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Role of Information & Communication Technology (ICT) In Sustainable Development of It/Ites Firms: Challenges and Future Prospects

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ABSTRACT

Technologies have revolutionized the individuals, corporations, communities, governance and economies to the great extent. In this research, the levels of information and communication technology (ICT) utilization as well as the issues that IT/ITES companies in Maharashtra, India confront are investigated. Variations in information and communication technology (ICT) adoption and integration among companies are investigated using a descriptive study approach and analysis of variance (ANOVA). The aspects that are highlighted include business size, industry, and geographic location. The findings point to considerable differences in the degrees of information and communication technology (ICT) use, with noticeable obstacles that impede efficient integration. These obstacles include the complexity of the technology and opposition from the organization. The results highlight the significance of creating individualized treatments with the goals of fostering technical literacy, facilitating organizational transformation, and improving resource accessibility. To successfully exploit information and communication technology (ICT) tools, which will drive innovation, efficiency, and competitiveness in the digital era while simultaneously supporting sustainable growth within the sector, it is essential for IT/ITES companies to address these difficulties.

Keywords: Information and Communication Technology (ICT), IT/ITES Firms, Maharashtra Technology Adoption, Organizational Performance, Digital Innovation, Sustainable Development

1. INTRODUCTION

IT, which represents information technology, is one of the monetary activities that is extending at the fastest rate in the globe (Mehta, 2020). It means to facilitate the progression of information at various levels and in the ideal example. With regards to the business area, information technology (IT) is gainful since it empowers associations to work all the more successfully and to produce the most noteworthy conceivable proficiency (Sikdar, 2020). There are a number of benefits that information technology may provide to your company, including the preservation of documents, electronic storage, and faster communication. The term "information technology" refers to the apps that run on computers, which are very important in almost every working setting (Bhattacharyya, 2020). Given the widespread use of computerized systems, it is beneficial for any organization to include information technology into their organizational structure. It is observed that the "primary slump" has given new opportunities to permitting the Indian information technology and information technology administrations business to go further and perhaps upgrade it (Sharma, 2020). This is despite the way that there may be different perspectives. Various specialist organizations were constrained to merge their tasks because of the stoppage, with the objective of augmenting productivity, effectiveness, and the use of assets, including the two individuals and equipment assets (Bhuiyan, 2023). In the famous discussion, the development of new troublesome advancements, for example, distributed computing, sustainability, and green information technology has been laid out.

1.1. Information and communications technology (ICT)

Clients can get to, store, transmit, understand, and control information using information and communications technology (ICT), which is an extensional term for information technology (IT). ICT puts an accentuation on the job of brought together communications and the coordination of telecommunications (phone lines and remote signs) and PCs, in addition to the fundamental endeavor programming, middleware, stockpiling, and varying media parts (Hossain, 2020). The combination of PC organizations, phone organizations, and varying media networks over a solitary cabling or connect framework is one more term that is utilized to allude to information and correspondence technology (ICT). There are critical monetary benefits related with the combination of the PC network framework and the phone network

framework by means of the utilization of a solitary brought together framework for the organization, conveyance, and cabling of signs. Any correspondence gear is remembered for the umbrella term known as information and correspondence technology (ICT) (Chatterjee, 2020). This incorporates radio, TV, cell phones, PC and organization equipment, satellite frameworks, and so on. Additionally, ICT includes many administrations and items that are related with these gadgets, for example, video conferencing and far off learning. ICT also encompasses analogue technology, which includes modes of communication such as paper communication, as well as any medium that delivers communication (Jain, 2020).

1.2. Sustainable Development of IT/ITES Firms

Within the context of the information technology sector on a worldwide scale, sustainability has evolved into an essential component of business operations. In the past, businesses operating in this sector concentrated the majority of their efforts on activities linked to corporate social responsibility (CSR). However, at the current time, investments in sustainability have begun to result in considerable returns and competitive benefits. The following is a list of some of the most important sustainability projects in the information technology sector in the year 2022. In order to collaborate with the COP 27Opens a new window, IBM, a world-renowned leader in artificial intelligence, cloud computing, and business services, was selected. Climate Change Conference of the United Nations, scheduled for 2022 (Mehta B. S., 2020). The firm demonstrated how consultation and technology may assist governments and companies in aligning the aims of their organizations with sustainability objectives while also complying with legislative requirements without having to make sacrifices in terms of revenues.

According to the National Institute of Standards and Technology, businesses that adopt environmentally friendly practices not only have the potential to make a positive impact on society, but they also have the potential to enhance organizational innovations and workplace morale, take advantage of tax incentives, become more marketable to consumers, and significantly reduce all of their energy costs (Tiwari, 2020).

1.3. Research objectives

- To ascertain the potential of use of ICT in IT/ITES firms in Maharashtra
- To identify the major challenges faced by IT/ITES companies during their day-to-day operations
- To investigate the influence that information and communication technology tools have on product marketing, sales, recruiting and selection, communication, and relationships with customers

1.4. Hypothesis of the study

- **Extent of ICT Utilization**

Null Hypothesis (H0): There is no discernible disparity in the degree to which information and communication technology (ICT) is used by IT/ITES companies in the state of Maharashtra.

