structure of facio-maxillary and other related parts of dentistry learning. The study brought out the evidence that it improved the understanding of anatomy.

## **6 Conclusion**

The study, conducted by many researchers through quite a number of literature reviews from many journals, concluded that the Internet of Things indeed comes with the greatest tools for the efficient teacher-learning environment. Some system would be expensive and might require conducive environment and cooperation from the learning community to get incorporated, adapted, and assimilated for the enhanced work premises. However, it comes with many benefits, such as engagement of students in the learning and encouraging them for better understanding of the abstract concepts, interactive hands on learning environment to learn and practice new skills, and implementation of immersive learning experience and sensory development.

## **7 Main Recommendations and Suggestions**

The IoT provides a virtual space for collecting, storing, and retrieving information whenever required. All tools are designed in such a way that it shares the same function with each other. It enables automatic attendance recording, interactive e-books for learning, and safety premises for enhancing the teachers' efficiency. Overall, it is paradigm shift from traditional learning to digital learning. Uncertain situations, like existing pandemic, have proven that learning and imparting knowledge can be uninterrupted because of these Internets of things. Since earlier theories on making learning through the Internet have been proven successful ad hoc when there was crisis, then it should be made into a working model for the day-to-day learning process for the kids at all levels right from elementary to higher education.

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# Chapter 13

## Effects of Gamified Learning on Academic Achievements: Does Gender Matter?



Deboshree Barman Seal and Sudin Bag

**Abstract** The term gamified learning or gamification of learning is a learning strategy incorporated by the academic institutions with a purpose to motivate and engage learners through various kinds of gaming elements in their academic curriculum. Gamification was acknowledged in academic sector in the late 2010. The objective of the research paper is to compare motivation and learning, learning achievement, attitude, and facilitating infrastructure towards gamified learning between male and female students of business management discipline. The researchers have conducted empirical research study and executed exploratory research method. Samples of students studying in post-graduation level from business management department are taken into consideration. The sample size for this research study were 314 students. A survey was carried out by filling up questionnaire from the students through Google Form. The link of the questionnaire was shared with the students. Data gathering took place in August, 2021, and face-to-face communication was avoided as the virus spread was high during that month. The analysis of the data has been carried out with the help of partial least square structural equation modelling (PLS-SEM). The findings of the study manifest that motivation and engagement, learning achievement, attitude, and facilitating infrastructures have positive influence on leaning intention, and there is no variance in the learning intention of male and female postgraduate students of business management domain. The gamified learning in business management discipline will assist students in obtaining a better understanding of the corporate culture that will sequentially shape them for future employment. Incorporation of game-based learning tools in the academic curriculum by the educators will transform the monotonous and uninteresting traditional teaching into a funny learning environment for the students. This research study will then comprehend in distinguishing the learning pattern of both male and female students of business management discipline through gamified learning.

**Keywords** Teaching-learning · Gamification · Motivation · Gender · Perceived learning · Gamified learning

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## 1 Introduction

Games have a significant impact on technology and are regarded as a component of enjoyment. Thus, it is thought that using them in the classroom can help to make learning more effective and enjoyable. Through the use of information technology, gamification enables the transformation of standard academic content into engaging game environments. Gamification aims to increase student engagement and help them succeed in their academic work, social interactions, involvement, and production (Hamari & Koivisto, 2013). The primary goal of gamification in education is to raise student participation to a level comparable to what video games can typically achieve. Gamification also aims to reinforce particular potentialities, create learning-related targets, involve students, improve learning, and promote social skills and conducts. To increase students' engagement in learning by including components of games is the strategy of gamification in education (Dichev & Dicheva, 2017).

Gamification in education process consists of regulations, different kinds of lucrative reward, badges, failures, opportunities to start the game afresh, and option to departure from the game. The previous studies have located that woman are much more impacted by the ranking system in comparison to men which may guide to unforeseen reverse representation. A continuous negative result in gamified learning without any improvement from the learner's part will give rise to avolition and displeasure amongst the students (Hanus & Fox, 2015). The researchers have anticipated that in succeeding years the concept of gamification will be astronomical in the domain of marketing, health and politics (MacMillan, 2011).

In the study of neuroscience of learning, it has been observed that a brain needs various conditions or circumstances in order to respond to stimuli and to develop new neurons. Connection of separate regions consisting of knowledge acquire, expansion of grasping ability, and cognitive function of brain together assist the person to construct the learning process more effective. Complex cognitive activity involves larger number of neural engagements which is helpful in learning process. It is fascinating to know that gamification encourage complex and collaborative learning only when answers to the questions are perceived through the information provided by several individuals. This reinforces the impression of diversification, as it is perceived that people learn more from socializing. Game-based learning has changed the concept of illustrative to experimental mode of learning helping the individuals to learn, socialize, achieve, and compete in a psychologically healthy and secured environment (Hlupic, 2019).

As the motive of every organization is to upgrade their products and services in order to have a competitive advantage, so is the aim of every educational institution is to guarantee quality education for all students (Yildiz, 2014). The success of any academy is based mostly on the quality of teaching, and to do so, a skilled educator becomes the utmost priority (Chen et al., 2014). Therefore, the prime focus of every educational expert is to upgrade the quality of teaching and learning activity in every area of curriculum. Application of educational games in learning will not only increase the knowledge of the subject but also improve the communication and

social skills of the students (Hamari et al., 2014). In the recent years, the educational institutions have started discovering that including game-based learning along with classroom teaching is feasible, worthwhile, and academically appealing (Glover, 2013). Many studies have been conducted application of gamification in education from primary section to higher education; it is found that game-based learning gives a firsthand experience to illustrate the success of such approach.

In the era of digitalization, education has made a viable multiform of learning. With continuous development in gaming, technology has opened many options for game designing as per choice. Gamification is a source of entertainment, which develops interest and involvement of users by gaining badges, prizes, and incentives by playing and learning through those games (Tvarozek & Brza, 2014). Multiplayer games help the users to learn empathy, cultural acceptance, motivation, communication, conflict handling, negotiation, organizational rules, and values in nominal time (Tariq & Abonamah, 2021). This aids to enhance the relationship between managers and workers, by learning technologized skills, and also enhance their creative skills and imaginative skills, leading them to be committed and to think positive (Michael & Chen, 2005).

Motivated with the impact that component of games can develop, researchers have shown interest to use of gamification in teaching-learning and obtaining favourable outcomes, for instance, increase of student participation, retention of the user, knowledge, and teamwork (Hakulinen & Auvinen, 2014). In spite of that few research, studies have displayed some unpredictable or detrimental outcomes from gamification (Christy & Fox, 2014).

The amalgamation of arguable consequences related to the influence of gamified learning in education has commenced unpredictability concerning to its advantages in educational environment. In addition, study regarding the influence of gamified learning constituents on learners' educational association and added consequences is a general objective. The aim must be set on the theme of what elements of gamification are productive for a particular grade of students involved in a given condition (Dichev & Dicheva, 2017). Different model of gaming constituents used for building various activities of gamified learning will constrain the method of determining which elements or category of elements are productive enough to motivate the learners of specific group or participants executing a particular activity (Dichev & Dicheva, 2017).

There is a gap in the effectiveness of gamification in management education. Very few studies have been done in this field. In spite of motivation and engagement of students through game-based learning, there still many challenges regarding game design and application of it in teaching (Conway, 2014). In fact, gamification in education is costly and challenging for classroom learning, since it requires technical infrastructure and teachers with technical skills.

Application of gaming components in teaching-learning activity is a favourable device to draw attention and engage students. The study corroborates with the study conducted by (Silva et al., 2019) that learning achievements, motivation and engagement of students, facilitating infrastructure, and attitudes (conceptual research model) are the pertinent constructs of perceived learning through gamification in

management education. This paper shows the impact of gender in conceptual research model. From this, we can identify whether gender variable differs the perceived learning through gamification or not.

## **2 Literature Review**

### **2.1 Gamification**

Gamification can be interpreted as the application of gaming tools and sketching of non-game setting (Werbach & Hunter, 2012). Gamification was first introduced in marketing field and then expanded to different areas, like health, environment, sports, engineering, mathematics, computer science, biology, communication, and psychology. The idea behind gamification is to encourage and involve the students in certain areas, which may help them to enhance their learning in that field (Huotari & Hamari, 2012). A game is related to experimentation of defeat and success through continuous learning (Buckley & Doyle, 2014). The important element for the student's development is the feedback, in which the students get from their respective teachers regarding their activity during their course (Kapp, 2012). In gamification of learning, the students get their motivation through achieving the badges and points, which works as feedback regarding the activity they have learned so far. In common observation, it is evident that gamification do not motivate individuals in the same way, and therefore, students have positive, negative, and mixed expression towards gamification. However, it is contemplated by many authors to be advantageous (González & Area, 2013).

In gamification, it is discovered that dissimilarity in demographic may have different levels of motivational drive and engagement (Venkatesh et al., 2000). Age and gender are other important variables, which can differentiate the motivational level on learning through gamification, but researchers have overlooked on this area.

### **2.2 Gamification in Education**

Gamification has been implemented into various fields, for instance, healthcare, business, and education. However, gamification is not restricted to the application of only technology-oriented game tools for learning motive; video games signify a huge part of all gamification in learning process, for instance, educational games in the form of critical thinking video games. In the research study done by Van Eck (2006), video games in learning process have been distinguished into three approaches:

- (a) Application of commercial off-the-shelf video games (COTS) utilizes the game content in the video games and converts it into a learning process, for instance, SimCity, Roller Coaster, and Tycoon 3, which helps the user to build their leadership and decision-making skill (Lin & Lin, 2014; Shah & Foster, 2014).
- (b) Application of critical games is a kind of video game which is not developed for any kind of entertainment, and the main aim of these type of video games is to provide education to the users, for instance, the ETIOBE Mates and ECOPET were developed to enhance learners' nutritional knowledge and train the students regarding the application of home energy conservation (Baños et al., 2013; Yang et al., 2012).
- (c) As a societal viewpoint on education, it helps pupils to hone their individual games to develop and maximise their cognitive, programming skills and design the games according to their needs.

The role of educators in gamification is to pull the students up to game-based learning, so that they can develop their areas of interest through this process. During the years, the educators have made an effort to introduce games in learning process to make it interesting (Denny, 2013).

The students learn through game-based education by achieving badges, rewards, and ranking, which depicts their level of knowledge towards their subject. The ranking and badge achieved by the individuals creates competitiveness amongst the users, which help them to prosper in their field. Gamification in learning has some challenges as well, like competitiveness amongst the users can create rivalry amongst them, which can lead to negative result (Zichermann & Cunningham, 2011). Therefore, the aim of teacher's should be to create a positive impact of game-based learning on the students by clearly defining the objective, rewards, and feedback (Csikszentmihalyi, 1990).

Involvement of students in various activities can be grouped into three parts, such as cognitive, affective, and behavioural (Kahu, 2013). Cognitive connection depicts the students understanding of critical level. Affective participation describes the student's interest in performing their assignment given to them. Behavioural engagement of student depicts the students' effort and determination towards their goal.

Gamification should provide opportunities for the educators to design obstacles, depending on the student's difficulty level with a goal to acquire new skills through learning. The games should be placed systematically and scientifically that users can explore different feature of their personality by playing new and different characters (Banks, 2008). Through various studies on games-based learning, it is evident that experience gathered through gamification helps in educating and learning, which leads to student's interest and engagement towards the process. Even though gamification has some advantages, still it does not convince that learning objectives will be achieved (Dicheva et al., 2015).

### ***2.3 Competency and Gamification***

In this modern digital era, the university graduate students are challenged for job opportunities, and in order to achieve the opportunity, the key factor is competency-based learning, which is based on the alliance between industry demand and classroom education. Researchers have indicated that these days, the main aim of higher education comprises of developing the student's capability and making them prepared for corporate ready, so that they can utilize their learning knowledge in professional work environment (Noskov, 2007). In order to develop skill and knowledge within the students and make the students capable of converting these classrooms' theoretical knowledge into practical use, competency-based education has been introduced in the new pattern of the education system. Present research studies demonstrate that gamification in education can help to achieve top-level cognitive skills, for instance, critical thinking, creativity (Klopfer & Yoon, 2005). Prior studies have established that critical games played in mobile phones have developed the students' cognitive and cooperative skills. In the digital era, critical games have also helped to develop many other skills within the users, such as communicative skills, teamwork, and social skill (Romero et al., 2015). On this matter, it can be said that gamification depicts a huge prospect in the field of competency-based learning, where the attention is student centric and result-based system in place of syllabus-based classroom education. More clearly, it can say that gamification encourages structured instruction, depending on individual learner's requirement, and gives individual students instant and repeated assessment on hit or miss learning process (Hanus & Fox, 2015).

### ***2.4 Gamification in Management Education***

In management education, the initial game-based learning was quite monopoly. After some time, the game-based learning became famous and favoured by individuals to learn at home as a unified method. During the World War II around the mid-1950s, a game was designed, which was used as an important tool for business management and politics studies stream. Moreover, different management-based games concentrate on taking decision-making on the different areas of management, like general administration, marketing strategies, accounting management, and so on.

In the recent years, game-based learning is being used in different areas of management, such as marketing, entrepreneurship, tourism, accounting, and general administration. In case of accounting, word processors, spreadsheets, etc. were utilized for developing quiz-based learning (Moncada & Moncada, 2014). Many game-based tools, which were not made for educating management, were found to be effective in respect to learning financial accounting. PowerPoint and Excel, being a simple tool for teaching, made it easier to improve exercises and memorize the

concept of financial accounting. In relation to management, there were still limited studies done on the application of gamification in management education.

## **2.5 Gamification Constructs**

Gamification is a frame, consisting of various educational game-based tools based on the knowledge imparted by management educators, which helps to understand the impact of motivation and engagement, learning achievement, facilitating infrastructure, and attitude of students on gamification on learning.

### **2.5.1 Learning Achievement**

In many studies, it has been described that gamified education not only makes a student determined, dedicative, and participative in nature but also leads to learning achievement. A game challenge faced by the students in gamified learning results in positive learning achievement (Sánchez-Martín et al., 2017). Some studies have by far described that amalgamation of gamified learning in modern education system like flipped learning can be a productive approach for strengthening the learner's learning achievement (Jo et al., 2018; Huang et al., 2019). It has been observed by many researchers that evaluation of the students through gamification has resulted in the development in their responses and grades in comparison to the traditional evaluation system without gamification.

### **2.5.2 Motivation and Engagement**

The majority of the studies done till now on gamification shows the impact of games in learning the domain of knowledge, with a motive to acknowledge the student's motivational influence on learning achievement, attitude, and perceived learning (Silva et al., 2019). The main objective behind the application of gamification is to find out how game influences a student's motive and their attitude towards the use of gamification. Gamification is also done to evaluate the student's knowledge base after the implication of game-based learning and also to find out the impression of students' perceived learning after using this kind of teaching method (Hamari et al., 2014). Motivation is a process that instigates, guides, encourages, and builds, determination in people to achieve their goal. Motivation can be intrinsic as well as extrinsic in nature, where the individual behaves differently in different environment or circumstances. In educational context, motivation describes the student's labour and dedication towards their learning and is considered as a key factor in teaching and learning process. Therefore, it is the duty of educators to decide which type of teaching style will increase the student's engagement and motivation towards their subject, which will lead to achieving positive result.

### 2.5.3 Facilitating Infrastructure

As per Rogers (2003) study, another construct in gamification in learning is facilitating infrastructure. It refers to that point at which an individual presumes that the prevailing technical infrastructure of an organization can give assistance in the teaching-learning process (Chan et al., 2010). In case of gamification facilitating infrastructure plays an important role as game-based learning is totally dependent on technology. Therefore, the educational institute needs to keep in mind that there is technological infrastructure for gamification. The teachers recruited must be technology savvy and must be trained as per the requirement.

### 2.5.4 Attitude

In social science research, attitude remains one of the interest areas for research, as it helps to understand the social behaviour of an individual (Ajzen, 2001; Omrane & Bag, 2022). Attitude can define as individual's judgement and feelings about someone or towards something, which is portrayed through their behaviour. All individuals have different types of personalities; hence, an educator cannot expect homogenous attitude in their students. Attitude towards learning can be positive and negative. Positive attitude will motivate the student to secure good result. The student's will be more engaging and dedicated towards the teaching process, whereas negative attitude of a student towards education means they are not engaged or interested towards the teaching process, which can lead to school dropout (Saeed & Zyngier, 2012).

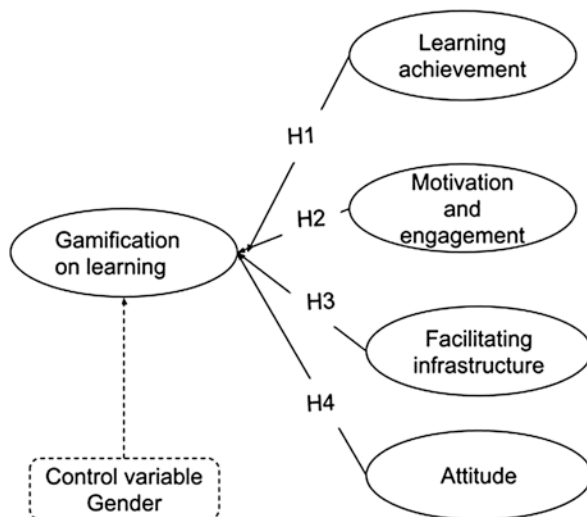
### 2.5.5 Gamification on Learning

Educators play a pivotal role in teaching-learning mechanism. They are the important element in student's development. It is the duty of teachers to guide the students on the right path, engage and motivate them, develop their skill and attitudes, and enhance their creative thinking (Sinha & Bag, 2023). To do that, they need to decide which teaching style will give maximum success. It is evident that schools with innovative perspective and well-defined learning goals are more qualified in assisting their students to be productive. Hence, analysing gamification on learning is important for student's development through effective learning process.

The following four hypotheses are formulated to find out the difference between male and female students of business management discipline regarding the learning intention through gamification.

H<sub>1</sub>: Learning achievement through gamification is significantly different between female and male students.

H<sub>2</sub>: Motivation and engagement through gamification are significantly different between female and male students.



**Fig. 13.1** Conceptual model

H<sub>3</sub>: Facilitating infrastructure for learning through gamification is significantly different between female and male students.

H<sub>4</sub>: Attitude for learning through gamification is significantly different between female and male students (Fig. 13.1).

## 3 Method

### 3.1 Data Collection

The research study is based on exploratory research approach. Samples of students studying in post-graduation level from business management department are taken into consideration. The sample size for this research study is 314 students. The survey was carried out by filling up questionnaire from the students through Google Form. The link of the questionnaire was shared with the students. Data gathering took place in August, 2021, and face-to-face communication was avoided as the virus spread was high during that month.

### 3.2 Data Analysis

The statistical tool used for the measurement and conceptual model of the study were analysed by partial least square structural equation modelling (PLS-SEM) (Bag et al., 2020; Ringle et al., 2015). Furthermore, multi-group analysis (MGA) is



also executed to compare the effect of gamification on male and female students. The appropriate nonparametric SEM for multi-group analysis is PLS-SEM. Preceding to multi-group analysis, the greatest prerequisite is to construct measurement invariance, in order to apply measurement invariance for composite (MICOM) technique (Rasoolimanesh et al., 2017).

## 4 Result

### 4.1 Measurement Models

To evaluate the measurement and conceptual model for both male and female business management students, PLS-SEM is used. The theoretical outline for this research paper consists of four constructs, such as motivation and engagement, learning achievement, attitude, and facilitating infrastructures, which affect intention towards learning through gamification. To establish measurement model, discriminant validity, reliability of indicators, and convergent validity of constructs concerning male and female students (Ali et al., 2018; Hair et al., 2017) have been checked. For indicator reliability, each construct (refer to Fig. 13.2) filled up with items should be more than 0.6 (Islam & Bag, 2020). Using composite reliability (CR) and Rho A, the construct reliability and the convergent validity must be greater than 0.7 (Bag & Omrane, 2022). The average variance extracted (AVE) on the other hand should be above the threshold value of 0.5 (Hair et al., 2017; Omrane & Bag, 2022; Ray et al., 2020). Table 13.1 exhibits that the composite reliability, reliability, and convergent validity of the measurement model, consisting of all the constructs of the study, have been acceptable for both male and female business management students.

Heterotrait-monotrait (HTMT) ratio has been carried out to test the discriminant validity. In order to develop discriminant validity, HTMT ratio of each dimension should be less than 0.9 (Bag et al., 2021; Henseler et al., 2015). Table 13.2 exhibits the outcome of HTMT ratio, depicting acceptance of the discriminant validity for both male and female students of business management discipline.

The important benchmark to carry out multi-group analysis is to measure invariance for both groups of students. The measurement invariance for composite (MICOM) approach is ideal for PLS-SEM. In order to conduct MICOM, three stages should be performed: (a) measurement of configural invariance, (b) measurement of compositional invariance employing the constructs correlation, and (c) measurement of equal means and variance. Besides, partial measurement invariance is to be computed in order to execute MGA, which is established by compositional and configural invariance. Table 13.3 exhibits the outcome of MICOM, which shows the full measurement invariance. Thus, depending on the outcome, MGA can be executed to compare the path coefficients for both the groups and to validate the proposed hypotheses.

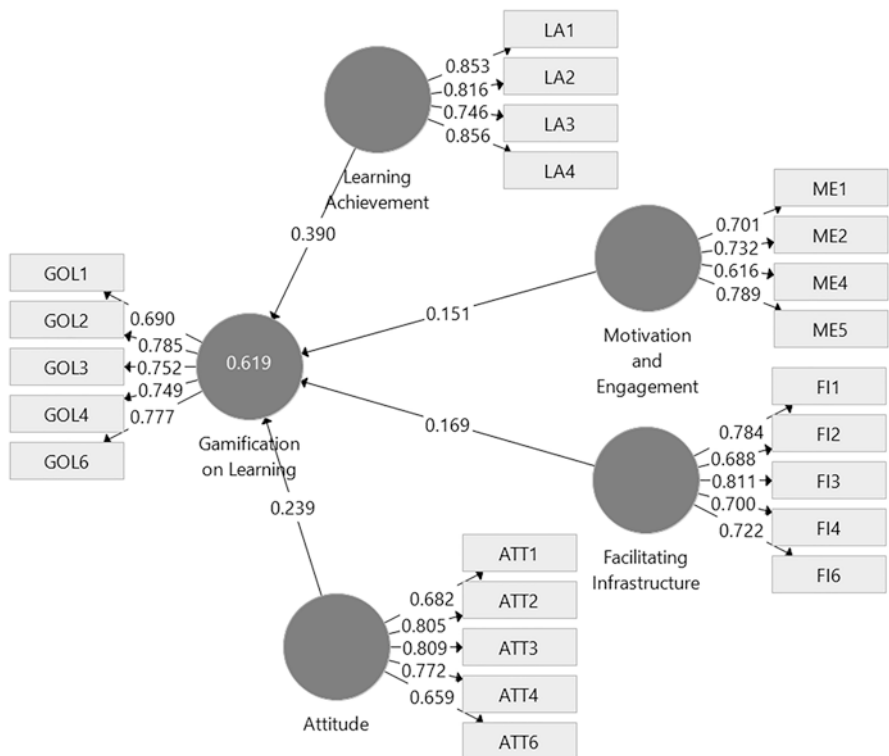


Fig. 13.2 Model of path analysis

Table 13.1 Reliability and validity of measurement model

Constructs	Cronbach's alpha		Composite reliability		AVE	
	Female	Male	Female	Male	Female	Male
ATT	0.839	0.773	0.820	0.775	0.548	0.517
LA	0.824	0.774	0.816	0.769	0.540	0.515
GOL	0.850	0.816	0.854	0.814	0.598	0.537
FI	0.864	0.755	0.865	0.753	0.563	0.518
M & E	0.788	0.770	0.790	0.760	0.565	0.537

Note: ATT attitude, FI facilitating infrastructure, LA learning achievement, GOL gamification on learning, M & E motivation and engagement

### 4.2 Assessment of Multi-group Analysis

Table 13.4 exhibits the positive and remarkable effects of motivation and engagement, learning achievement, attitude, and facilitating infrastructure on learning through gamification intention for female and male students of business management students. Table 13.4 also exhibits the outcome of multi-group analysis and

**Table 13.2** Discriminant validity

Female						Male				
	ATT	LA	GOL	FI	M & E	ATT	LA	GOL	FI	M & E
ATT										
LA	0.837					0.807				
GOL	0.825	0.507				0.796	0.606			
FI	0.870	0.647	0.813			0.824	0.726	0.791		
M & E	0.760	0.819	0.412	0.742		0.642	0.828	0.556	0.668	

testing of proposed hypothesis. To formulate the impact of management students' engagement dimension on learning intention between male and female business management students, two conservative and nonparametric approaches, such as Henseler's MGA, implementing bootstrapping, as well as permutation approach (Chin & Dibbern, 2010), have been taken into consideration. Applying these methods, the outcome of MGA exhibits that there are no differences between female and male students from business management discipline towards learning intention through gamification.

## 5 Discussion and Conclusion

The main objective of this study is to conduct a comparative analysis of perceived learning achievement, motivation and engagement, facilitating infrastructure, and attitude towards learning through gamification between male and female students in the business management discipline. Although the use of gamification is less common in the management discipline, previous study has shown that it helps to increase learning in a variety of areas in education. The current research study conducts an empirical investigation into how management education might be made more fun for both male and female students. The findings show that gamification on learning is significantly impacted by learning achievement, motivation and engagement, facilitating infrastructure, and attitude. Gamification in education is thought to be a successful strategy for boosting student engagement and motivation while also advancing their social and cognitive abilities. In respect to management discipline, gamification in learning will help the students get an experience on the work culture, which in turn will help them to become ready for future employment. In order to strengthen employment, the educational institutions must make notable changes in the teaching style and also must motivate and educate the teachers and students towards the game-based learning.

Computer games are good source for learning, as it creates virtual situations that help to create a psychological reality for the learner. In order to implement gamification in management education, the educational institution needs to build up the infrastructure technology friendly, must decide the type of games they need to implement in their syllabus, and also needs to train the teachers, so that they

**Table 13.3** Results of invariance measurement testing using permutation

Constructs	Configural invariance	Compositional invariance (correlation = 1)		Partial measurement invariance established	Equal mean assessment		Equal variance assessment		Full measurement invariance established	
		C = 1	Confidence interval (CIs)		Differences (Female-male)	Confidence interval (CIs)	Differences (Female-male)	Confidence interval (CIs)		
AT	Yes	0.998	[0.998, 1.000]	Yes	-0.233	[-0.243, 0.227]	Yes	0.273	[-0.373, 0.429]	Yes
FC	Yes	0.998	[0.997, 1.000]	Yes	-0.023	[-0.218, 0.231]	Yes	0.151	[-0.457, 0.201]	Yes
FL	Yes	0.998	[0.999, 1.000]	Yes	-0.120	[-0.266, 0.259]	Yes	0.313	[-0.228, 0.485]	Yes
LI	Yes	0.999	[0.999, 1.000]	Yes	-0.169	[-0.234, 0.233]	Yes	0.460	[-0.459, 0.481]	Yes
MT	Yes	0.999	[0.992, 1.000]	Yes	-0.137	[-0.229, 0.246]	Yes	0.115	[-0.310, 0.312]	Yes

**Table 13.4** Results of hypothesis testing

Hypothesis	Relationship	Path Coefficient		Path Coefficient Difference	Henseler's MGA	Permutation <i>p</i> -values	Remarks
		Female	Male				
H1	<b>LA → GOL</b>	0.135	0.286	-0.151	0.212	<b>0.215</b>	<b>No/No</b>
H2	<b>M &amp; E → GOL</b>	0.214	0.162	0.052	0.625	<b>0.619</b>	<b>No/No</b>
H3	<b>FI → GOL</b>	0.473	0.335	0.138	0.207	<b>0.186</b>	<b>No/No</b>
H4	<b>AT → GOL</b>	0.208	0.121	0.087	0.362	<b>0.322</b>	<b>No/No</b>

can guide and support them whenever the students need help in game-based learning process.

In respect to the dissimilarity between male and female students of business management discipline studying in post-graduation level, it is established that there is no significant distinction between learning achievement, motivation and engagement, facilitating infrastructure, and attitude towards gamification on learning intention.

In this digital arena, it is the perfect time for the educational institutions imparting higher education in management to focus on gamification in teaching-learning method to make the learning process more interesting, motivating, and participative in nature. The use of gamification in education will not only help students and teachers become more technologically savvy, but it will also enable students experience the corporate world virtually. The students' talent, creativity, and behaviour will be shaped by the educational institutions' positive structures, preparing them to prove their worth. The proficiency must be acquired from the institutions in order to inspire pupils and drive them forward.

## 6 Limitation and Recommendation for Future Research

Alike to other comprehensive study, our trivial effort is not without any kind of limitations. The research study encounters with time limitation, and it would have been satisfactory if we could have allocated more time to reach the optimum result. However, on the other side, the result would be more reliable and competent if we would have managed to communicate with large number of respondents, since small sample might not demonstrate worthy in displaying the outcome. Primary data is collected through exploratory research. The elucidation of the data and observation from our findings are a trivial image of the data we managed to collect from the respondents through a structured questionnaire. The study corroborates with the study conducted by Silva et al. (2019) on gamification in management education. However, this research paper demonstrates that, along with learning achievement, motivation and engagement, facilitating infrastructure, and attitude

also play an important role in perceived learning with the help of gamification in management education discipline. The study is confined to four constructs, such as learning achievement, motivation and engagement, facilitating infrastructure, and attitude, which would have been appropriate if we would have managed to throw light on other constructs too. A definite apathy is observed amongst the respondent to respond rationally, logically, and critically. The voluntary participation would certainly help us to obtain a maximum profit. Hence, this study would definitely unlock avenues for the researchers to throw light on different issues. Due to the limitation of time, we have been able to determine five constructs for this study.

With regard to future research, we recommend that other empirical qualitative and quantitative studies be considered on the implementation of gamified learning activities in teaching management curriculum as well as the influence of employing gamified learning constituents on students' learning achievement, motivation and engagement, facilitating infrastructure, and attitude. Besides, the present-day games consisting of individual procedures and principles, in comparison to previously tested games, must be evolved and evaluated as per its repercussion. Another logical argument is to investigate the learners in an exclusive incident, along with various research methods, that assimilates control class and group of new participants who are adopting the game for comparison.

In the future, researchers would certainly evaluate more constructs to attain a far more satisfying outcome. The determination and effort would exceptionally give support to the educational institutions imparting management education to develop a model to make the learning process through gamification more engaging, motivating, and interesting for the students.

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# Chapter 14

## Students' Perception of ICT Use in Higher Secondary School Students: An Exploratory Factor Analysis Approach



Gouranga Patra, Sumona Datta, and Rikta Mukherjee

**Abstract** Information and communication technology (ICT) made a lot of changes in the process of education. It helped students in their holistic development of learning. The application of ICT-based education in India is not significantly higher but we observed a lot of initiatives taken by private and public organizations to make it an alternative mode of teaching and learning. But it is quite difficult for school-level applications because of infrastructure, use of technology devices, and Internet connectivity. Therefore, the present study attempted to examine the student's perception of ICT used and how ICT helps students in their teaching and learning development. A total of 401 participants were administered a set of items that included statements about their attitude toward ICT use. The data were analyzed using descriptive statistics, inferential statistics, and principal component analysis. We found that there are four important determinants of the ICT-enable teaching and learning process, the *effectiveness of learning*, *innovation in learning*, *engagement in learning*, and *learning efficacy*. The other notable outcome is that the perception of ICT-based learning between gender is the same but there is an attitudinal difference concerning their geographical location and academic background. Therefore, the study gave us an indication that if schools develop proper infrastructure which is needed for ICT-based teaching, and design the course curriculum in line with technology-based teaching, then it should be the effective method of teaching and learning in school education for the holistic development of students.

**Keywords** Perception · ICT · Exploratory factor analysis · Higher secondary school · Digitalization

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## 1 Introduction

Information and communication technology is an important tool in our daily life. It is the basic thought of the digitalization era. Information and communication technology (ICT) was widely used in various industries, but during the pandemic it acted as a basic parameter of the education system (Tezci, 2012; Kubiak & Halakova, 2009). It played a more important role in changing the educational curriculum starting from the pedagogical process to deliberation of thought. The traditional methods of teaching-learning have become challenging after the introduction of ICT in education.

However, research suggests that the use of ICT is not very effective for the students in their learning outcomes (Woreta et al., 2013; Sarfo & Ansong-Gyimah, 2011; Tezci, 2012; Drent & Meelissen, 2008). Venkatesh and Abrami (2006) conducted a study to access the perception of students based on ICT-based teaching using expectancy-value theory. The theory is based on persons' perceived value and expectancy of success which determine their intention to perform a job. The study proposed that students are likely to use ICT-based teaching if they develop perceived value, which is related to the high success of innovation and value perceived to offer more than perceived cost. It claimed that perceived value leads to decision-making which may enhance their adaptation (Wigfield & Cambria, 2010; Pintrich & Schunk, 2002). Nevertheless, educational institutions are trying to adopt the online platform in their teaching-learning process. The basic reasons for acceptability are ease of use, learning flexibility, and a controlled environment from a remote location system. To enhance the engagement level of students, there is a need for the instructor's presence and learner interaction and to make them confident about the ease of use of technology and its benefits (Gray & DiLoreto, 2016). In India, education through ICT is in a nascent stage, due to the problem of infrastructure a major chunk of government institutes is unable to adopt it, but in due course the government is trying to implement ICT in their education system. Teachers play an important role in the implementation of ICT because they integrate pedagogy with technologies to enhance student learning. Therefore, all the intricacy related to the operational process must be understood by the trainer to make a learning environment for students by proving a space for information exchange and generating deeper thinking (Zhu, 2018).

Research indicated that the effectiveness of ICT implementation depends on the computer usage of the students. Teo (2008) claimed that students' positive attitudes toward computer technology have a direct positive influence on their innovative use of ICT. Woodrow (1991) points out that "awareness of student attitudes towards computers is a critical criterion in the evaluation of computer courses and the development of computer-based curricula." Therefore, it is obvious that schools must have the proper infrastructure of computer labs and trainers which could increase students' attention and develop a positive perception of ICT use (McLachlan et al., 2010). Students' perception of the use of ICT depends on three major criteria: how it adds value to their learning system, the expectancy of success, and the cost

associated with that. A positive relation among these indicates a higher tendency for ICT use. Charles and Issifu (2015) explained that the use of ICT perception differs among the students from private and public schools. Most private school students acknowledge the value of ICT in learning, but many do not integrate it into their studies. Different scenarios are noted for public schools because there is a lack of proper infrastructure, trainers, and awareness levels. The study also noted that the use of ICT may help administrators, students, and employers. It develops a good educational delivery process for students for enhancing their learning procedure, knowledge, and skills in the real world of work mainly in the school education system.

Fu (2013) explained various benefits associated with the ICT-enabled learning process. It helps learners to learn anytime and anywhere. They can access their study material 24 h from any location. It helps the learner to interact with the instructors and peers through virtual classes with ease and convenience. It allows learners to solve their academic-related issues without any boundaries. It is also a cost-effective method, like learning and teaching no longer depend exclusively on printed materials. Students can explore them to gain knowledge through various sources and there is ample scope to enhance their value. They can learn through MOOC courses, video clips, audio sounds, and visual presentations.

Research suggests that an ICT-based teaching module is a path to making the teaching-learning process more learner-centric and the course and curriculum have been designed for different levels of learner adaptation (Castro Sánchez & Alemán, 2011). In ICT mode, learner involvement is higher in the learning process of the virtual classroom. In each step learner responses can be counted, they could be assigned by the instructor to solve their problem, design their plans, and so forth (Lu et al., 2010). ICT, therefore, is a platform for both teachers and students to make learning mechanisms more convenient, effective, and objective oriented.

ICT is a process that gradually transforms the education system from classroom-based to automation which is more on digital space. It is not only limited to developing a customized learning management system designed for content development, but also study material preparation, assessment, evaluation, and discussion among students on academic matters. Additionally, it helps educational administrative activities like admission, registration, grievance handling, payment system, and single-window solution to student problems. There are a lot of studies indicating that ICT has a significant impact on the academic performance of students (Lowther et al., 2008; Weert & Tatnall, 2005). As Weert and Tatnall (2005) claimed, effective use of ICT enhances the quality of education and the learning process. It helps the learner to change their expectation of learning through the various sources of knowledge that depart from traditional approaches. As time goes by, the expectation of seeking a new dimension of knowledge level will enhance the willingness of students. Skills in using ICT will be an indispensable prerequisite for these learners. Researchers have explained the benefits of ICT-enabled teaching-learning.

Brush et al. (2008) have stated that ICT helps students to search various topics, solve the problem which they are unable to solve, and make an effective solution to the problem in their learning process. ICT makes knowledge acquisition more accessible, and concepts in learning areas are understood while engaging students

in the application of ICT. Therefore, it assists students to access digital information effectively and efficiently. Castro Sánchez and Alemán (2011) describe that ICT helps to search for new knowledge through accessing, selecting, organizing, and interpreting information and data. Based on learning through ICT, students are more capable of using information and data from various sources, and critically assessing the quality of the learning materials. It enhances support for student-centered and self-directed learning.

ICT helps to produce a creative learning environment. Chai et al. (2010) mentioned that ICT provides various learning methods for looking into the problem. For example, in a reading class, students can read e-books but using ICT tools they can transform them into various formats which make them easy to access. Therefore, it designs various applications that provide an innovative way to meet learning and learner needs.

ICT develops a collaborative learning environment and connects others in a remote location. Koc (2005) mentioned that the use of ICT makes learning transparent like students can discuss, share, and work together from any location if they have Internet access. This makes it a timeless system. For example, virtual or teleconference classes invite students from various locations for debate and discussion, for solving problems, exploring new ideas, as well as the development and design new thoughts and processes. There may be different methods of the learning solution. Students not only get exposure to rich knowledge but also get opportunities to share their learning outcomes to express themselves and reflect on their learning. Therefore, undoubtedly, ICT is a very useful tool in the teaching-learning system. It helps students with their holistic development of learning which makes them update their learning for a better career option. There are numerous studies indicating that in higher education systems implementation of ICT-based learning is progressing very fast because students understand and adapt to technology. It is therefore quite obvious that irrespective of their use of technology in general, they accept ICT-based learning.

Indeed, government schools are not able to support ICT-based teaching because of infrastructural issue which is not in proper shape but significant initiatives have been observed by the government to improve the infrastructure. But there is a significant development in private schools that have set up their computer lab, digital library, Wi-Fi system, smart classroom, and online value-added courses. Therefore, in the present study, we will examine the students' perception of the ICT-enabled teaching-learning system and how this system helps them for creating a better learning environment and develop their career progress.

## 2 Review of Literature

In the introduction, we have discussed the pros and cons of the use of ICT in the education system. But it is a fact that in higher education, the implementation level of ICT is high because of their understanding and willingness to adopt it. In this section, we will critically review researchers' contributions in this area.

Shrestha et al. (2019), Salloum et al. (2019), and Pérez-Pérez (2020) explained the mode of online teaching for developing students' confidence levels. It is applicable not only for higher studies but also for higher secondary and secondary students. It is noted that a lot of educational institutions offer online coaching for the preparation of students for examination. They also identified that satisfaction level depends on certain factors like age, gender, prior knowledge of computer literacy, and learning style. It is stated by Rogers et al. (2019) and Dearing and Cox (2018) that day-by-day technology literacy has increased for students because of a high level of use of smartphones and digital devices. They explained that diffusion of innovation is an appropriate model for technological adaptation in the education system. There is a need for proper spread out of information so that the interest level of the students will automatically increase. As Mlekus et al. (2020) stated, the technology adaptation model depends on two important factors, perceived usefulness and perceived ease of use. These two depend on course structure, learner instructional ability, level of students' engagement, the perceived learning capacity of the students in an online learning environment, and finally instructor presence with students' satisfaction. Gray and DiLoreto (2016) also claimed that students' engagement depends on learner interaction on perceived students' learning and instructor presence. It is a fact that online education is a new concept and this is evolving with rapid technology. Therefore, the design of course structure, pedagogy with technologies, and the instructors should be provided a space for information exchange and to generate deeper thinking, so that the interest level of the students will enhance (Zhu, 2018). Martin and Bolliger (2018) explained that student engagement leads to increased student satisfaction, enhances their level of motivation, reduces the sense of isolation within the study period, improves their academic performance, and finally creates a comfortable online learning environment. Therefore, it is the role of the instructors, designers, and administrators to design the course in a lucrative manner so that it enhances learner engagement. Abbasi et al. (2020) highlighted the popularity and acceptance level of e-learning in India and stated that due to rapid digitalization and effective use of communication technology, it gains greater attention among the students to have experience with e-learning using ICT. They have become more inclined toward online learning tools to interact with each other and the instructor. Khan et al. (2021) explained the preferences of students for e-learning as it provides them much freedom to connect with their teachers and fellow students and engage with their study materials in the comfort and flexibility of space and time. The easy access to study resources is found to be one of the major reasons for students to opt for e-learning. The study indicates that e-learning technology enables easy information access leading to positive attitude formation of students toward it.