Alternative Hypothesis (H1): There is a substantial disparity in the degree to which information and communications technology (ICT) is used by IT/ITES companies in the state of Maharashtra.

- **Challenges Faced in Integrating ICT**

Null Hypothesis (H0): IT/ITES companies don't experience any major obstacles while incorporating ICT into their daily operations.

Alternative Hypothesis (H1): IT/ITES companies encounter several obstacles while attempting to incorporate ICT into their daily operations.

2. LITERATURE REVIEW

Joshi, A. K., Matai, R., & Murthy, N. N. (2024) measured the influence of secondary data from 300 Indian MSME manufacturing firms' Prowess database on profit before depreciation, interest, tax, and amortisation. Utilising the design of experiment (DoE) approach, this framework was examined. The results of the research demonstrated a strong positive correlation between profitability and ICT investment (Joshi A. K., Measuring the impact of information and communication technology investment on the profitability of Indian manufacturing MSME, 2024). The purpose of this research is to forecast investment plans and optimise profit objectives by analyzing the various ICT investment levels. It is important to note that investing in ICT maximizes return at one million rupees. The sustainable business decision-making of MSME executives is aided by this finding. This research is specifically limited to the Indian environment, while various nations have different needs for enterprises. The results need to be verified using a wide range of operational factors and extended to additional firms with more information.

Rodriguez et al. (2023) analyzed that IT firms have given birth to innovative practices like work from home which reduces the wastage of time, transport, energy, spaces etc. Young people are increasingly freelancing, and there are more IT specialists and startups offering IT-enabled services. However, since the current infrastructure, such as technology parks, is primarily restricted to big cities, Pakistan must provide enough chances in a greater number of cities in order to further grow this industry. The promotion of ICT-enabled services in Pakistan would necessitate the development of effective human resources, which calls for ongoing professional development initiatives and skills development programmes.

Batta, A., & Kar, A. K. (2023) examined the optimal resource utilization, several organizations use information and communication technology (ICTs) to enhance the productivity and efficacy of their workforce. Although ICT usage has many clearly beneficial effects and advantages for businesses, there is a chance that workers may experience "technostress," or elevated stress (Batta, 2023). This research evaluates a model to determine the association between technostress and employee turnover in Indian IT organizations during a pandemic that increased workers' reliance on ICTs and caused stress. For this research, the "person-environment fit" model has been used to many dimensions. A global IT company used stratified sampling for primary data collecting. An inferential model was created and statistical tests were run. The results validate the model and provide light on the function, importance, and hierarchy of six factors related to employee attrition. The results unequivocally point to the existence of technostress brought on by ICTs and its consequences for worker attrition during a pandemic.

Mageswari, S. U. (2023) demonstrated that IT/ITS sectors have a great deal of contribution towards India's total economic development. The conventional financial performance metrics show that Indian manufacturing enterprises are in good financial shape. Innovation improves the performance of some Indian industrial companies, especially big companies. India has become a major Centre for global manufacturing, drawing businesses with its solid supplier base and inexpensive labor. The manufacturing sector is confronted with several issues concurrently, including low productivity, a shortage of trained workers, the shift to Industry 4.0, and so on. The use of ICT technologies has become essential in the digital age, and creative approaches like knowledge management may improve organisational performance (Mageswari, 2023). Therefore, this study uses structural equation modelling and mediation analysis to investigate how much ICT is used by manufacturing organisations, as well as how this usage affects innovation and organisational performance. Knowledge management (KM) serves as the mediator in this relationship. Although there is a little mediation effect of knowledge management (KM) according to the research, there is a large direct influence of ICT on innovation and organisational success.

IT firms have gained the momentum because they deal with large and complex data. As a result, green IT has emerged as a trend. Data centers are significant energy consumers, making their efficiency crucial for sustainable IT. Recent studies show advancements in energy-saving techniques. Zhang et al. (2023) highlight the use of AI and machine learning to optimize data center cooling and energy distribution, leading to substantial reductions in energy use. McGeoch et al. (2023) discuss novel approaches in green software development, including energy-efficient coding practices and the implementation of algorithms designed to minimize computational demands.

It is observed that IoT enables comprehensive environmental monitoring, crucial for sustainable IT infrastructure management. Choi and Kim (2023) highlight how IoT sensors can improve the efficiency of energy use and detect potential inefficiencies in real-time, thereby promoting sustainability. In addition, blockchain technology provides transparency and traceability, which are crucial for maintaining sustainable practices. Nakamura et al. (2022) explore how blockchain can streamline supply chains and support ethical sourcing and recycling efforts in the IT industry.