There is a lot of research conducted on the issue to understand the use of ICT and its' link to academic performance (Hatlevik et al., 2015). Irrespective of a space like a school or home, ICT has an impact on learning (Wang, 2019; Fernández-Gutiérrez et al., 2020). Skryabin et al. (2015) suggested that ICT use in the classroom makes a significant impact on students' learning performance. Petko et al. (2016) investigate the relationship between ICT use and learning. They found a positive relationship between skill enhancement in mathematics, science, and reading skills while

used at home. Selwyn (1999) and Woodrow (1991) explained that the success of educational technology in school programs depends on the attitude of students and teachers. Teo (2008) discussed that perception toward ICT-based teaching-learning enhances if the readiness to accept computer technology increases in school. Hence, there is a need for proper infrastructure and awareness to enhance the readiness level. Dorup (2004) found that students have a positive attitude toward technology and that leads to a preference for ICT use in teaching. Kennewell (2001) gave a similar statement in that the positive attitude of the students can be increased with factors like classroom organization, classmate willingness, teachers, and the environment of schools.

There are some drawbacks of the ICT-based teaching process which have been heavily noted during pandemics when schools were closed for a long period. It is observed that the dropout level is high, as the students were unable to adapt to the courses because the courses are unsupervised and self-spaced and learning is isolated (Rice, 2006; Kopnina, 2020; Borup & Stevens, 2016). In this situation, it is important to enhance the motivation level of the students which may help them to develop self-efficacy that will increase their persistence and reduce the abandonment of learning (Jung & Lee, 2018).

Students' self-efficacy increases their degree of confidence to achieve a certain goal (Breslow et al., 2013; Jordan, 2014). It is also noted that students with higher self-efficacy are more likely to participate, persist, work harder, and have fewer adverse emotional reactions (Trautner & Schwinger, 2020). Students with high self-efficacy are more persistent to adopt ICT/online learning of education which leads to learning efficacy (Danesh & Shahnazari, 2020).

In school education, the major role of a teacher is to enhance the students' engagement level. In classroom teaching, it is quite high because the teacher has a physical interaction with the students (Hall et al., 2011). Researchers have defined the students' engagement level into three criteria: cognitive, behavioral, and emotional (McLennan & Keating, 2005, Hall et al., 2011). These are associated with willingness of learning, level of participation in the class, and interest in various activities (Fredricks et al., 2004; Kong et al., 2003). Some researches prove that technology helps to increase students' engagement level as well as control their learning (AAS, 2006; Abel, 2005).

Studies relating to ICT-based teaching and students' engagement, however, generate a mixed response. Some studies explained its impact on solving the critical problem as well as retention, critical listening, evaluating, and explaining (Paechter, Maier & Macher, 2010; Bransford et al., 2004); others, however, put forward contradictory findings. For instance, limited access to ICT and less confidence in technology usage may lead to less engagement. Cadwalladr (2012) proposed a blended learning environment that helps develop a "learner" feeling to the students rather than being only "listeners." Coats (2005) suggested that a learning management system is an effective tool for a better learning environment and retention level. Hattie (2003) explained that teacher–student interaction is the greater predictor of learning engagement. It is explained by the researcher that the design of pedagogy, infrastructure, Internet access, and study material supply through a learning

management system make a potential contribution to the enhancement of students' engagement (NCTM, 2012; Shuva, 2010).

There are a few studies that have been conducted by Gray and DiLoreto (2016), Zhu (2018), and Bolliger (2018) to judge the effectiveness of ICT in enhancing students' engagement. The researcher suggests that learner-to-instructor engagement strategies seemed to be most valued among the three categories of student engagement. Icebreaker/introduction discussions and working collaboratively by using online communication tools were rated as the most beneficial engagement strategy in the learner-to-learner category, whereas sending regular announcements or email reminders and providing grading rubrics for all assignments were rated most beneficial in the learner-to-instructor category. Thus, we can conclude that student engagement increases student satisfaction, enhances student motivation to learn, reduces the sense of isolation, and improves student performance in the online learning environment.

It is also noted from the abovementioned review that most of the studies have been done with higher education institutions. At the school level, the studies are limited. Despite that, it is reflected in the review that ICT helps in enhancing students' engagement, increases learning efficacy, and enhances the effectiveness of learning. Nevertheless, the review also revealed a few difficulties in the use of ICT in teaching and learning. In this context, we are trying to investigate the above components in the school education system because we found a significant transformation of the education system from offline to online during the pandemic.

### 3 Objectives of the Study

- To explore the components of the students' perception of ICT use.
- To examine if there is a mean difference in the perception of ICT use among the male and female students.
- To examine if there is a mean difference in the perception of ICT use among the students from urban and rural districts of West Bengal.
- To examine if there is a mean difference in the perception of ICT use among the students from science, arts, and commerce backgrounds.

### 4 Method

**Participants** Participants were 401 young adults (Male = 198, Female = 211; Mean age = 21.75 years, SD = 2.85) studying in different universities in three different districts of West Bengal. Students belonged to different academic backgrounds, that is, science, arts, and commerce. Inclusion criteria included the use of ICT in the academic curriculum of the students.



**Tool** Participants were asked a set of 13 statements, about the effectiveness of ICT use among the students. The statements included three response categories, “Never,” “Rarely,” and “Always.”

**Procedure** Permissions were obtained from the colleges and universities across the three districts for data collection. After permissions were obtained, rapport was established with the students. The set of statements was administered in small groups of students. After data collection, the data were cleaned and analyzed using different statistical analysis techniques.

**Statistical Analysis** Principal component analysis was done to explore the component structure of the students’ perception of ICT use. Cronbach’s alpha was done to examine the internal consistency of their response. Further, the mean differences in their perception were checked concerning their gender, location, and academic background using a t-test and one-way analysis of variance.

## 5 Results

### 5.1 Descriptive Statistics

Table 14.1 shows the mean and standard deviation of the 13 items. The mean values of all 13 statements ranged between 2.03 to 2.28, while the standard deviation value ranged between 0.55 to 0.68.

**Table 14.1** Descriptive statistics of the 13 statements ( $n = 401$ )

Items	Mean	Std. Deviation
Q1	2.07	0.550
Q2	2.04	0.590
Q3	2.13	0.685
Q4	2.18	0.639
Q5	2.23	0.655
Q6	2.03	0.597
Q7	2.21	0.597
Q8	2.28	0.653
Q9	2.24	0.613
Q10	2.19	0.626
Q11	2.21	0.598
Q12	2.20	0.609
Q13	2.21	0.600

## 5.2 Exploring the Component Structure of Students' Perception of ICT

The multivariate component structure of the students' perception of ICT was explored using the principal component analysis (PCA). The correlation among the statements was found to be adequate, and hence PCA was fitted.

PCA with Varimax rotation (orthogonal rotation) extracted four components, explaining a total variance of 51.06%. Based on the items that loaded on each of the components, the components were named. The first component correlates with four items and is named *Effectiveness in Learning*. The second component also correlates with four items and is named *Innovation in Learning*. The third component correlates with two items and is named *Engagement Through ICT*. Finally, the fourth component correlates with three items and is named *Learning Efficacy*. Hence, the perception of students toward the ICT method can be understood in terms of four components, that is, its *Effectiveness in Learning* (effectiveness of ICT in facilitating the learning process), *Innovation in Learning* (innovation brought in teaching pedagogy through ICT), *Engagement Through ICT* (student engagement generated through ICT), and *Learning Efficacy* (belief that one can learn better through the use of ICT) (Table 14.2).

**Table 14.2** Principal component analysis exploring the component structure of students' perception of ICT ( $n = 401$ )

Statements	Components			
	1	2	3	4
Q-9 ICT in the teaching-learning method could better construct knowledge for the students	0.730			
Q-11 ICT helps to improve the quality of teaching	0.603			
Q-7 Makes the teaching meaningful and this makes learning more effective	0.558			
Q-3 Enhances knowledge sharing capacity	0.439			
Q8 Updated pedagogy tools to solve complex problem		0.743		
Q10 Dynamic and innovative learning environment		0.716		
Q12 Helps in teaching-learning process especially to relate with real-life practices		0.660		
Q6 Teachers can evaluate the students' progress quickly and properly by the use of ICT tools		0.470		
Q5 Helps the students to be more engaged in the lesson			0.823	
Q4 Makes learning more comfortable with easy resource available			0.736	
Q2 Helps express my depth of knowledge after teaching by using ICT				0.780
Q1 Makes understanding of lesson more interesting				0.730
Q13 ICT makes the teaching resources and materials more creative				0.436

### 5.3 Reliability of the Domains of Students' Perception of ICT Use

Finally, after the components were extracted, Cronbach's alpha for each of the four domains were checked to examine the level of consistency in the components extracted. It was found that all the components are moderately consistent and therefore reliable (Table 14.3).

### 5.4 Mean Differences in Students' Perception of ICT

Following the PCA extraction, the item raw scores were converted to factor scores for standardizing the values. Finally, mean differences with respect to gender, district, and stream of the study were compared for the four components of students' perception of ICT.

Gender differences were examined using an independent sample t-test and the difference was found to be non-significant, that is, both male and female students perceive the use of ICT to be equally effective ( $p = 0.57$ ), innovative ( $p = 0.37$ ), and to be promoting engagement ( $p = 0.61$ ) and learning efficacy among students ( $p = 0.76$ ) (Table 14.4).

On comparing the perspective of students from different districts, it was found that the students significantly differed among themselves with respect to their perception of ICT use in promoting student engagement [ $F(2, 406) = 11.94, p < 0.0001$ ]

**Table 14.3** Cronbach's alpha of the domains of students' perception of ICT use, extracted through PCA ( $n = 401$ )

Name of the component	Items included	Cronbach's Alpha
Effectiveness in learning	9, 11, 7,3	0.51
Innovation in learning	8, 10, 12, 6	0.62
Engagement through ICT	5,4	0.55
Learning efficacy	2, 1, 13	0.51

**Table 14.4** Descriptive statistics and Independent sample t-test showing gender differences in the domains of students' perception of ICT use ( $n = 401$ )

Domains		Mean	SD	t test	df	p value
Effectiveness in learning	Male ( $n = 198$ )	5.14	0.99	0.571	407	0.568
	Female ( $n = 211$ )	5.09	0.93			
Innovation in learning	Male ( $n = 198$ )	5.72	1.09	0.902	407	0.368
	Female ( $n = 211$ )	5.61	1.21			
Engagement through ICT	Male ( $n = 198$ )	3.45	0.90	0.517	407	0.606
	Female ( $n = 211$ )	3.41	0.81			
Learning efficacy	Male ( $n = 198$ )	4.07	0.92	0.310	407	0.757
	Female ( $n = 211$ )	4.04	0.76			

**Table 14.5** Descriptive statistics and one-way analysis of variance (ANOVA) showing mean differences in the domains of students' perception of ICT use concerning the different districts of West Bengal ( $n = 401$ )

Domains		Mean	SD	F Value	df	p value
Effectiveness in learning	Howrah ( $n = 137$ )	5.01	0.90	2.23	2, 406	0.11
	Hooghly ( $n = 57$ )	5.01	0.99			
	Birbhum ( $n = 217$ )	5.21	0.99			
Innovation in learning	Howrah ( $n = 137$ )	5.58	1.09	1.06	2, 406	0.35
	Hooghly ( $n = 57$ )	5.56	1.13			
	Birbhum ( $n = 217$ )	5.74	1.19			
Engagement through ICT	Howrah ( $n = 137$ )	3.29	0.85	11.94**	2, 406	0.0001
	Hooghly ( $n = 57$ )	3.08	0.86			
	Birbhum ( $n = 217$ )	3.61	0.82			
Learning efficacy	Howrah ( $n = 137$ )	3.89	0.75	9.28**	2, 406	0.0001
	Hooghly ( $n = 57$ )	3.82	0.78			
	Birbhum ( $n = 217$ )	4.22	0.88			

\*\* $p < 0.01$ ; \* $p < 0.05$

**Table 14.6** Descriptive statistics and one-way analysis of variance (ANOVA) showing differences in the domains of students' perception of ICT use with respect to their academic background ( $n = 401$ )

Domains		Mean	SD	F Value	df	p value
Effectiveness in learning	Science ( $n = 286$ )	5.14	0.97	0.75	2, 406	0.47
	Commerce ( $n = 53$ )	5.13	0.78			
	Arts ( $n = 70$ )	4.99	1.04			
Innovation in learning	Science	5.58	1.16	5.70**	2, 406	0.004
	Commerce	6.15	0.87			
	Arts	5.64	1.23			
Engagement through ICT	Science	3.47	0.83	3.90*	2, 406	0.02
	Commerce	3.55	0.78			
	Arts	3.18	0.97			
Learning efficacy	Science	4.11	0.84	2.63	2, 406	0.07
	Commerce	3.94	0.71			
	Arts	3.89	0.91			

\*\* $p < 0.01$ ; \* $p < 0.05$

and learning efficacy [ $F(2, 406) = 9.28, p < 0.0001$ ]. Students from the Birbhum district perceived the use of ICT to be more engaging and to be promoting efficacy in learning, in comparison to their counterparts from other districts (Table 14.5).

Finally, the students also differed significantly in their perception of ICT use with respect to the role of ICT use for bringing innovation in the learning process [ $F(2, 406) = 5.70, p < 0.001$ ] and generating engagement among students [ $F(2, 406) = 3.90, p < 0.02$ ] (Table 14.6).

## 6 Discussion

The present study had two objectives: first, to explore the components of students' perception of ICT use, and second to examine if any difference exists in their perception, concerning their gender, location, and academic backgrounds.

Exploration of the students' perception extracted four components, namely, *Effectiveness in Learning*, *Innovation in Learning*, *Engagement Through ICT*, and *Learning Efficacy*. It implies that the perception of students is understood in terms of the importance placed on the effectiveness of ICT in facilitating the learning process, innovation brought in teaching pedagogy through ICT, student engagement through ICT, and the belief that one can learn better through the use of ICT. This finding is a novel addition to the existing literature in this area of research since all previous literature focused on perceived usefulness and ease of use (Mlekus et al., 2020). However, the present finding is in line with the research findings of the Mlekus study. The components extracted are similar to the ones reported to be contributing to the student's perception of the use of ICT. For instance, the researchers discussed the role of ICT in generating student engagement as one of the key factors in shaping the students' perception. Similar findings had been reported by Gray and DiLoreto (2016) and Zhu (2018) as well. Their research also focused on the importance of teaching pedagogy in ICT use and the innovation involved in the same. The effectiveness of ICT use as one of the contributing factors was also reported previously by studies like that of Abbasi et al. (2020), who reported the importance placed on digitalization and effective use of communication technology for generating popularity and the acceptance level of e-learning. Further, studies on ICT usage in classrooms also emphasized the engagement level among students. For instance, findings from Paechter et al. (2010) and Bransford et al. (2004) reported a strong association between the use of ICT and student engagement.

It is, however, important to note that the fourth component extracted, that is, *Learning Efficacy*, has not been explored previously. Students' perception of ICT use is hugely affected by their belief about their capability to learn through ICT. This finding provides empirical evidence for studies like that of Danesh and Shahnazari (2020), which state that students with high self-efficacy are more persistent in the adoption of ICT or e-learning. Therefore, the present finding has a significant contribution to exploring and understanding the students' perception of ICT use.

In a further attempt to understand the prevalence of students' perception of ICT among different groups of students, it was found that both male and female students equally perceive the use of ICT. Rahim and Rahman (2002) and Mizrachi and Shoham (2004) found that no significant difference exists in the perception of ICT use among male and female students. However, a few other studies like Kubiato and Halakova (2009) and Khan et al. (2021) examined the perception of ICT adaptation and found a significant difference in attitude among males and females.

Therefore, we may conclude that there is no uniformity in the inference drawn and that it may vary due to differential access to ICT tools, subject, and geographic location.

Further, the students differed among themselves concerning their perception of ICT use in promoting student engagement and learning efficacy. Additionally, we found that the students from commerce backgrounds found the use of ICT to be affected by the level of engagement and innovation, in comparison to other students from science and arts backgrounds. As reported by Danesh and Shahnazari (2020), Paechter et al. (2010), and Bransford et al. (2004), these components play a significant role in shaping the perception of ICT use among students. It is, therefore, important to note that students from different locations do differ in their perception of engagement and capability to learn. Probably this may be explained by the infrastructure and overall acceptance among students from different locations and different backgrounds.

The study findings have important implications for designing courses and developing e-learning pedagogies. Academicians should consider the students' perception of innovation in the teaching-learning process and the perception of their capability to learn through the use of ICT while designing e-learning pedagogies. Well-designed and enriching pedagogies are not only more effective but also motivate students to a greater extent, hence creating a learning niche. Present findings, therefore, have serious implications for enriching the teaching-learning process in the new normal phase of blended learning through ICT.

## 7 Conclusion

The present study explored the different dimensions of students' perception of ICT use in their learning process. A detailed exploration of the process revealed four components, namely, *Effectiveness in Learning*, *Innovation in Learning*, *Engagement Through ICT*, and *Learning Efficacy*. It may be concluded that the exploration of this perception has led to a better understanding of students' overall attitudes toward ICT use. The study delineates that perceptions of online teaching-learning methods differ in various geographic locations. The study gave us an indication that if schools develop infrastructure in line with ICT requirements then it can be an alternative route of learning and students can enhance their knowledge and skill which is interdisciplinary. If we look into our new education policy, more focus is given to the holistic development of the students, and the learning process should be a more skill-based and blended mode of learning. Therefore, the present study is a learning construct for the schools that are yet to start the ICT-based method of teaching-learning.

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# Chapter 15

## College Management System and Ubiquitous Technologies in Education



Nisarga Chand, Sweta Bhattacharjee, and Arkya Santra

**Abstract** In recent digital era, as electronic systems empower the fast creation and circulation of documents, hence, individuals supplant paper documents with electronic ones. In the academic domain, electronic documents as data sources have expanded in number; and thus, recovering the data among an enormous number of documents has become an issue. College management system can help to develop the proficiency and adequacy of this system. It can further enhance the sharing of information between students and get groundbreaking thought from other investigations which can result in the creation of a smart education system. *WonderVersity* is an Android application which we have designed in this perspective. This application gives a common and simple platform dedicated to college-going students, in order to foster a superior communication between them, the faculty members, and the other administrative staff. By doing so, our project allows to offer special and supportive elements of raising appropriate queries, where students can post their inquiries and any connected member can respond to them. Besides, through an online management system, every faculty member could benefit from an assistance choice which helps him in finding any data with respect to classes, faculties, and webinars. *WonderVersity* additionally makes a stage where students can get regular updates of their participation prospectus and time table. It is also important to mention that the *WonderVersity* application works fluidly as it depends on a web-based data set framework called firebase. Overall, it is able to find out every element that is required to tackle the essential issues of college students.

**Keywords** Android application · WonderVersity · Online management system · Smart education system · Documents · Firebase

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# 1 Introduction

The plan and execution of any data system aims at giving the administrative staff of organizations, and more particularly schools, the information related to clients/students in order to reach them easily, as well as to supplant their ongoing paper records. In this perspective, it is commonly known that the school staff is expected to transfer all the information, results, and school notices through a solid, online point of interaction utilizing android gadgets (Manekar et al., 2017). Before any real record alteration that could take place, the data server does an exhaustive audit of all the data and approves it. The system is then designed for student UI, allowing students to get advice and tips provided by their seniors. All the data is stored securely on SQL servers under the school administrator's watch. The system reduces desk work and the amount of time needed to access student records. Prior to this drive, the school heavily relied on paper records, which had their own disadvantages. This system provides a fundamental link point for maintaining student data. It might very well be used by educational institutions or schools to efficiently manage student records. Using a manual system to achieve this goal is difficult because the data are scattered and may be excessive, and gathering pertinent data might be very time consuming. Our proposed system guarantees to defeat these impediments. The main objective of this paper is to provide data in a straightforward manner so that organizations like Internet-based enlistment and profile making of students, participation checking, round notices, along these lines decreasing automation of the record-keeping process and administrative tasks at educational institutions. There is a rising pattern for advanced education organizations normal to screen student records (Kamane, 2017). This mobile app creates investigates the consequences of exploration that thought about the impact of participation on student execution; reviewed planning students about participation issues, imparted the outcomes to associates remembering understanding for a Departmental strategy change, and evaluated the methodology scholastic staff ought to take towards unfortunate participation.

The web-oriented application proposed in the present work enables to provide complete information about the college's faculty, students, facilities, and other related elements. This application offers a virtual tour of the campus. It affords the most updated information about the faculty and students here. This traditional application was created to assist students of a company with information on the curricula, subjects, classes, assignments, grades, and schedule. It also provides assistance so that a staff member can review his daily schedule, transfer tasks, and notify the kids (Mei-shan et al., 2012). Here, the manager will handle the student and resource records, create the schedule, and transfer the most recent information on the grounds. We can cite some of these features as follows:

- *College data:* Through this aid, the person can get all available information about the college campus, including courses offered, affirmation process, situations, college events, accomplishments, etc (Zhongxi, 2015).
- *Students location:* Any organization that requires to review the college student's profile will actually want to choose the specific students for their needs, so they

will be provided with a specific connection through which they may get the necessary information (Hlaing and Ko, 2015).

- *Student status*: It indicates the level of student participation. Workforce will update it occasionally and should be visible to students and guardians (Sultana et al., 2015).
- *Student's result in exams*: This office provides the student's performance on every test that a college or university, such as a midterm, directs. Resources that students and parents can access will update the test scores that pupils received.
- *Test notification*: This office informs students and guardians about assessment plan.
- *Events*: It will provide information on various events that the college will occasionally organize. Information regarding these events will be updated by the head.
- *Online tasks*: With this assistance, the office can pass work to its staff, and students can present their assignments online (Vantova et al., 2017).
- *Data about staff*: It will assist in maintaining accurate information about college staff, such as their area of expertise, organizational structure, date of hire, compensation, and so forth. When students graduate from the college, the head will use fresh resources and wipe their records clean (MohanJoshi, 2015).

## 2 Related Research Works

Some of the proposed works related to the domain of our research are cited as follows:

1. Joshi et al. (2018) implemented their "Android Based Smart Learning and Attendance Management System" while using Android applications for things like online study materials, announcements, academic calendars, exam reminders, online attendance records, performance records, and parent notification systems. With the use of a smart phone, this technology enables teachers to collect attendance and maintain student records for use in ongoing assessments. As soon as a student's attendance falls below the defined attendance level, this system sends them an SMS as a prior warning.
2. Noor et al. (2015) developed the "Android-Based Attendance Management System." In this paper, a technique for taking attendance using an Android platform application is suggested. Once installed, this program can be used to retrieve the list of students from a certain web server. The gadget will then function as a scanner to individually scan each student card to validate and verify each student's existence based on the downloaded list of students.
3. Yue and Jin (2010) implemented "The Development and Design of the Student Management System Based on the Network Environment" which talks about how information is managed in higher education. We build the student management information platform and design models for college students' management

information by utilizing cutting-edge information technology on the basis of an extensive investigation and analysis of student management in higher education. Additionally, we examine the characteristics of information management in higher education and develop solutions to the challenges students face when managing their higher education.

4. Dhiman et al. (2019) developed “A New Android Application (Breeze) for College Management System,” which includes the distinctive and practical function of question-raising, where students can post their questions and anyone can respond. In order to keep an eye on problematic posts, a report tool is also offered. This feature alerts the administrator to incorrect posts and suggests potential remedial measures. Additionally, it offers users a support option that enables them to find out any information on labs, teachers, and lecture halls. Additionally, Breeze develops a site where users may check daily updates to their attendance schedule. The Breeze app operates without a hitch because it is built on the Firebase online database technology. Additionally, it offers fundamental functionality like password and profile image changes and password recovery.

### **3 Planning and Analysis**

#### ***3.1 Problem Analysis***

Currently, students’ information is placed physically in colleges. The students’ subtleties in isolated records are monotonous. Alluding to this large number of records and refreshing them is more than required, especially in order to diminish manual mistakes.

##### **3.1.1 Issues in Existing Framework**

- It was confined to a unique system.
- It was less user-friendly.
- It involves a lot of manual labor (the term “manual system” does not necessarily mean that we just use pen and paper; it also refers to using spreadsheets and other basic software).
- It necessitates the hiring of an increased number of workers.
- The procedure was laborious.
- The mechanism in place was incredibly less secure.
- Making several sorts of reports is impossible.

### 3.1.2 Solution for These Problems

The activities that aim to motorize the entire cycle while still taking the data set blend method into consideration are included in the improvement of the new framework.

- Ease of use is given in the application of different controls, making it user-friendly.
- The framework makes the general endeavor the executives significantly simpler and versatile.
- It may be reached over the Internet.
- Different classes have been utilized to give record move and mail features.
- While the endeavor progression is underway, there is absolutely no possibility of a data breach occurring at any level.
- It gives a raised level of safety utilizing various protocols like https, etc.

## 3.2 System Analysis and Arranging Versus User Necessity

### 3.2.1 User Requirements

By examining the user needs, the following prerequisites have been gathered as follows:

- A person should have the option of accessing the framework from the application's home page.
- The administrator is able to create users based on user demand.

Administrators have the ability to move the data for a specific student. Users (students, parents, and faculty) can view reports when a move is successfully completed (Al-Muhaidhri, 2019).

- The user will genuinely desire to view the circumstance with their explicit student ID number.
- The student (user) is permitted to use all of the offices, just as he would in a college.
- Students have more energizing access to attendance, views, grades, reports, and numerous offices.
- Each student's record will have a unique page where he may examine his grades, attendance, and other information.
- With the username and secret word provided, parents may easily view the student's record.
- Staff members can inform students of their attendance and other information.
- The administrator confirms this large number of reports and creates them so that users might be able to see them.

The next step is to examine the problem and determine its unique circumstances after examining the project's prerequisites have been determined. Focusing on the current framework and understanding the requirements and scope of the new framework are the stage's two main activities. Both tasks are equally important, but the initial development serves as a foundation for providing the useful specifics and, later, an efficient plan of the suggested framework (Sulaiman et al., 2014). Understanding the characteristics and requirements of another framework involves creative problem-solving and knowledge of the currently operational framework because a poor understanding of the latter can result in a deviation from the original plan. A few elements of the system include:

- **Memory limitations:** There are memory constraints due to the quick progress of dirty databases which has various exceptional keys and colossal datasets.
- **Software interfaces:** Oracle MYSQL Workbench serves as the backend and Advanced JAVA serves as the frontend; the association point is an ODBC controller.
- **Framework highlights:** Simple Graphical User Interface (GUI), easy to use, no need for special preparation, reasonable cost, and defense through affirmation procedure.
- **Significant ideas utilized:** Using ADODB Connection, we have connected our frontend and backend code. In our endeavor, we have made use of the data environment and data reports. To make clear elements open to everyone, we used modules.

### ***3.3 Feasibility Gained by Our System***

#### **3.3.1 Specialized Feasibility**

Since our project is in JAVA, we need to have a strong base in programming. A PC with Java Development Kit (JDK) is required.

#### **3.3.2 Economical Feasibility**

To execute the framework, we require more than one PC. Since the framework will be completed in the existing environment, there will be convincing explanation to buy the PCs. The system is financially feasible.

#### **3.3.3 Operational Feasibility**

Our framework will be quite easy to present and use. Hence our framework is functionally commonsense.



### 3.3.4 Cost-Benefit Analysis

The cost incurred as a result of our framework integrates only the product interminably cost of the PC expected to run the endeavor the advantages brought about by our framework will consolidate.

## 3.4 Model Analysis

This document assumes the life cycle (SDLC) enhancement since it accurately depicts all of the framework's requirements. It suggests that designers will use it, and it will be crucial during the testing phase. Later changes to the requirements must go through the standard change underwriting process. In his 1988 article, "A spiral Model of Software Development and Enhancement," Barry Boehm described the "SPIRAL MODEL." This model served as the main tool for understanding why the accentuation models were used rather than the primary model to investigate iterative development.

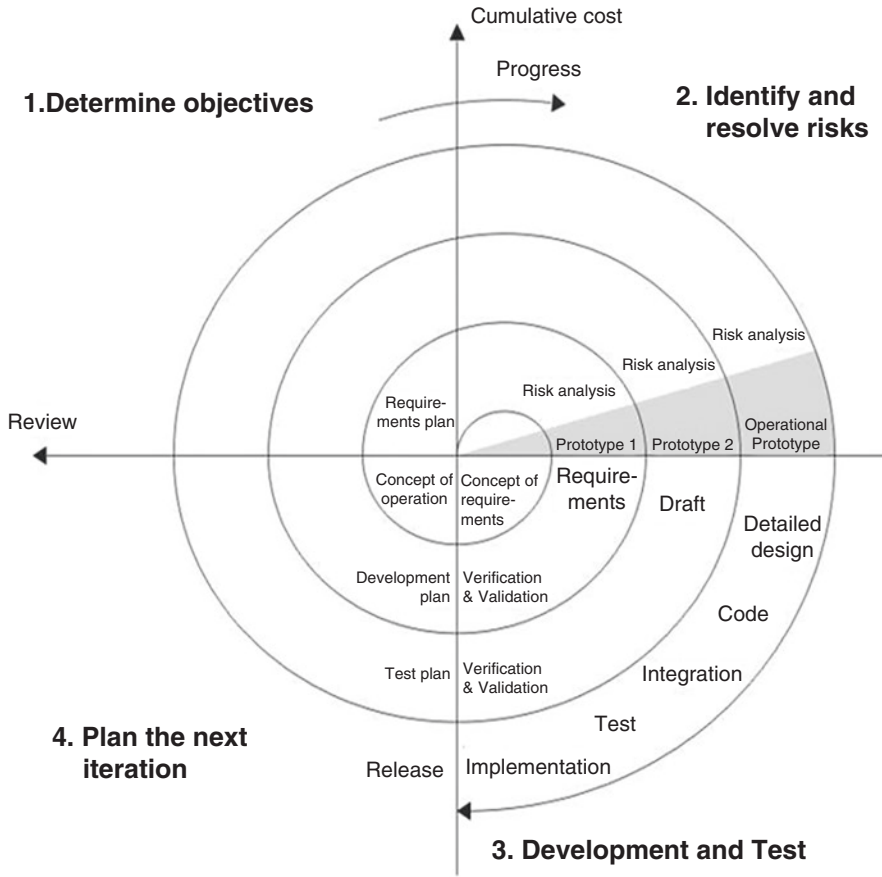
The emphases often lasted from a half year to two years, as initially thought. Every step starts with a plan goal and ends with a client reviewing the progress made thus far. At each stage of the project, efforts are made to examine and plan with an eye toward the mission's specific goal.

### The Steps for Spiral Model Can Be Summed Up as Follows

The new framework requirements are explained in as much detail as reasonable. This framework typically entails: meeting with numerous users, talking with all of the internal or external users, and discussing various aspects of the existing framework. Thus,

- A draught of the new framework is created.
- From the initial plan, a first model of the new framework is created. This paradigm, which is typically scaled back, provides an estimation of the characteristics of the unavoidable outcome.
- A later model is made using the following four steps:
  1. Examining the advantages, disadvantages, and risks of the first model in a long time.
  2. Defining the requirements for the next model.
  3. Setting up and organizing the next model.
  4. Building and evaluating the next model.

At the client decision, the entire endeavor can be stopped if it is thought of as unreasonably uncommon to accept the gamble. Risk factors may have implied that improved cost overwhelms, working expense error, or anything other part that might, in the client's judgment, result in a not exactly palatable possible result.



**Fig. 15.1** Spiral model related to college management system. (Source: Researchers' own production)

- As shown by the four-part approach previously described, the current model is examined similarly to the previous model, and if necessary, another model is created from it. The prior innovations are tweaked until the client is satisfied that they achieve the desired result.
- The final structure is constructed after being thoroughly examined and tested in light of the improved model. Regular maintenance is performed under the premise of preventing major setbacks and minimizing downtime.

Figure 15.1 shows how a spiral model acts.

## **3.5 Survey of the System**

### **3.5.1 Graphical Interface**

A strategy seen as a crucial issue through a scrutinizing interface has been encouraged by the flexibility of the causes for the association point. The major level GUIs have been asked for this purpose, including:

- The administrative UI
- The functional or traditional UI

The administrative user interface (UI) is focused on the consistent information, which is crucial for hierarchical operations and requires real approval for information acquisition. With the provision of robust information search capabilities, the association assist the associations with all of the contingent states, including Data consideration, Data crossing out, and Date reviving. Through continuous information and necessary organizations, the utilitarian or customary UI aids the customers upon the structure in trades. Additionally, the useful user interface helps regular clients manage their own information in a modified manner in accordance with supported adaptabilities.

### **3.5.2 Number of Modules**

The system after detailed examination has been perceived to be given the going with modules:

The modules included here are:

#### School Data

Through this aid, one can obtain all available information on the school's facilities, such as courses offered, the confirmation process, circumstances, school events, accomplishments, and so forth.

#### Student Tracking

Any organization or association that has to look at a list of the school's pupils will really want to choose a single student for their needs; therefore, they will be provided a specific link via which they may access the information needed.

### Student Participation Status

It gives the participation status of students. Workforce will refresh the participation occasionally and should be visible to students and guardians.

### Student's Presentation in Tests

This office provides a student's performance on each test that a college or school assigns, such as a midterm exam. Resources that students and parents can use will be used to update the marks that kids received on tests.

### Test Notification

This office informs students and guardians about assessment plan.

### Occasions

It will provide information on various events that the school will occasionally host. The chairman will update the information on these events.

### Online Tasks

This help gives the office to workforce to transfer tasks and to students to present these tasks on the web (Shulin and Jieping, [2014](#)).

### Data About Staff

It will assist in maintaining comprehensive information about school employees, such as their field of expertise, unit, date of hire, pay, and so forth. When they graduate from the school, the head will hire new personnel and wipe their record clean (Thangam et al., [2017](#)).

## ***3.6 System Planning***

### **3.6.1 Pert Chart**

Focus is placed on things like a cost-benefit analysis, specialized attainability, time plausibility, and job usefulness while performing and evaluating achievability. PERT charts should be used for project scheduling. To determine whether

the suggested system is realistic for the organization, a practicality study is conducted.

### **3.6.2 Technical Feasibility**

The technical viability focuses on the existing PC system, such as the hardware, software, and so on. Banks need to handle SQL databases, which are often well-accessible with extensive development help from manuals and websites.

### **3.6.3 Economic Feasibility**

The most frequent method used to determine whether a system is adequate is called the economic feasibility. This technique, more often known as a cost/benefit analysis, entails determining the benefits and investment funds that are typical of the applicant system and contrasting them with costs. The decision is therefore remade to plan and implement the system if it is determined that the benefits outweigh the expenses.

### **3.6.4 Requirement Analysis**

The “feasibility study” is another name for this interaction. The improvement group focused on the site necessity at this stage. They investigate the need for a potentially compelling depiction of the site and enhance security features. The group sets up a record with the various explicit ideas for the rival system near the end of the feasibility study. It also includes faculty assignments, expenses, project schedules, deadlines, and so forth. The process of obtaining requirements is intensified and unusually focused on programming. This stage’s primary goals are to identify the demand and identify the problem that needs to be solved. It was accumulated to follow realities during this time.

- Decide the clients’ needs
- Distinguish current realities
- Lay out the objectives for the proposed system
- Feasibility for the latest system

## ***3.7 System Analysis and Design***

The overall design of the product and its intricacies are described at this stage. In terms of client-server innovation, this stage describes the various stages needed for bundle engineering, database planning, information structure planning, and so on.

In the entire improvement cycle, evaluation and design are crucial. Any inaccuracy now could cost money to fix later on in the programming development process.

Thus, following is the fundamental methodology taken during website planning:

- DFD
- Database Designing
- Structure Designing
- Pseudo code for strategies

### 3.7.1 Waterfall Model

The Waterfall Model is a successive programming headway process, in which progress is seen as streaming reliably plummeting and descending (like a cascade) through the times of origination, initiation, analysis, plan (validation), development, testing, and maintenance.

In order to use the waterfall paradigm, one goes from one stage to the next in a successive way. When the necessities are completely finished, one proceeds toward the plan. The software being referred to is planned and an outline is drawn for implementers (coders) to follow—this plan ought to be an arrangement for executing the prerequisites given. Whenever the plan is completely finished, an execution of that configuration is made by coders. Toward the later phases of this execution stage, separate software parts created are consolidated to present new functionality reduced risk through the evacuation of errors.

As part of the software engineering life cycle process, we used the waterfall model. It is the most widely adopted, most established, and least complex process model for programming development.

The name of this paradigm comes from how the typical programming life cycle is described as a series of slipping advances.

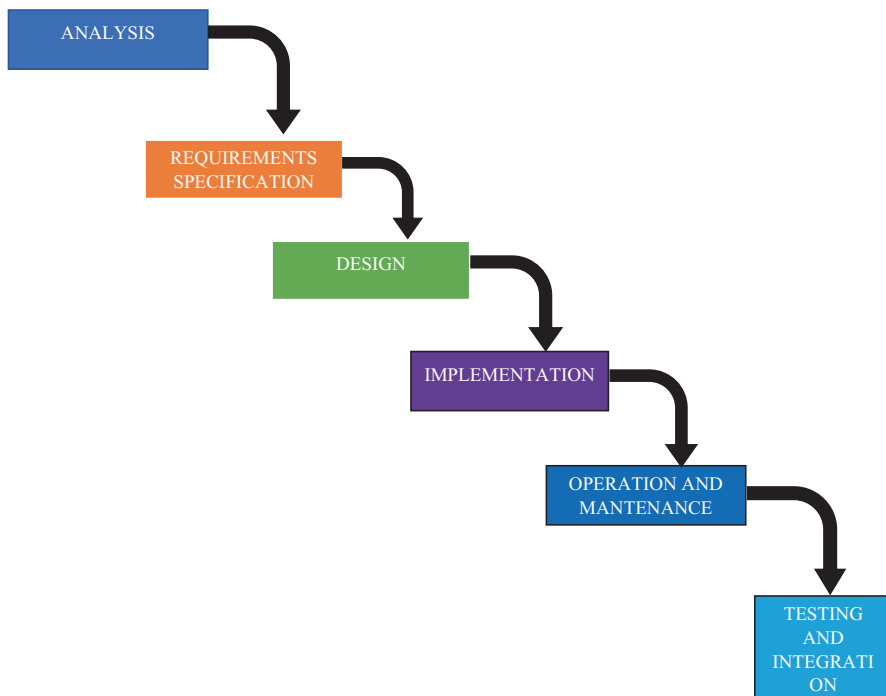
The project is divided into several stages, with some overlap and enough recirculation between them. The emphasis is on planning, scheduling, meeting deadlines, budgeting, and carrying out the entire framework at once. Broadly written documentation, conventional surveys, the board's approval/signoff at the conclusion of most stages, and data innovation are all used to maintain tight control over the project's existence before moving on to the next step.

The fundamental standards of the waterfall model are as follows (Fig. 15.2).

### 3.7.2 ER-Diagram

An entity relationship (ER) diagram is a kind of flowchart that delineates how “elements,” for example, individuals, articles, or ideas, connect with one another inside a framework (Fig. 15.3).

Fundamental standards of the waterfall model are:



**Fig. 15.2** Water fall model of college management system. (Source: Researchers' own production)

### 3.7.3 Flow Chart

The framework stream chart is a visual portrayal of all handled in successive request. The system stream outline chart is a graphical portrayal of the connection between every one of the significant parts or steps of the framework. Stream graph chart can exclude minor pieces of the framework (Fig. 15.4).

## 4 Method

### 4.1 Method Adopted and System Implementation

- The application runs on a web server called Apache Tomcat.
- The climate variables are all established.
- The web apps organizer will not let you move the application.

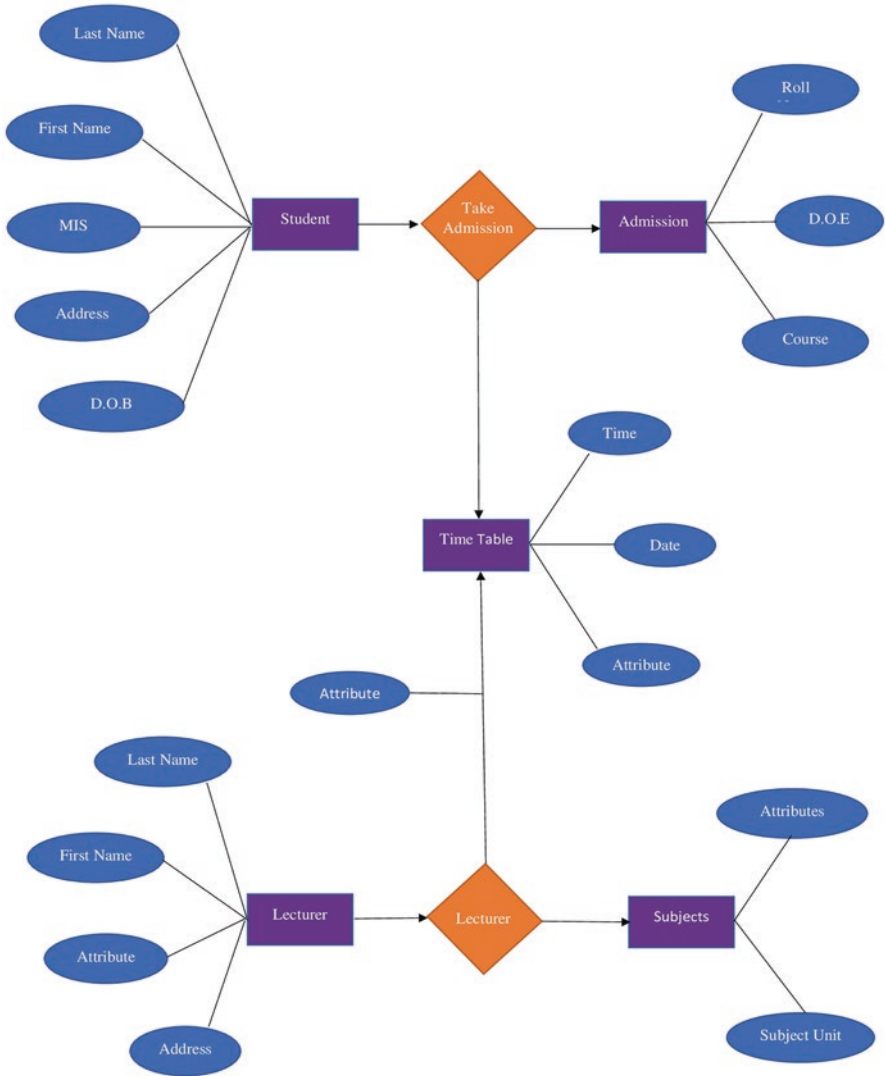


Fig. 15.3 ER-diagram of collage management system. (Source: Researchers' own production)

- The web server has now started.
- A web application composing <http://localhost/cis> is demonstrated.
- Web.xml records are used to regulate client and stream activity.



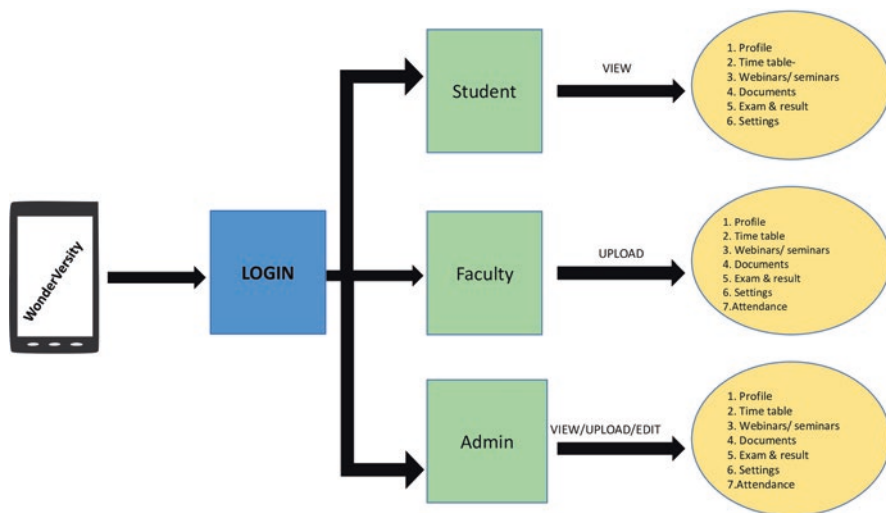


Fig. 15.4 Flow chart of collage management system. (Source: Researchers’ own production)

## 4.2 Details of Hardware and Software Used

### 4.2.1 Hardware Specification (Minimum)

Disc space:	30 MB
Processor:	Snapdragon
Memory:	512 MB RAM
File system:	32 bit

### 4.2.2 Software Specification

Operating system (server side):	Windows XP
Operating system (client side):	Lollipop
Client end language:	XML
Local validation:	JAVA
Server-side language:	JAVA
Database:	Firebase
Web server:	XAMPP server
Web browser:	Chrome/Mozilla Firefox

### ***4.3 Method Used for Testing***

A system cannot be finished until every aspect of it has been tested. However, this provides the impression that the project is complete; a project cannot exist without going through this stage. Therefore, at this point it is determined whether the project can successfully complete the ongoing climate execution with few to no break-downs, so a package can still be rejected at this stage.

#### **4.3.1 Testing Techniques**

Typically, white box testing and discovery testing are used to separate programming testing methodologies. These two approaches are used to illustrate the viewpoint a test engineer adopts when organizing experiments.

##### **Black Box Testing**

In black box testing, the product is treated as a “black box,” with little to no knowledge of how it is being executed internally. Comparability dividing, limit esteem analysis, all-matches testing, fluff testing, model-based testing, detectability grid, exploratory testing, and detail-based testing are examples of black box testing methodologies.

##### **White Box Testing**

When comparing white box testing to black box testing, the analyzer approaches the internal information designs and calculations (and the code that executes these). A test suite that was created using black box testing methods can also be evaluated using white box testing procedures. This ensures that the primary capacity focuses have been tested while allowing the product group to examine areas of a system that are rarely used.

##### **Gray Box Testing**

This type of testing at the customer, or black-box, level involves approaching internal information designs and computations for reasons for planning the experiments. Controlling information and designing results are not considered to be “dim box” tasks because they are visibly outside the “black-box” that we are referring to as the system being tested. When conducting combination testing between two code

modules created by two distinct designers, where just the points of interaction are exposed for testing, this differentiation is extremely important. Dark box testing may also involve dissecting code to determine things like limit values or error messages.

1. Execution testing determines whether the product is capable of handling massive amounts of data or clients. Most often, this is referred to as programming versatility. Typically, this non-functional software testing procedure is referred to as load testing.
2. Testing for solidity determines whether the product can consistently function adequately in or over an appropriate period of time. The term “indurations test” is frequently used to refer to this non-functional software testing procedure.
3. Assuming the user interface (UI) is not challenging to use and understand, convenience testing is anticipated to verify this.
4. For programming that handles sensitive data and to prevent system disruption by programmers, security testing is essential.
5. These aspects of programming are anticipated to be tested by internationalization and limitation, for which a faux restriction technique can be used.

Now, some of the factors which we have taken into consideration while developing the project are mentioned below:

- If the client wants to use it in a laptop/desktop, we have prepared a website for this app to be used and the data will be automatically updated in the app whenever any changes are made in the website as it is connected to the website.
- If the client asks for a multifactor authentication at the time of login, we can update the system as per the client’s requirement. Basically, there exist 3 types of multifactor authentications: knowledge-based, possession-based, and inherence-based authentication. As we have already been using knowledge-based authentication, in the future we can update the app and include the other two authentication types in the system. For the website purpose, we can use the first two authentication types, that is, knowledge based and possession based. As knowledge-based authentication is already being used, we only need to insert the possession-based authentication to the website and the rest for the mobile application (Bhavana and Jasmine, 2016).
- When results of any exams are announced in a college/university, there is a huge rush of students who are going to log into this portal simultaneously. There can be over thousands of concurrent users. Hence, we have decided that we will connect this site to the university servers. As in universities, there are thousands of data already been registered in their servers and the servers are handling all those students’ login details in the university website without any hustle, so we can connect our site to the university servers and those thousands of logins can be handled easily by their servers (Figs. 15.5, 15.6 and 15.7).

**Fig. 15.5** Input screen of the app



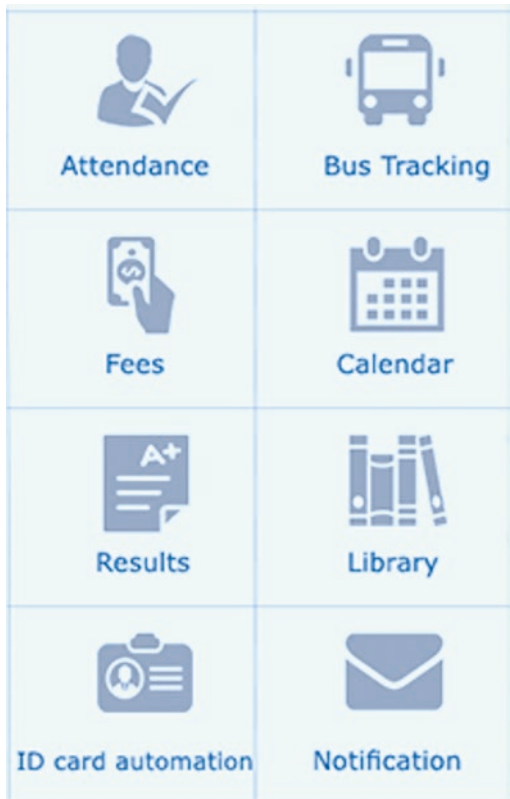
## 5 Results

### 5.1 Input and Output Screen Design (Snapshots)

## 6 Conclusion and Future Perspectives

The college management system is the plan of action required for handling problems related to a particular business. This experience has been successfully completed with all of the components mentioned and detailed in the framework requirement. An accurate information about any college is essential for the advancement and success of both students and the workforce. Thus, the proposed system meets the best needs of both associated parties in an appropriate way.

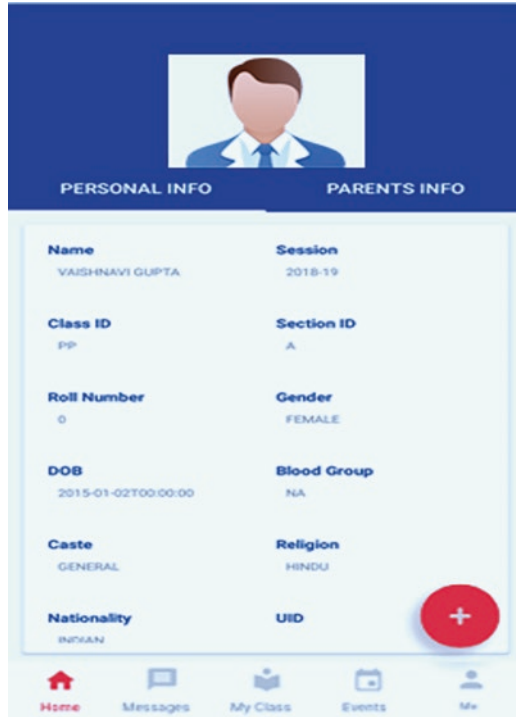
**Fig. 15.6** Index screen of the app. (Source: Researchers' own production)



Accordingly, our project is basically focused on the advancement of students, and on a total framework that is a data-based support that could be available inside the faculty. The design is to lessen the errand of the staff individuals and to help them practically from all viewpoints. Labor and manual work will be enormously diminished by the appearance of this Android-based application, and any data refreshes/recovery should be possible effortlessly. Students are introduced into this application with the necessary adaptability and they might associate with the specific staff all the more often for any reason at any time any spot. From now on, the students might plan with this application, they can have the option to see their inward stamps and report to the specific employees assuming that rectifications are to be made. This framework will bring an easier use and an upgraded framework which will meet all the expectations of the staff individuals engaged with the association. In any case, further updates on this application and extraordinary enhancements are to be applied to it in the upcoming days, in order to give some ground to the requirements of the staff individuals and the students.

This college management system can be further extended by adding more features like placement opportunities, library books, location tracking, etc. Students

**Fig. 15.7** Output screen of the app. (Source: Researchers' own production)



and faculty members can use these services in a hassle-free manner through the mobile application. This mobile application can reduce manpower as all essential information, documents, etc., can be found in just a single app. This application permits flawlessly interfacing the educators, students, administrators, and guardians and keeping them continuously informed of all parts of the organization (Bansal et al., 2015).

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# Chapter 16

## Information and Communication Technologies in Education: A Framework for Transforming the Indian Education System through Smart Learning



**Prama Chatterjee, Arnab Gantait, G. Anjaneya Swamy, and Babu George**

**Abstract** Literate and educationally advanced population is the primary characterizing feature of any developed nation. In this context, digital inclusion in education system is seen as a potent solution to the holistic growth of an education system, since it provides a comfortable learning environment that meets the demands of individual learners, and that of the society as a whole. Like many other governments around the world, the Government of India has also made strides in modernizing its education system by promoting Information and Communication Technology (ICT)-based education. Educational institutions support this innovative technology-based education system, known as “Smart Learning”. The current chapter focuses on ICT’s required capabilities in establishing a digital environment and examines how ICT may upgrade education for next generation, while also being effective in smart learning. The study further emphasizes the opportunities and benefits of ICT in the education system, and throws light on a few important initiatives taken by the Indian Government and other organizations toward the holistic development of the Indian education system by bringing sophistication in the field of education. This work can be categorized as descriptive research. Researchers have chosen a qualitative method by reviewing and analyzing reports, research works, and other information sources pertaining to the topic. Thematic and Content Analyses are used to infer from the data acquired from various reports, reviews, and also from experts’

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opinions. The challenges that pose impediments in the path of successful implementation of the ICT-based teaching-learning system in India are also dealt with. Findings of this study will provide guidance to educational policymakers as well as future researchers of the country.

**Keywords** ICT · Digital literacy · Smart Learning · E-learning · Indian Education System

## 1 Introduction

Education is the engine that propels the socio-economic progress of any nation (Hanushek & Woessmann, 2011). In a broader sense, education improves people's living standards, which benefits both individuals and society. A country's development goals can be met only through educational progress. The constitution of India ensures equal access to education for all its citizens irrespective of their caste, creed, gender, and religion. Knowledge is at the heart of today's society. With the explosion of knowledge, the quality of education has now become a serious challenge for education experts, planners, and policymakers.

The definition and meaning of "education" and "knowledge" have evolved over time. People in the era of technology now have new perspectives on these terms. In this digital era, technological advancement has rendered civilization reliant on technology. Terms like "educational-technology", "audio-visual classroom", "smart class", "virtual class", "digital library", "online learning", etc., are now being frequently used. With the rapid development in communication technology, the usage of ICT in various fields, particularly in the education sector, has soared to new heights. This growth of new inventions in multimedia technologies, improvement of Internet connectivity, and its widespread application have brought a revolution in the field of communication and education in the last few decades. As the potentiality of ICT is increasing day by day, it is becoming more relevant, and simultaneously upgrading the quality of education in developing nations (Tinio, 2002). It is, therefore, not farfetched to say that the application of ICT has reformed the entire education system at a global level (Watson, 2001).

In India, education is primarily focused on increasing access to education, fostering self-directed and lifelong learning, and implementing new techniques to deliver education (Vasudevaiah, 2016). Although India's literacy rate has increased in recent years, the country is yet to cater to all the residents, particularly those in rural areas, the kind of education that the current situation demands. The introduction of communication technology has made it very clear that technology can be used for formal and non-formal education, teaching, and learning even at higher levels.

Application of ICT in teaching and learning can provide more opportunities for teachers, students, and researchers to work better, and thus ICT can strengthen the Indian education system.

The present study focuses on the requisite capability of ICT in creating a digital environment and discusses how ICT can transform education for the next generation and can be effective for smart learning. Researchers also highlight the prospects and benefits of ICT in the education system, as well as few initiatives taken by the Government of India and other organizations to advance the country's education system. The promising practices in ICT adoption are specially highlighted. This research work also addresses the challenges that stand in the way of successful implementation of an ICT-based teaching-learning system in India.

## **2 Objective of the Study**

This research study revolves around few key objectives. The first objective is to conceptualize the idea of Information and Communication Technology (ICT) and its scope in the education sector. The second objective focuses on ICT's potential to create a digital environment, and the numerous benefits of ICT in education and training sectors. The third objective is to investigate the role of Information and Communication Technology (ICT) in the education sector, particularly in higher education and also in "smart learning". The fourth objective of this chapter is to highlight a few key initiatives taken by the Indian government and other organizations in recent years to improve the overall development of the Indian education system by bringing sophistication to the field of education in recent times. The fifth objective deals with problems that stand in the way of the successful implementation of an ICT-based teaching-learning system in India and makes recommendations for better ICT implementation in the growth of India's educational system.

## **3 Methodology**

This study can be categorized as conceptual research. Researchers have chosen a qualitative method by reviewing and analyzing media reports, published works, research papers, working papers on Information and Communication Technology (ICT), and the Indian education system. Apart from this, researchers also got inputs from academicians and other education experts to know their perspectives on ICT's ability to create a digital environment, its benefits in education and training sectors, and common challenges of implementing an ICT-based teaching-learning system in India. Finally, thematic and content analysis has been applied to scrutinize and infer the data acquired from various reports, reviews, and experts' opinions.

## 4 ICT: Definitions and Meaning

The term “ICT”, which is commonly used nowadays, stands for “information and communication technologies”. Communication technology can be described as the process of sending, receiving, and exchanging information. “ICT” has been explained in many ways. ICT comprises all electronic equipment, tools, resources, and services that can be converted into or delivered through digital forms. UNESCO in 2002 defines ICT as the combination of information technology with additional technologies, specifically, communication technology (Anderson et al., 2002). Biswas (2019) addresses ICT as technologies and computer programs; those are mainly used to access, save, organize, retrieve, and present the data through an electronic mode. ICT in education refers to a technology-based teaching-learning system and computer-based communication that governs the entire learning process (Ghavifeker & Rosdy, 2015).

## 5 Scope of ICT in the Education Sector

Nowadays, the computer-aided teaching and learning process has become popular. Using ICT technologies, one may even encourage and enhance the learning process. ICT can be used as a means of engagement, a source of knowledge, and a medium for knowledge transfer. ICT offers a broad range of applications and has the potential to play an important role in the education sector. Students in rural schools can easily understand the content if it is presented in their native language, and by using ICT technologies, their language of communication can be further developed, which is the biggest obstacle to rural people in the case of receiving modern education. Apart from all the schemes launched by the government regarding educational development, the ICT scheme has now become inevitable. The Government of India (GoI) has declared the period from 2010 to 2020 as the decade of innovation with ICT-enabled education and adoption of ICT skills for students.

## 6 Capability of ICT in Creating a Digital Environment

ICT-enabled teaching-learning process encompasses a variety of tools, approaches, and technologies that enhance the quality and efficiency of the teaching-learning process. There are numerous ways to use ICT tools in a classroom. A regular classroom can be transformed into an ICT-enabled classroom with widespread usage of teaching-learning technology. Even in informal education, new media provides a wealth of information in a range of formats. On YouTube, people can share their

knowledge and tips. Teachers can disseminate free YouTube tutorials and text-based learning resources. In the instructional process, some media technologies can be employed. A teacher can deliver his/her lesson effectively in a well-known classroom with the help of those media and materials. ICT is basically access to technology. Computers can be placed in classrooms to maximize the opportunities for curriculum activity (Kennewell et al., 2000).

### **E-learning**

Learning over the Internet, using digital media tools and digital information processing, is referred to as e-learning. E-learning is a method of education that is mostly dependent on electronic devices and Internet connectivity. For learners, e-learning eradicates geographical barriers. One can obtain a variety of e-materials from websites. E-learning allows students to gain knowledge while staying at home. Information technology is the sole practical means of reaching out to the world's students and providing education as a service (Bhattacharya & Sharma, 2007). Gunjan (2014) has mentioned some e-learning tools which are successfully running in the field of higher studies such as: Web Blogs, Podcast, Wiki, and Instant Messaging Apps like G-Talk, Messenger, Skype, Text Chats, and Internet Forums. It is important to understand that technology is merely an enabler of education in e-learning. It does not replace the value of educational content or pedagogy.

### **Open and Distance Learning**

The open and distance learning system is defined by the Commonwealth of Learning as a method of providing learning opportunities that are characterized by the separation of teacher and learner in time or place, or both; learning that is certified in some way by an institution or agency; use of a variety of media, including print and electronic; two-way communications that allow learners and tutors to interact; the possibility of occasional face-to-face meetings; and the use of various media, including print and electronic (Source: Commonwealth of Learning, "An Introduction to Open and Distance Learning", 2000). ICT provides open and distance learning opportunities for students who have dropped out of school and are unable to complete their formal education in a traditional set up. It allows individuals to enroll in their desired course and continue studying, accessing study materials, submitting assignments, and conversing with mentors. In this process, digital libraries, e-books, online publications, etc., can be accessed by the learners. Ultimately it benefits distant learners. Realizing the effectiveness of ICT in Open and Distance learning; now India's educational strategies have also prioritized the use of ICT in its distance learning education programs in order to improve human resource development and extend access to education at all levels. With the help of ICT, thousands of people from most remote corners of the country can easily access education through distance learning.

## 7 Benefits of ICT in Education

As students have smooth access to information in this digital age, there is an increasing demand for research work, critical thinking, and skills. Students need to apply that knowledge in right place (George, 2017). ICT supports learners with special needs too (Moore & Kearsley, 2012). There are various software applications like excel, databases, etc., which are helpful in learning. Different software applications help the learners in learning and understanding the subject and also help them in developing a problem-solving approach. Computer technology helps the learners with high-order thinking (McMahon, 2009). ICT expedites the collaborative and constructive approach to learning activities of pupils which enhances their performance. Here, Table 16.1 displays various benefits of ICT in education from theoretical aspects given by different scholars.

## 8 Role of ICT in Education

Importance of ICT in the educational sector is increasing day by day. ICTs in school education aim to prepare students for long-term survival and expansion of a knowledge society, which in turn accelerates the country's overall socio-economic development. Education makes a clear path for a person, which adds value to his/her socio-economic and political mobility (Amutabi & Oketch, 2003). ICT has been used in education since its foundation; but its widespread presence has never been seen (Hepp et al., 2004). The Internet is the main tool for e-learning. With the help of the Internet and the web system, ICT extends the e-learning system. ICT consists of components like cyber infrastructure, online libraries, and online learning technologies; all are connecting stakeholders and making a new digital identity of pupils in the field of education (Chandra & Patkar, 2007).

ICT-based education can provide reliability, validity, and efficiency in data collection and make analysis process, evaluation, and interpretation easier at any educational level (Mooij, 2007). Teaching through the Internet with the help of multimedia makes the classroom virtual which comes closer to offline classes, it is like tele-teaching, and the whole learning process becomes interactive (Sampath et al., 2007). There are options like the World Wide Web WWW), teleconferencing, and multi-media-based self-learning through which the teaching-learning process can be handled.

Gurumurthy and Vishwanath (2010) conducted a study on computer-aided learning program (CAL) in Indian states Kerala and Karnataka. This study was based on the theoretical exploration and policy reviews. The study findings reveal that digital technology has the capability to construct local knowledge and also support audio-visual applications and text modes.

ICT extends more opportunities in formal as well as non-formal education. According to the International Institute for Communication and Development

**Table 16.1** Benefits of ICT in education from theoretical aspects

Scholar Name	Benefits of ICT in education from theoretical aspects
UNESCO (2003)	Educational system of Asia-Pacific region makes extensive use of ICT, much like other parts of the world. Many believe that ICT will provide teachers more control, shifting emphasis of teaching and learning, away from being largely teacher-dominated toward student-centered activities. It is also expected that ICT would offer students the opportunity to enhance their creativity, problem-solving abilities, and other higher-order thinking skills, thus improving the caliber of students' learning
Razak and Embi (2004)	The scholars have put up a framework for ICT competency for English language teachers in Malaysia. Three levels of competencies such as (1) beginner, (2) moderate, and (3) advanced are suggested. It also consists of four additional components: (1) basic computer knowledge and operation skills, (2) teaching and learning skills, (3) planning and managing computer-based environments, and (4) assessment and evaluation. Authors have claimed that this framework could be beneficial to teachers
Nyvang (2006)	He has proposed a theoretical framework for "ICT application in higher education", based on "Activity Theory" and a "Case Study" conducted at a Danish University. Three processes that make up his model are selection and adaptation of ICT, and change and practice with ICT.
Kabouridis (2008)	He opines as ICT has been tried and proven in underdeveloped nations for managing challenges related to teaching-learning process; it might therefore be successfully incorporated into the Indian educational system to teach a variety of disciplines, including mathematics, science, and engineering
Koehler and Mishra (2009)	Authors proposed a model named technological pedagogical content knowledge (TPACK) which refers to the types of knowledge required by a teacher for successful technology integration. This model focuses on the linkage between teachers' content knowledge, pedagogy and technological competency to promote effective teaching. Seven components of TPACK are divided into three main components. They are content knowledge (CK), pedagogical knowledge (PK), and technology knowledge (TK), which are considered as core competencies. Pedagogical content knowledge (PCK), technical pedagogical knowledge (TPK), technological content knowledge (TCK), and technological pedagogical content knowledge (TPACK) are the products of interaction between those three components. TPACK can be used effectively in "integration of ICT in teaching learning" (IITL)
Metbe et al. (2011)	In their study, academicians have promoted the use of ICT in education systems, and to bolster their argument, they have highlighted how University of Dar es Salaam—a public university of Tanzania in East Africa—Has successfully implemented technology to enhance its educational and instructional practices
Ndibalema (2014)	He conducted a study on Tanzanian school teachers' attitudes toward using ICT as a "pedagogical instrument" and discovered that the teachers had a positive opinion on the technology

(continued)

**Table 16.1** (continued)

Scholar Name	Benefits of ICT in education from theoretical aspects
Luhamy et al. (2017)	The study tried to examine ICT integration in teaching-learning in a teacher training college in Tanzania. The author took integration of ICT in teaching learning (IITL) as the main variable which was measured by the SAMR Model, that is, substitution (S), augmentation (A), modification (M), and redefinition (R) (Lubega et al., 2014). The study proposes that through the “theory of planned behavior (TPB)”, IITL of a teacher educator’s can be explained
Ratheeswari (2018)	In her scholarly article, she has advocated that the quality of instruction will be naturally improved when using technologies like teleconferencing, audio-video conferencing, internet, e-modules, etc., in teaching and training processes
Lowoga and komba (2015), Awwadand Al-Majali (2015), Yakubu and Dasuki (2018)	Using the “Unified Theory of Acceptance and Use of Technology” (UTAUT) model, studies showed that student’s “performance expectancy” and “effort expectancy” is related to their behavioral intention to use ICT. The UTAUT model explains the behavioral intention of users to use technology (Venkatesh et al., 2003)
Buabeng-Andoh (2019)	According to him, successful integration of ICT into the teaching-learning process has elevated to the top of the priority list for many organizations and governments worldwide after realizing the importance of ICT in learning and education
Dhingra (2022)	He talks about the interactive classes, where teachers and students work more closely together. According to him, with the use of various assessment tools and software, teachers can set up online assessments and quizzes to monitor students’ progress

(IICD), ICT provides better quality of education for all. ICT can make better content and develop supportive administrative procedures in educational institutes which increase the accessibility of education for students and teachers both through distance learning (Gunjan, 2014). Now-a-days integration of ICTs in schools has become more important as technology helps students to learn in a better way (Ghavifeker & Rosdy, 2015). ICT improves teaching-learning methods by developing educational tools that provide motivation to learners and they can learn basic skills easily with the help of modern instructional technology which promotes their competency and quality.

### ***8.1 Role of ICT in Higher Education***

In today’s world, everyone requires a minimum education to function as social beings, and this is non-negotiable (Khatun et al., 2021). In the past, learning and teaching relied solely on textbooks, but now ICT has opened doors to a wide range of study materials. ICT improves educational accessibility. Learners can get information on anything at any time and from any location. The process of learning has changed. It is quite beneficial in higher education. Students can obtain information

from e-books, websites, and online data by using technological devices. They can test and prepare themselves by taking online mock tests, model question papers, previous year question papers, and so on. They can also improve their knowledge by accessing online data, current events, current affairs, etc. There are many publications, research papers, and journals available online, and users can also contact resource people, experts, and researchers. People can communicate and meet with one another over the Internet. Teachers, students, professors, and academicians throughout the world have access to digital resources such as online libraries. Some universities, such as Terbuka University in Indonesia and IGNOU in India, have made extensive use of radio and television networks for both direct instruction and school broadcasting. The University of Air in Japan began broadcasting courses on radio and television in 2000. For each course, 45-min lectures were televised. Students were also given additional printed study materials and online tutorials (Iwanaga, 2000). In this regard, Narashimhan (2000) states that educational technology is essential for students in higher education to provide updated knowledge about their discipline as well as soft skills such as oral and content presentation, teamwork, time and conflict management, producing technical reports, and so on.

For any country's progress, a highly educated population is essential. Higher qualifications provide advantages in various areas of life for an individual. Teachers, professors, economists, politicians, and academicians all play an important role in the growth of the country. Higher education, according to Singh (2011), is crucial for developing future leaders in various domains, including cultural, economic, political, scientific, and technological. With the use of ICT, the quality of higher education can be improved. Jayasubramanian et al. (2015) researched on ICT awareness, access, and its usage. A survey among students of 60 colleges was conducted for the study to determine the satisfaction levels and preferences about ICT-enabled classes. According to the findings, students prefer ICT-enabled lessons because they are more participatory, appealing, and instructive than traditional lectures. The authors concluded that an ICT-enabled teaching-learning system had improved students' confidence, updated skills, and intelligence. According to several studies, ICT has a vital influence on education. As a result, the teaching and learning process is always evolving, and ICT is becoming increasingly useful in higher education.

## ***8.2 Role of ICT in Smart Learning***

With the advancement of digital technologies, the term "smart education" becomes common nationwide. A smart education system creates a smart learning environment for learners. It improves the quality of learning and extensively promotes thinking abilities, intelligence, and the digital literacy of the learners through seamless learning. According to Gawak (2010), smart learning is an effective and tailored learning which emphasizes content and learners and is mainly based on advanced IT configuration. This learning concept does not just depend on utilization of devices. It is a



learner-centered and service-oriented approach that amalgamates ubiquitous and social learning (Kim et al., 2013). A smart learning environment helps learners to access digital resources without the bondage of time and place as well as provides them useful tools and techniques and directions at the right time and place (Hwang, 2014). Middleton (2015) talked about the benefit of smart technologies in smart learning processes. This engages students in learning which increases learners' independence. Koper (2014) opined that a smart learning environment refers to an environment that is saturated with context-aware, digital devices for quality and fast learning.

In Singapore, a smart and student-oriented environment has been created to nurture the learning activities and fulfill several requirements of learners with the help of ICT (Education and Learning Sub-Committee, 2007). In North China, a pilot project named "Flipped Classroom" was executed in a middle school with the idea of smart pedagogies (Tucker, 2012, p. 82–83). Instructions by teachers usually happen in classrooms, but now it happened at home through videos made by teachers in this project. It was started with four classes initially but later all classes were included in the project. The purpose of the project was to develop self-regulated collaborative learning capabilities among school students. The project was designed with two phases: "*self-regulated questioning*" and "*practice showing*". All the students used tablet PC in their learning. The result of the study revealed that the learning capacity and consciousness of problems of students had improved. Teachers of that school started giving importance to personal learning of students and their professional required skills were upgraded and the level of education of the school was overall enhanced.

Countries like Korea, the United Arab Emirates, and Singapore initiated smart education projects for the development of their education system. These countries proposed world-class teaching-learning environments using advanced digital technologies. It aimed to encourage students to engage more in learning and develop critical, creative, and innovative thinking. It developed digital literacy among teachers and students. Smart technologies make them technologically equipped, expert, active, and competent (Zhu et al., 2016). In that case, it can be said that this type of project is likely to be successful in India as well. The Indian education system can be further improved. Although some efforts have already been made in India, they are lagging behind due to some obstacles.

### **8.3 Teachers with ICT Competency in Smart Education**

In this age of change, new discoveries are being made in the field of technology every day; in this case, teachers also need to have knowledge of modern technologies. Knowledge of modern technologies will help the teachers in teaching students and make them understand the content clearly. ICT supports both students and teachers in the process of effective learning with the help of learning aids like computers, etc. (Jorge et al., 2003). The role of the teacher has changed with the spread of ICT and more will come in the coming days. A teacher of tomorrow, with the

knowledge and competence of ICT, would design a lesson plan and content presentation technologically. He/she can deliver lectures with the help of advanced ICT tools which will help the pupils. Hence, teachers need to be trained and ICT equipped. A teacher must have knowledge of technology for skill and professional development. Inclusion of ICT in teacher education has become essential.

Application of ICT in education is successful when teachers are skilled and empowered through ICT. It does not depend upon the advanced software, it depends upon how a teacher can be influenced and empowered by ICT to use those advanced hardware and software, observed Yuen et al. (2003). If necessary arrangements, equipment, and technological support are provided to the teachers, and they are able to develop ICT classes and can change and formulate the course structure and format assignments for students (Watts-Taffe et al., 2003). According to Lau and Sim (2008), ICT promotes learning deeply and teachers can fulfill various academic needs of different learners at any level. A teacher should learn how to use modern technology at the time of teaching in classrooms and he/she should learn from the student's perspective, how technology can be integrated with classroom activities to enhance learning (Tezci, 2011). Therefore, to further engage students in classroom activities and develop effective lessons for the students, teachers have to use ICT in a productive manner with creative thinking (Honan 2008; Birch & Irvine, 2009). Integration of technology in pre-service teacher courses enables teachers to learn how to use technological tools in the enhancement of their teaching quality and the learning of students (Chai et al., 2010).

#### ***8.4 Learner-Centric Aspect of ICT in Smart Learning***

Educational technologies help learners to demonstrate their new ideas, explain their thoughts, and transfer information in a learning environment. ICT promotes a constructive approach to learning activities. Students get opportunities to make contact with teachers and other students and also have a conversation. They can access various sources of information. With collaborative learning, learners can deal with issues, and decode and resolve them (Gredler, 2000; El-Amin & George, 2020). Few skills and abilities which should be developed by the students through which they can gather information using the Internet, synthesize them, and can draw inferences (Sampath et al., 2007). The skills include basic knowledge of computers, multimedia software, Internet, net surfing techniques, storing and retrieving data, and communication with other persons. ICT can provide creative learning (Fu, 2013), and it develops new understanding among students (Chai et al., 2010). ICT helps to develop skills of critical thinking among students (McMahon, 2009; Fu, 2013). ICT offers collaborative learning, students can work together which enhances their learning capacity (Rodrigues, 2002; Suryani, 2010). Rodrigues (2002) says that effective learning happens when students are interactively engaged in a learning task.

## 9 ICT in India

For many years, India has used technology in education under the moniker of education technology. Computers, radio, television, and telephone are examples of educational technology. With the advancement of new breakthroughs and advanced technology, a new term ICT (Information Communication Technology) emerged. The Internet is a crucial communication technology tool. The Internet has been used in India for a long time, and it was first identified as ERNET (Educational Research Network), observed Sampath et al. (2007). It was not available for the general public, because it was created solely for educational reasons and was only available to educational research communities. In 1975, the Kerala government, in partnership with AIR Trivandrum, launched a radio-cum-correspondence program for teachers. It was a professional development program for in-service teachers. The “Teach English” program for primary school teachers was launched in 1976 by AIR Ahmedabad in partnership with State Institute of Education (SIE), Ahmedabad, and H. M. Patel Institute of English, Vidyanagar. AIR Madras began airing two programs per month on various topics such as science, history, mathematics, geography, education technology, and so forth. As a result, AIR Pune began broadcasting programs to assist unskilled elementary school teachers with the assistance of the state (Goel & Jaiswal, 2000).

With the expansion of television networks, more educational programs were introduced. ETV programs for students aged 5–8 years and 9–11 years and also for school teachers were launched by the Central Institute of Education Technology (CIET) and National Council of Educational Research and Training (NCERT). There was a University Grant Commission (UGC)-sponsored program named Country Wide Classroom (CWCR) for university students which was telecasted in 1984. To study the effectiveness of CWCR, the “talkback” program was conducted by UGC and ISRO from November 25–30, 1991. Eight centers in total were selected for that program. Out of eight, two centers in Jodhpur and Imphal were connected through the Delhi studio and the other six centers were connected through a telephone network (Goel & Jaiswal, 2000).

### A Few More Instances of ICT Initiatives in India

- An experiment program named SITE was launched in India in the year 1975–1976. The purpose of the program was to broadcast educational programs in 2400 villages in India. The experiment was done through the distribution of 500 television sets in villages. States like Andhra Pradesh, Rajasthan, Karnataka, Gujarat, Odisha, etc., were selected. Television programs were telecast for rural students of class I to class IV.
- EDUSAT is the satellite that was launched in 2004 by ISRO to meet the demands of the educational sector focusing on distance education. The INSAT satellite was launched in 1981 to telecast educational programs.
- IIT Kanpur has launched an online platform called “Brihaspati”. It was developed by the education and technology research group of IIT Kanpur. This

platform was created to enhance learning through learning, discussing, and sharing study material online (Bhattacharya & Sharma, 2007).

- The National Program for Technology-Enhanced Learning (NPTEL) project was started by Ministry of Human Resource and Development (MHRD) in 2003 to provide quality education in engineering. Some video courses and e-courses were developed. The program was launched by the joint collaboration of seven IITs (Indian Institute of Technology) of Delhi, Madras, Mumbai, Roorkee, Kharagpur, Guwahati, Kanpur and Indian Institute of Science (IISc) Bangalore.
- From 2005, to create an ICT lab in all government schools, the Government of India started the ICT program “BOOT” (Build Own Operate Transfer).
- In 2007, the Centre for Distance Engineering Education Program (CDEEP) was launched by IIT Mumbai. Under this program, interactive classrooms were created through interactive satellite technology.
- In 2012, the UP government launched the “free laptop distribution scheme.” Under this scheme, free laptops were given to high school and intermediate pass out students to encourage them toward higher studies.
- ICT initiatives such as E-Gyankosh, GyanDarshan, GyanVani, and various other distance education programs have also been launched in India (Shradha & Budhedeo, 2016; Biswas, 2021).

## 10 Challenges to the Implementation of ICT in Education

Undoubtedly, ICT has the capacity to improve the education system and can accelerate its development, but there are many impediments to the implementation of ICT in India. In this section, authors talk about those challenges. For this purpose, authors consulted a good number of academicians, education experts, and a few government officials. On the basis of the data collected from these resource persons, a total of 11 most common challenges associated with successful implementation of ICT in the education sector in India are listed below.

1. Illiteracy is one of the major problems in the development of ICT education.
2. Lack of knowledge and training in ICT.
3. Teachers are not properly trained in ICT. ICT does not exist as a separate subject in every school. So trained teachers are rare in schools, teachers have to take a number of classes in a day, and they are bound to do multiple tasks in school. Hence, they do not have the time or interest to teach a new subject and different subject, that is, ICT.
4. Shortage of schools, shortage of classrooms, especially in rural areas.
5. Lack of interest in ICT. Sometimes it has been seen that schools and educational institutions are not interested in implementing ICT in their institutions. They fail to perceive the need of ICT in education.
6. Lack of infrastructure. Lack of computers and accessories in schools.
7. Lack of accessibility of facilities by the beneficiaries.

8. Lack of computer labs in schools.
9. Lack of teaching aids. Teaching ICT is not possible without updated equipment. Computer, software, educational database, Internet connections, etc., which are not made available in all schools.
10. Problem of insufficient funds in schools. Many schools suffer from financial problem. ICT tools like computers and accessories, software, and hardware are not affordable for all schools.
11. Language is also a barrier in the educational development. A large proportion of educational software are in English, and resource materials are in English. In developing countries like India, the English language is a barrier for a rural student, so they cannot get benefits of ICT.

## 11 Conclusion

E-learning has occupied a central role in the education landscape during COVID-19. These changes were about to happen, but the pandemic gave an additional impetus and a greater sense of urgency. Educational technologies were adopted by various educational institutions with an experimental mindset. This allowed organic possibilities for customizations and developing unique competitive advantages for institutions. However, certain issues should not be overlooked. Especially, digital inclusion and equity are vital for a country like India that has got millions of people lacking handheld devices or Internet for accessing e-learning (Ward et al., 2021). The urgency to adopt e-learning also meant uncritical inclusion of content and learning methodologies, some of which might not fit with Indian ideals of education. Application of ICT in education has a significantly positive impact on the learning process (Nair & George, 2016). ICT facilitates the accessibility of education by breaking geographical barrier. Educational development can reduce the gap between rural and urban areas (Djan & George, 2016). Rural schools need to develop, and it is only possible with the help of ICT. Talented students are available in large numbers in rural India, but still a large section of them do not have access to modern technologies; hence, they miss the opportunity for a bright future through ICT. Those learners mainly need opportunities, which can only be possible through the utilization of ICT in a proper way in rural schools in India. Not only in rural schools, the same scenario exists in schools of towns and cities. Many school managements are still not aware of the benefits of the use of ICT in education; as a result, they still depend on written material, textbook, and class notes.

Since education provides a platform for people in socio-political, cultural, and economical mobility, the barriers in the education system must be removed. The ICT-enabled education system can bring democratization to the field of education in developing countries. For the development of the Indian education system through smart learning, a few suggestions are proposed below:

1. Use of Internet can cover up this gap. Sitting at home, a student can get knowledge or guidance on any subject, by using the Internet, online coaching, online course, or directly from teachers through Skype.
2. Easy access to the Internet and digital technologies must be provided to teachers and students and academic staff to run the education system smoothly. Internet facility, digital infrastructure like smartboard, and projectors must be provided in classrooms, schools, colleges, and teacher education institutions. It is also necessary to make digital content available for both students and teachers.
3. Teachers should have the skill and competence to use advanced digital technologies for clear presentation of content, to provide quality teaching which leads to a higher level of learning for students.
4. Schools should have their own website.
5. Students should be familiar with the basic concept of ICT. Both the teachers and students should have basic knowledge of computers.
6. Computer, software, educational database, Internet connections, etc., are not available in most of the schools. All these should be made available, so that students can take full advantage of them.
7. Schools should give importance to class lectures through PowerPoint presentations, this will help students in memorizing and understanding the subject matter. They should conduct educational programs through video conferences.
8. In rural areas educational training programs and ICT training programs should be in local languages so that people can understand them easily.
9. ICT must be implemented in teacher education for capacity building of teachers that will help them to make new teaching strategies, and lesson plans in an innovative way and to convert an ordinary class into an interactive and interesting class. Wide use of ICT and its successful integration into teacher and student education will make the future better.

In developing countries, there are many hurdles in the betterment of the education system. Barriers like poor infrastructure in educational institutions, language problems, poor socio-economic conditions, lack of good teachers, lack of resources, and lack of job opportunities cause students to drop out. In India, ICT could be the solution to these impediments that prevail in society. A lot of the ICT models were developed pre-web 2.0. These models did not give credence to the social nature of virtual learning. Also, the possibilities of decentralized knowledge centers and credential authentication brought about by block chain-based technologies needed to be factored into any ICT model in education. Finally, our study takes into account the Indian realities. This study recommends ICT adoption in the Indian education that takes into account both the reality of India and the evolving nature of educational technologies. In India, technology-based instruction largely bypassed the legacy of the Learning Management Systems which popularized online education in the west. The findings of the study may contribute to more clarity regarding approaches toward enhancing student learning outcomes at the business unit level (school/college). To conclude, it can be inferred that ICT provides broad support to all the stakeholders and can make a roadmap to achieve the goal of developing the

Indian education system through smart learning with the help of successful application and implementation of ICT in education.

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# Chapter 17

## Information and Communication Technology Tools in Language Learning Classroom: Developing Metacognitive Skills and Its Social Ramifications



Arjab Roy and Ambalika Guha

**Abstract** This chapter focuses on some of the crucial pragmatic concerns associated with a group of passive, non-interactive, and non-performing ESL (English as Second Language) learners (our target learners) in multi-lingual classrooms. It broadly investigates the ways in which metacognitive skills (Flavell JH, *Am Psychol* 34:906–911, 1979) of the identified group of language learners are developed through certain task-based activities and by the usage of information and communication technology (ICT) tools. The chapter describes those language-learning strategies that modern smart technology supports and helps the learners to develop individual autonomy. The learners' autonomy facilitates the process of self-regulated learning. The subject learners are B. Tech students from two institutions in India, one is Adamas University (Kolkata) and the other is Indian Institute of Information Technology (Guwahati). The chapter follows a combination of experimental, descriptive, and analytical methods to formulate its observations and arguments. From the learners' responses to different task-based activities aimed to enhance their listening, speaking, reading, and writing skills, that were conducted twice—without and with ICT tools—the chapter deduces that ICT-based language teaching empowers the target learners, offers them alternative strategies to claim their space within the educational fold, and articulates their self and aspirations. This model, for further results, may be specifically tested across Indian classrooms on learners belonging to marginalized sections of India. The chapter is divided in the following sections—first, it situates the problem that challenged the authors intellectually; the second section highlights the research gap in the existing ICT-based language

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learning literature and poses the research questions; the operative relationship between ICT tools and critical thinking is discussed in the third section; in the fourth section, we propose metacognition as an effective language learning strategy; finally, the fifth section states the implication of the current research.

**Keywords** Language learning · ICT · University students · Critical thinking · Metacognition

## 1 Introduction: The Problem at Hand

This chapter emerges from the recently encountered challenges by both the authors while teaching courses titled as “Communication Skills Practical” and “Professional Communication” at Adamas University, and “English” at IIIT-G to heterogeneous learners specializing in technical education. All of these courses are oriented toward the Teaching of English as Second Language Acquisition (TESLA). The chapter investigates into the language learning strategies that technology supports and helps the learners to develop self-regulated learning.

There are numerous challenges that both learners and educators face with TESLA especially in the context of the education system in India where the classrooms are filled with heterogeneous learners. The heterogeneous learners in India are composed of multi-lingual and multi-cultural students who belong to diverse social categories such as gender, religion, and caste, and also to different economic strata. They hail from a curious mix of different and sometimes largely uneven educative institutional cultures. Further, they display varying levels of competence in language communication in general, and English language communication in specific. Altogether, they reflect and embody the complex differential phenomenological histories within the ambit of education.

It may be noted that due to the varying intensities of the global Covid-19 pandemic, the teaching-learning mechanism at both the institutions at that time was being conducted in the virtual mode through the usage of Information and Communication Technology-based tools. Apart from immediate challenges that threatened continuous seamless teaching-learning processes, such as, the digital divide, disparate and incommensurate life conditions at homes, the authors faced daunting tasks of being unable to reach out and communicate with a group of students who remained inert during the class sessions. The conventional strategies of attempting to ensure their participation in most of the learning, assessment, and evaluation procedures proved futile.

While the authors had received feeble responses from the target learners in a number of task-based activities, it was a “story-telling task” that struck chords with the learners. During the “story-telling task” (assessing coherence and cohesion of ideas among the learners) that was conducted twice—without and with information

and communication technology (ICT) tools—it was observed that during the former, the target learners showed memory failure, difficulties in mapping contexts and events, lack of comprehension about the text generated by the previous participants, and that culminated in the overall failure to understand the text narrative. However, later when the same task was executed with image cards, and power point presentation over a Learning Management System (LMS) platform, the target learners could successfully fulfill the assigned tasks. During self-assessment, they unanimously chose visual perception as a stimulus that facilitated in understanding, remembering, analyzing, applying, and creating their knowledge level. It was the first time that the learners not only participated in the activity, but were also actively engaged in self-assessment and evaluation processes. They finally opened up and started regularly articulating themselves in the teaching-learning sessions.

The above instance and the outcomes that it generated actually led the authors to furthermore dwell on the relational aspects of ICT tools in inducing the metacognitive faculties of the target learners. It has been found that ICT-based language teaching meta-cognitively empowers the target learners, offers them alternative strategies to claim their space within the educational fold, articulates their self and aspirations.

## 2 Research Questions and Research Gap

This chapter stems from a common concern of the authors for learners who appear passive and inert during classroom-based teaching-learning sessions. Thus, the research question or problem that the chapter engages with is fundamentally practical in orientation. It aims to explore ways of ensuring increasing involvement in the teaching-learning process through the usage of ICT to achieve maximum participation of the target learners. Therefore, the chapter focuses on some of the crucial pragmatic concerns associated with a group of passive, non-interactive, and non-performing ESL (English as Second Language) learners (our target learners) in multi-lingual classrooms. It broadly investigates the ways in which metacognitive skills (Flavell, 1979) of the identified group of language learners are developed through certain task-based activities and by the usage of ICT tools.

The problem compelled the authors to ponder and introspect on the theoretical and practical-pedagogical formulations in the field of TESLA which interacts heavily and regularly with the domain of ICT in language learning. It appears that the philosophical-theoretical debates on the role of ICT in the language learning domain (Warschauer, 2002; Thorne & May, 2008; Widodo et al., 2017; Pasternak, 2020), and the practical-pedagogical challenges involved therein (Chambers et al., 2004; Kenning, 2007; Calderon, 2020), have hitherto remained focused solely on motivated learners. Motivated learners are those who regularly interact, engage actively in tasks and activities given by the educator in the classroom and outside, take the assessments seriously to score or fare reasonably or comparatively well, and thus are able to achieve either all or most of the learning objectives. The levels of competence in any subject for the motivated learners also tend to remain high. However,

the passive, non-interactive, and non-performing learners (our target learners) in the classroom have remained discursively excluded from the foci of the researchers. As a result, there is a dearth of academic literatures on how to enable the inert learners to be more active. Thus, it was an imperative for both the authors to turn their attention toward the latter—both in terms of pedagogic practice and situating the specific pedagogic experiences in the backdrop of theoretical approaches toward education. It is probably a no brainer that for the authors, the immediate challenge was to devise pedagogic strategies and make sincere repeated attempts at involving the target learners to engage in the everyday institutional educative process for obvious reasons. It was only much later that the idea of publishing the experimental findings, observations, and conclusions seemed important to be shared with the larger academic fraternity.

### **3 Information and Communication Technology–Based Education and Enhancement of Critical Thinking**

ICTs are defined as a “diverse set of technological tools and resources used to communicate, create, disseminate, store, and manage information” (Tinio, 2003). ICT tools and services include “web based and non-web based resources” (Alkamel & Chouthaiwale, 2018)—Internet dependent digital platforms that function as knowledge repository outlets belong to the former whereas devices like computers, mobile phones, tablets, and broadcasting technologies like radio and television, among others, belong to the latter.

With rapid strides in the global technical and digital advancements, newer ways, avenues, and modes of learning have emerged. ICT services and tools have assumed the formal incorporation into what is understood to be smart education that thrives on modern existing and emergent technologies of customized learning. The new smart technology enables education to be more learner-centric, where the learner can exercise principal choices in the elaborate knowledge acquisition procedure, and secure autonomy to take responsibility of the learning process. As a result, the learner emerges as a key agent in the field of education.

Through the meeting of individuated requirements or customized formations, smart technology provides several alternatives in terms of knowledge sources for prospective learners to engage in learning activities. Consequently, it increases the learners’ participation and also promises ample scope for the learners and the learning process to be interactive. Thus, ICT-based smart education has transformed the landscape of education by replacing the erstwhile lecture based and the teacher-centric process of knowledge exchange. With the sole focus on the learner, smart education seems to provide the former with increased motivation. Two contrasting features appear to operate simultaneously in this field—one, fragmentation of knowledge and atomized individualization of the learner, and two, assembly of fragmented knowledge to generate an impression of a “holistic” view of knowledge

content, and cultivation of academic solidarity by “interpellation” (Althusser, 1970) of the learners within crystallized communities. ICT as a support for smart education provides several benefits, such as easy access to reading and other study materials, continuation of learning outside the classroom space, and online discussion forums, which enable teachers and learners to render the study process more flexible and focus on the principle of individualization based on different interests, levels of competence and expertise, and needs.

Apart from the pedagogic advantages offered by ICT-mediated instruction, the faculty of critical thinking can be developed as learners engage with tools, discuss, experiment, collaborate, make decisions, and solve problems using various tools (McGuinness, 1999; Wright, 2010). Moreover, in ICT-mediated learning, the control on the entire learning process consisting of aims and objectives of a particular lesson, the specific kind or sort of information and knowledge that needs to be accessed, the time factor as to when it would be accessed, the utilization of the information-data-knowledge, securing the outcomes of the learning, and qualitative and quantitative assessment and evaluation of the learning rests on the learner. ICT-mediated education establishes a self-regulated learning process, where the learners are aware of what, why, and how they are learning. Technology-based learning (in particular, e-learning) enables the teaching-learning process to be more flexible as it takes into consideration the needs of different learners depending upon their levels of competence—basic, intermediate, and advanced levels. They can plan, monitor, and evaluate their own learning process. The minute constitutive process adds on to the critical thinking capacity of the learner in this case.

In order to develop critical thinking skills and analytical skills, the learning environment needs to be conducive and learner friendly. ICT tools like various learning applications, different types of software, videos, images, audio files, power point presentations, among others, simulate a “constructivist” classroom wherein the learners can engage in long-term learning processes, constructing their own learning by asking questions and finding better approaches to solve the problems. The ICT-mediated classroom makes the learning process more interesting as ideas and information can be presented in different forms such as images, video clips, audio clips, tables, graphs, and even multimedia. The emergence of the World Wide Web associated with Internet has compelled stakeholders within the academia to invent new forms of learning that would add significantly to the creation of learner’s autonomy and its enhancement as well. As noted by Ghasemi and Hashemi (2011) “Learners can take all the decisions concerning their learning: determining targets and objectives, choosing contents and materials, selecting methods and techniques, organizing their learning and assessing their progress.”

Considering that this work focuses solely on English as Second Language Acquisition (ESLA) and TESLA, it may be claimed that ICT provides the language learners the opportunity of real-life exposure to the technical and socio-cultural aspects of language communication by giving them an insight into those who speak the target language as their native language. For example, through digital platforms such as emails (Gmail, Yahoo, Hotmail, etc.), social media outlets such as Facebook, Twitter, Instagram, Snap Chat, Face Time, professional networking sites such as

LinkedIn, and other video conferencing applications such as Google Meet, Zoom, and Cisco Webex platforms to name a few, language learners can interact with native speakers and this enables them to understand the communicative culture of the target language speakers.<sup>1</sup> That in turn facilitates the language learning process for non-native speakers. ICT tools such as interactive whiteboards, power point presentations, video clips, and images provide stimulating visual aids as a productive strategy to support the comprehending, understanding, and using of the target language in real contexts.

In ICT-mediated learning, the learners have freedom to access information and control their own learning speed. It makes the language learners aware of the whole learning process. The learners can consciously adopt preferable language learning strategies as per their need. This further intends to establish a more action/outcome-based learning.

Language learners choose to operationalize thoughts & actions in carrying out multiple tasks beginning with rudimentary learning to advanced linguistic performance (Cohen, 1996).

While using technology to plan their learning goals and outcomes, the learner becomes aware of one's own cognitive process, which further inculcates self-regulation of learning objectives and active monitoring of the learning process. Thus, the arena of language learning and knowledge acquisition gets invested with neural vectors with the predominant intersection of a complex network involving cognitive, supra-cognitive, and metacognitive practices for the fulfillment of broader goals.

## 4 Metacognition as a Language Learning Strategy

The strategies adopted during the course of English Language Acquisition for L2 learners began to get academic attention from the mid-1970s (see Anderson, 1991, 2002; Cohen, 1998; Hosenfeld, 1978; Macaro, 2006; Oxford, 1990). Learning strategies are techniques for understanding, remembering, using information that are consciously controlled by the learner (Pressley & McCormick, 1995; Oxford, 1990). Language learning strategies involve direct strategies and indirect strategies. Direct strategies include memory strategies, cognitive strategies, and compensation strategies; indirect strategies include metacognitive strategies, affective strategies, and social strategies, as mentioned in Taxonomies of Language Learning Strategies (Oxford, 1990). Zhang and Goh (2006) state that those learners who are equipped with metacognitive skills are able to plan their learning in advance, monitor it during the task performance, and evaluate their learning after the task accomplishment. Such forms of metacognitive skills cause shifts in the learning process to a more

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<sup>1</sup>Globally renowned institutions offer specific courses for prospective learners who can access them from any part of the world. Some of these courses are also digitally archived in streaming platforms such as YouTube.



outcome based and learner-centric one, where the learner through an active agency takes the responsibility of his/her learning methods. These kinds of strategies involve thinking about learning processes, planning, monitoring, and evaluating learning. Metacognitive strategies are found (in the literature of language learning strategies) to be more effective than other learning strategies. The language acquisition proceeds at a faster rate as the learner self-regulates the learning process (Anderson, 2002).

Papaleontiou-Louca (2003) states that metacognition means cognition about cognition. If cognition involves perceiving, understanding, conceptualizing, and remembering, then metacognition involves thinking critically about one's own perceiving, understanding, conceptualizing, and remembering. It further involves reflection upon one's own action. Metacognition helps in monitoring one's own learning process through four stages (as noted by Flavell, 1979): (i) metacognitive knowledge, (ii) metacognitive experiences, (iii) goals (or tasks), and (iv) actions (or strategies). Flavell (1979) redefined metacognition as individuals' information and awareness about their own cognition.

Metacognition can be understood in two levels: metacognitive awareness and metacognitive strategies. Metacognitive awareness is the learners' knowledge about their learning, while metacognitive strategies refer to learners' regulation and management of their learning which encompasses a wide range of activities: selecting the most useful strategies for a particular task; planning, monitoring, regulation, and evaluation of learning (Schraw et al., 2006).

In the case of ESLA, the setting of the primary goal from a particular lesson, that is in turn based on the immediate task at hand, and the practical actions that are required to achieve that goal need to be decided in advance. The learners, who adopt metacognitive strategies, while setting the goal, have to consider the following:

- The goal has to be specific
- The goal has to be quantifiable or measurable
- The goal has to be attainable
- Therefore, the goal has to be realistic
- The goal has to be time-bound

Hence, it is implied that metacognitive strategies in language learning requires conceptual and practical clarity. It has to pass through careful planning and continuous assessment and evaluation of the total process itself. For an L2 learner, the metacognitive skills, "the conscious control processes such as planning, monitoring of the progress of processing, effort allocation, strategy use and regulation of cognition" (Papaleontiou-Louca, 2003) are of supreme importance.

Practitioners of TESLA advocate a number of context-dependent metacognitive conventions and strategies for successful concretization of learning objectives, aims, and goals. In 2021, during an online faculty development program conducted by the Amity University (Tashkent), one of the speakers, Shravasti Chakravarti, cited situational examples such as, if an L2 learner wished to improve on the possessed competence in writing skills, then s/he could practice 15 min of free writing daily for a duration of 1 month. Similarly, if the learner wanted to effectively boost

the confidence level, then s/he could practice speaking for a month by standing in front of a mirror so as to critically observe and chart the changes in the body language. What may be understood from these examples is that there is an imperative for the learner to have knowledge about what the tasks enumerated above as sample specimens entail and how they may be performed so that the results can translate into desirable outcomes. Such understanding however further raises key critical philosophical questions regarding the conflicts between Chomsky's Universalist paradigm that is heavily influenced by Kantian philosophy of Enlightenment and the British Empiricist philosophy. While the former argues for the hitherto availability of metacognitive knowledge within the learners' minds from pre-existing metacognitive experiences, the latter envisages the idea of the learners' minds being primarily empty slates or (the *tabula-rasa*).<sup>2</sup> Extrinsic thoughts, knowledge, and experiences shape the metacognitive abilities in them by the constitutive formation of impressions.

The digital era has reconfigured the earlier formal ways of acquiring, nurturing, and practicing cognitive as well as metacognitive skills such as listening, reading, speaking, and writing. The print technology was earlier historically essential in exposing learners right from their infancy to the four enlisted ways of acquiring the cognitive and metacognitive skills. These ways have been subsumed and accommodated within the ambits of the new digital technology in the contemporary times. As part of language learning processes, ICT tools and services play key roles in constituting assistive frameworks that fundamentally help learners, especially the passive, non-interactive, and inert ones,<sup>3</sup> to develop metacognitive skills. This is evident from the observations and data spanning a period of 6 months to a year, as available with the authors on account of their practical experiences in teaching.

The subject learners in this case are students from technical fields, engaged in B. Tech courses in two academic institutes of India—one is Adamas University (Kolkata) and the other is Indian Institute of Information Technology (Guwahati) (IIIT-G). For the study, B. Tech students of Adamas University Kolkata and IIIT-G have been considered. At the former, the learners are offered communicative English courses in two consecutive semesters whereas at IIIT-G the course is offered only for a semester.<sup>4</sup> The primary goal for providing such courses is to improve the verbal English Language proficiency of the learners and the courses involve mostly listening, speaking, reading, and writing (LSRW skill-set) training practices through providing the learners exposure to Indian and global audio content from an eclectic mix of sources such as TED Talks, news clips, interviews, panel discussions, group discussions, role plays, debates, oral presentations, pronunciation practice, voice

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<sup>2</sup>The given debate is beyond the scope of this work.

<sup>3</sup>There could be multiple reasons for the said inertness but the scope of the work does not include dwelling on the matter, except for a brief observational comment that there is a predominant lack in cultural continuity with knowledge content and materials that fall under the purview of the print technology.

<sup>4</sup>The courses are titled as "Communication Skills Practical" and "Professional Communication" at Adamas University in consecutive semesters, and "English" at IIIT-G

and accent training, writing exercises in the form of creative pieces, and technical reports (journalistic writing, content writing, company reports, etc.) among others.

To show how ICT helps in nurturing metacognitive skills of language learners, the authors have taken into account four task-based language learning activities—covering listening, speaking, reading, and writing skills—that we have implemented in the communicative English classes at our respective institutes. Now, we will discuss these tasks by describing what they entailed, noting our observations regarding the performance of the learners, takeaways from them, and finally drawing summary conclusions from the entire experience of the learners. The first task which we will discuss is a story-telling task.

### ***4.1 Activity 1: Story Telling Task***

One of the most conventional and well-tested activity in a language learning session for L2 learners involves the “story telling task.” This task effectively teaches the significance of coherence and cohesion of ideas while speaking and listening.

In this task the learners in the classroom were arranged and distributed in small groups. Members of each group had to create and construct stories. This task was conducted twice—first without the usage of any ICT tools and services, and then in the second instance, it was conducted by using ICT tools and services. During the first time, the different groups of learners were asked to choose themes of stories on their own by consulting the group members. There was a strict restriction on the usage of Internet in order to search for prospective topics. Once the learners had agreed upon a specific theme, they were asked to build a story or plot based on the agreed theme. During the story-telling session, a learner was required to utter a few sentences following what the previous learner had said.

We noticed that the learners had difficulty in understanding, remembering, and using the information that the immediate previous participant had articulated. In most cases, the learners failed to identify the context in which the story or plot had originated. Further, they failed to mentally map the events narrated in the story. Later on, the restrictions on the usage of ICT tools and services were withdrawn. The learners were asked to collectively collaborate in groups on the story telling task by using ICT tools, services, and features. In order to come up with the stories, the learners were provided with the freedom to use audio-video clips, image cards, and power point presentations, among other ICT tools.

In the next class, we noticed that one group of students prepared a power point presentation, wherein each member had their thoughts written down on each slide accompanied by images. They orally presented their story with the support of images, whereby the images were ordered sequentially following the storyline. The second group presented their story by displaying moving images, and the third group played the silent video clips in the background when each of the members illustrated their ideas, eventually creating a story. This entire process becomes interesting to observe while reflecting on the fact that images and video clips helped the

learners to understand, remember, contextualize the theme of the story better, and enunciate the story in a linear narrative format, which otherwise had been deemed difficult for them.

At the end of the task, the learners were given a worksheet where a number of reasons were pointed out for failing to perform the task without ICT tools, and for successfully executing it with the support of the ICT tools. The learners were asked to choose the reasons for the same as per their understanding of the task. We noticed that they unanimously chose visual perception as one of the abilities that helped them in understanding, remembering, analyzing, applying, and creating their knowledge level.

What we can derive from this observation is that ICT-based language teaching makes the learners aware of the knowledge, skills, and abilities that they have and do not have, and this helps them to strategically use those skills that they have to develop the skills that they do not have. Like in the story-telling task, the learners could develop their creative thinking skills (which they did not have) with the help of visual perception (which they have).

## ***4.2 Activity 2: Reading Comprehension***

Prof. Paul Gunashekar (2021) during the same faculty development program (mentioned earlier in the chapter) points out the following reasons for reading: (i) Reading is a means of extending our command of the language concerned; (ii) reading contributes most to self-dependence in learning; and (iii) reading should be valued not only as an educational tool but as a source of enjoyment.

For the reading exercise, we had chosen digital texts, which includes read aloud (synthetic text to speech) programs. The read aloud feature breaks the entire text into understandable chunks as the speed of the audio clip can be controlled. This also helps the learners to identify the key arguments of the text quite quickly and easily. This happens because the read aloud program supports the learners' understanding of the word image with the sound image, which further leads to the formation of sense of the text. On the other hand, silent reading involves only understanding the shape of the word image and forming sense out of that shape, which not only complicates but also delays the process of understanding the text.

We also chose texts which had illustrations as visual images capture the reader's attention and help him to interpret the written words better. By providing such texts to the learner, we expected two outcomes. The first was that the learners would make use of existing schemas while reading the words given in the text and the second was that the illustrations would help in modifying the existing schemas. For example, when the learners read the following text without the illustration, they had the following misinterpretations of the text. First, they thought that the driver and the conductor had separate identities (supports their pre-existing knowledge of the society they live in), second, they thought that the driver and the conductor were both males (again supporting their pre-existing knowledge), and they failed to identify the reference of the "she" in the second paragraph.

“The bus conductor careered along and ended up in the hedge. Several passengers were hurt. The driver was questioned by the police.”

“She was later congratulated on her quick thinking and skillful handling of the bus when the brakes failed.”

We presented this text in slide show. In the next slide, when the story was again presented with the illustration, the students could identify that the “she” was the bus conductor, who was also the driver. The illustration acted as a stimulus to modify their background knowledge.

Later, when we asked the students to bring reading texts of their own choice to the class, most of them brought digital comics which are accompanied with illustrations and they have in-built read aloud programs. The reasons that the learners gave for choosing e-comics and e-graphic fictions as texts are stated in the following text:

- i. Digital texts are easy to access and can be shared with others in no time over technologically aided platforms, like WhatsApp, Facebook page, Messenger, e-mails, and LMS platforms (CANVAS and Microsoft Teams).
- ii. Comics and graphic fictions bring humor in the reading process, which they otherwise think is a monotonous activity.
- iii. Small chunks of languages are used in comics and graphic fictions, which helps in easier comprehension.
- iv. Encourages imagination to think beyond the narration.

With the advancement of the ICT-integrated education system, more interactive and collaborative language learning environments have come into existence. Learner’s autonomy can be created through ICT-mediated education. An autonomous learner is assumed to take control over his learning management, cognitive process, and learning content. Control over the cognitive process consists of attention or awareness and reflection upon one’s learning process. Learning content means learning situations in which learners have the right to make decisions about their learning. A learner can be called autonomous if he can set learning goals; select appropriate learning strategies to achieve those goals; select appropriate materials and tools to initiate the learning process; and finally, can reflect upon the learning process and performance.

### ***4.3 Activity 3: Listening Exercises***

Listening skills account a relatively understated arena of focus in language learning classrooms, although its requirement and significance are both of supreme importance. This is not exactly the excerpt but the essence of a conversation back in the year 2019, between a faculty member of a University in India who was conducting faculty recruitment interviews for the institution and one of the authors of this work. For our classes devoted to enabling the learners to a wide variety of narratives ranging from the domain of creative to technical information and knowledge, the teachers had designed a listening activity whereby they handed out audio content across

topics such as sports, entertainment and culture, educational content belonging to the domain of science and technology, hard news such as national and global politics, from a wide array of websites and digital streaming platforms.

On one such occasion, learners were asked to consult the Internet and come up with material and content in the context of the ongoing war between Ukraine and Russia. The authors had mandated that these materials and content needed to emerge from Indian and global sources for the benefit of the learners in terms of getting an opportunity to listen to the English diction of India as well as the ones prevalent in some of the Western countries such as Britain, United States of America, Australia, New Zealand, and others. The immediate task for the learners was to listen to the audio content, note the words that are spoken in the context, categorize the key words into different grammatical categories, comprehend the affective implications of these categories, make an effort into charting a genealogy of commonly used vocabulary amidst the context of wars, understand the point of view of various stakeholders and groups associated with the war as per the information and knowledge sources, secure an insight into the perceptive reception of war itself from socio-political, economic, cultural, and psychological perspectives. Therefore, apart from technicalities associated with listening skills, cultural communication also plays an important role here. The learners were also asked to prepare a pool of words and expressions that were either foreign to them, or the ones whose meanings were not clear to them.

This task was handled differently by the multiple clusters of learners—those who possessed impressions about the history of the conflict could actually well follow the technical instructions of noting down key words and terminologies that are popularly used in media discourse. They were able to classify these words and terms into the various grammatical categories such as nouns, verbs, adjectives, adverbs, among others. Moreover, they could smoothly delineate the mental landscapes associated with the affective impact that these words, terminologies, and the grammatical categories overall had cast. From that the general majoritarian moods, senses, sentiments, emotions, feelings, and solidarity emerged quite clearly. It is perhaps quite easily comprehensible that these learners could well articulate the various angular perspectives regarding a war-like situation in general, and in the case of Ukraine and Russia's conflict to be specific. They could without any hindrance express concerns over the human costs of a war in general and the specific topic as well. In fact, they had cited supplementary content that they had consumed in different popular social media platforms. Such clear and deft handling of the instructions given to them along with the careful organization of the mandatory consultation of both nationally and globally produced content was definitely impressive. However, the interesting approach to the entire task was adopted by those who were either not at all acquainted or not that well versed with the given subject.

Due to some reason, may be out of peer pressure or on seeing some of the above-mentioned students' clusters, there were sections who also wanted to contribute to the fulfilling of the tasks. The latter quickly realized that they could not cognize the said topic as such and therefore identified the predominant lacunae in the knowledge gap or information gap between the event and their regular sense of learning self. They formulated a strategy of referring to the Indian content at first as that

would be positing them and the material content in a plane of similarity—cultural familiarity stemming from a shared sense of belonging. The learners therefore listened carefully to the content from India, mostly a couple of times, and tried to locate the unfamiliar territories and arenas at the beginning. Instead of focusing on what they knew or on pre-existing sets of information, data, and knowledge, they tried to consider words and expressions that they were unfamiliar with. In some of the cases, globally used key terms such as the NATO and some of the abbreviated forms of various agencies and organizations operating within the ambits of the United Nations were noted. Next, they consulted the globally produced knowledge material and content in order to compare their available knowledge pools. A crucial challenge that lay at that moment was deciphering the English diction and pronunciation. That was definitely a major hassle for these groups that they tried to negotiate with by reducing the pace of the audio and video speeches. Some of the learners tried to read the transcript by switching on the options for subtitles while focusing on the listening activity. Thus, on realizing that the voices, accents, diction, and pronunciation of English in the globally produced knowledge material and content was not familiar to the Indian ears, the learners proceeded to reduce the gap by making attempts of listening and reading simultaneously. Words, terminologies, and expressions that the learners failed to identify on listening, were effectively attempted to be read so that the final meaning was not completely lost on them. The learners adopted every strategy available so that they could understand the audio and video content. This was the technical negotiation that these learners felt could be strategized upon to draw a more comprehensive meaning and not remain in complete lurch with regards to the content.

Among those who were not well versed with the entire topic, there were groups of learners that had not been exposed to imagistic ideas of war. They tried to listen to the contents and materials for some time before realizing the fact that there was a significant connection gap between what they were listening to, and what knowledge they already possessed. To bridge that gap, they opted to exercise a strategy of connecting the dots by typing words such as “war,” “Russia-Ukraine war,” among others in order to perhaps secure some visual stimulation. They needed images, videos, and photographic materials on the thematic of modern-day warfare to be able to primarily imagine a context amidst which the topic was given to the learners for securing materials and content.

After these sets of activities, they proceeded to compile a set of items that they could not understand despite various attempts. Therefore, considering the significant gap between the knowledge materials, the historical impression of whatever was happening around the world, and the self of the learners, the learners actually made attempts to at least secure inputs in alternative forms. For example, when they could not aurally relate to the spoken words, they explored the chance of visually reading them—first silently, and then loudly to ensure cognitive registration of the word itself in their respective brains. On being allowed to consult online dictionaries, the learners proceeded to obtain the meanings of those words and expressions that were unfamiliar to them. Similarly, they referred to pictographic materials at the point of failing to assimilate the emotional affect and impact of a war-like crisis situation. The images, photographs, paintings, and videos often provide

supplementary sources of information and knowledge that probably posited these learners at the gateway of a deeper insight into the questions that were raised during the class.

Thus, it is quite evident that learners, especially the ones who are passive and inert, may be able to enhance their cognitive and metacognitive faculties by focusing on their predominant areas of weakness. It might be surmised that the ability to quickly assess one's level of knowledge is a reflection of strong metacognitive skill. In our case, we were dealing with undergraduate students but it is applicable for children as well. Blakey and Spence in their study on the metacognitive faculty and ability displayed by children opines that at the start of a research activity, children need to make conscious decisions about their knowledge. Initially they write, "What I already know about..." As children research the topic, they continue to verify, clarify and expand, or replace with more accurate information, each of their initial statements (Blakey & Spence, 1990).

In this task-based activity, these learners actually dwelt on the issue of unfamiliarity, complete lack, or little possession of what may be considered to be prior knowledge forms and realized that these obstacles had to be overcome. Hence, they proceeded along a certain trajectory to ameliorate their weaknesses. Making use of supplementary sets of information, data, and knowledge depending upon situational contexts was a strategy that they invoked to come to replace the conditions of non-familiarity. That allowed them, or rather empowered them, to think about the strengths and weaknesses of each learner, collate them in the form of clusters, and address the given issues so as to secure a successful redress of the problems. The entire phenomenological experience endowed the agency of the learner figure to evolve from a metacognitive sense of the term through the persistent response-based negotiations that had to be meted out to the given set of challenges. Thus the consistent usage of ICT tools and services and features actually facilitated the entire metacognitive journey of the learners in this case by constantly pushing and motivating them to solve the problems that they faced. Also, they had to continuously assess and evaluate not only their knowledge levels but also the available choices that would ensure a smooth progress in the fulfillment of the task-based activities. In fact, a solidarity among the learners emerged through these activities that ultimately crystallized to form bonds of friendship thereby ameliorating the competitive spirit that had earlier been noticeable among them. Thereafter, these learners actually could be observed to share class notes and other materials through interactive social media applications.

#### ***4.4 Activity 4: Writing Exercise***

One of the prime skills without which language learning sessions remain incomplete for any L2 learner is the writing skill. Apart from the significance in terms of the skill set, writing tasks and activities account for a substantial portion of the grading that happens in both Adamas University (Kolkata) and IIIT-G.



Keeping in mind the point of inspiring L2 learners to institutionally, culturally, and pedagogically develop their own selfhood and agency in the language learning process, the authors at first provided a glimpse into the world of a variety of writing cultures that are in vogue at the moment. Starting with creative writing under the purview of fictional writing, to exploring techniques of purpose-based technical writing—covering journalistic reports, opinion-editorials, popular features, reviews, content writing, issue and company-based compilation of reports, academic writing—the authors made the learners aware of the intricate processes that are involved in the act of writing itself. In the next class, the learners were given the task of selecting a topic or subject of their own choice. The learners could select topics from a wide array of available options such as education, entertainment, sports, cultural matters, travel and cuisines, etc. Prosaic written items belonging to the different categories had already been exhibited in the class from various media repositories, websites, and cyber-journalism platforms. They were discussed in the classroom so that learners who are not acquainted with the culture of reading newspapers and magazines could effectively gather impressions regarding their nature and form. When the learners were instructed to choose a topic, it was totally left on the individual learners to select subjects and topics of their own interests.

The process struck chords with the learners in the classroom as they were not compelled to write on any given topic that probably did not have any appeal for them. The process resonated with them and it was observed that the learners who have been already responding to the lessons proceeded to quickly begin writing on subjects and topics of their own choice. The learners who had remained inert in many occasions were on the other hand quite slow as they were observed to take time to think about a viable topic. It seemed to emanate a condition wherein they were allowed freedom and autonomy to exercise their choices for perhaps the first time. They pondered for about 5–10 min before beginning to start the writing process.

The topics that they covered stemmed from the areas of sports, cinema, environmental concerns, and latest developments in software technology. These learners wrote slowly in contrast to the already active bunch of students. In fact they wrote a sentence or two and paused thereafter to think of the next set of sentences. The inert learners seemed to have got the confidence of being able to execute the task a little late into the class session. One of the students in fact candidly confessed of not being given an opportunity to write on a topic of his choice since the start of the educational journey. Nevertheless, they proceeded to complete the task in the space of two such sessions.

During assessment and evaluation, it was revealed that the non-inert learners committed few mistakes here and there whereas the inert ones had more of them in comparison. But what was rewarding in these evaluative and assessment-based feedback is that the latter participated with more energy and vigor as they wished to know their errors, strategies to rectify and overcome them. Consequently, a self-critical, objective metacognitive perspective began to shape in each such inert learner. It may be admitted that these ICT tools and services-enabled knowledge apparatus actually got them converted into interested, non-inert set of learners at the end of the completion of the task, and self-evaluation and assessment of their own individual performances.

The entire paraphernalia of metacognition seeps into the learners causing a fundamental shift in the selfhood of these learners. Knowledge acquisition in general and language learning to be specific becomes a smooth process once they become aware selves—they begin to notice, explain, and understand the mistakes that they make. Similarly, they are also able to point out circumstances where they emerge to be correct in their judgements. Thus, critical thinking capacity and metacognitive skills in students receive significant boost from the strategies followed by the authors in letting the students execute task-based writing activities such as the one that has been described in the preceding text.

## **5 Conclusion: Implication of the Study**

The chapter has attempted to illustrate through practical task-based activities the key role and function of ICT tools and services in catalyzing the faculty of critical thinking and metacognition in inert, non-responsive learners in the context of ESLA classrooms at two institutions of India. The chapter has followed a descriptive-experimental-analytical framework for the moment. From the results or observations and conclusion drawn from the set of experiments, there is an implication that education in general and ESLA-TESLA to be specific should attempt to reconfigure the classroom composition by transcending the degrees of activeness and passivity shown by the learners. That would effectively ameliorate differences in the minds of the learners among themselves with regard to each other's proficiency and competence levels. The appropriate usage of ICT renders new vistas of possibilities in the academic measurements, assessments, and examination conventions followed by institutes of higher education. Based on a normative acceptance of learners who might be on the quieter side due to a variety of factors, the focus would be pointed on the learners as new ways of assessing their performances, levels of competence, and proficiency would emerge. A relook at the conventional uniform approaches toward assessments would perhaps yield effective results. Furthermore, it lays out the fact that various learners may adopt different legitimate pathways to fulfill the same objectives and achieve the same target goals.

The authors are aware that a quantitative research-based approach to the problems discussed in this chapter would be necessary for the next phase of this work. Moreover, the model of ICT tools and service-enabled facilitation in the inculcation of cultures of critical thinking and metacognition among inert, non-responsive learners in the Indian classrooms may further be explored to chart patterns of behavior exhibited by the learners from socially marginalized and subjugated groups. Spatial and temporal elements in such kinds of research problems may be often crucial. These awaited experiments and the results that they generate would hopefully be able to take this research further. The scope of the research will be extended and expanded, as and when deemed necessary, keeping in mind the questions and problems that future studies would seek to address.

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