Lin, Y. C., & Park, S. D. (2023) comprehended how foreign trade, foreign direct investment (FDI), and human capital (FDI-HC and ET-HC) in the ICT sector impact Taiwan's steady economic development between 2001 and 2020. The two primary phases of the empirical analysis approach used in this research are as follows: First, it employs primary, data mining, and semantic network analysis (SNA) keywords that are associated with factors that possess authenticity and dependability (Lin, 2023). Second, it uses the vector error correction model (VECM) to look at the short- and long-term interactions between the variables. Using FDI and ET as keywords, data mining and SNA findings show that phrases related to HC have high degrees of centrality, clustering, and frequency. The results of this study suggest that the variables ET-HC and FDI-HC are valid and useful as interaction factors. Additionally, FDI-HC and ET-HC have favourable short- and long-term effects on GDP, whereas ET-HC has significant mid- to long-term effects on ET, FDI-HC, and GDP.

3. RESEARCH METHODOLOGY

3.1. Research Design

In order to determine the level of ICT utilisation among IT/ITES companies in Maharashtra, pinpoint integration issues, and examine the effects of ICT tools on different operational facets, this study used a descriptive research approach.

3.2. Research approach

A descriptive technique was used to assess ICT use in Maharashtra IT/ITES organizations. It included recognizing and comprehending the challenges of incorporating ICT into their operations and examining how ICT tools affect key operational aspects. The research used stratified random sampling to represent IT/ITES enterprises by size, industry, and location. A sample of 165 enterprises was sufficient for industry analysis. Key individuals at the selected businesses were given standardized questionnaires with closed-ended and open-ended questions to collect quantitative and qualitative data. We used descriptive statistics to measure ICT use and inferential statistics like t-tests and ANOVA to assess hypotheses. Ensuring informed consent and participant confidentiality were top priorities throughout the research. Despite probable response bias and the limited scope to Maharashtra, the study sought to provide light on the IT/ITES ICT scene.

3.3. Sample Population

This study focuses on IT/ITES employees in Maharashtra, who use ICT tools for various sectors. The sample includes professionals at various levels, including executives, managers, and technical staff. The population is diverse, encompassing both male and female employees, and includes employees from different companies. The aim is to understand the role of ICT in driving sustainable development and the challenges faced in this process.

3.4. Sample Size

This study aims to investigate the role of ICT in sustainable development in the IT/ITES sector in Maharashtra, focusing on 165 employees. The sample size is chosen to represent the diverse workforce and capture diverse perspectives on ICT utilization and its impact on sustainable development indicators. The sample size ensures robust statistical analysis and practical feasibility, allowing for meaningful relationships and differences in variables.

3.5. Variables of the study

Dependent Variables: The dependent variables examined in the study included:

1. **Product Marketing:** The effectiveness of product marketing strategies was assessed based on past performance and outcomes observed within IT/ITES firms in Maharashtra.

2. **Sales:** Sales performance was analyzed retrospectively to understand the impact of ICT utilization on revenue generation and sales growth within the IT/ITES sector in the region.

3. **Recruitment and Selection:** Past practices and experiences related to recruitment and selection processes were evaluated to determine the influence of ICT tools on hiring efficiency and talent acquisition strategies.

4. **Communication:** Communication effectiveness was examined based on historical data and feedback regarding the use of ICT platforms for internal and external communication within IT/ITES firms operating in Maharashtra.

5. **Customer Relationship Management (CRM):** Past interactions and customer engagement initiatives were reviewed to assess the role of ICT tools in enhancing CRM practices and fostering long-term relationships with clients in the IT/ITES industry.

Independent Variables: The independent variables investigated in the study included:

1. **Information & Communication Technology (ICT):** Various ICT tools, including social media platforms such as Facebook, YouTube, and WhatsApp, along with company websites, were examined based on their past utilization within IT/ITES firms in Maharashtra.
2. **Social media (Facebook, YouTube, WhatsApp): Past** usage patterns and strategies employed by IT/ITES firms in utilizing social media platforms for marketing, communication, and customer engagement purposes were analyzed to understand their impact on sustainable development.
3. **Company Website:** Historical data related to the development, maintenance, and functionality of company websites were reviewed to assess their role in facilitating product marketing, sales, recruitment, communication, and customer relationship management efforts within the IT/ITES sector in Maharashtra.

3.6. Data collection

Primary Data Collection

The study aimed to understand the role of ICT in driving sustainable development within the IT/ITES sector in Maharashtra. Data was collected through structured questionnaires and semi-structured interviews, focusing on quantitative metrics and qualitative narratives. The approach allowed for in-depth discussions and exploration of key themes, providing a comprehensive dataset for a nuanced understanding of ICT's impact on sustainable development.

Secondary data collection

The study aimed to examine the role of Information and Communication Technology (ICT) in sustainable development within the IT/ITES sector in Maharashtra. It gathered secondary data from academic literature, industry reports, and governmental publications. The literature review provided theoretical insights and frameworks, while industry reports provided industry-specific data. The analysis of these sources enhanced the study's findings and allowed for a comprehensive examination of ICT's role in fostering sustainable development.

4. DATA ANALYSIS

4.1. Demographic profile

Table 1: Demographic Profile

Gender	**Frequency**	**Percentage**
Male	100	60.61%
Female	65	39.39%
Sector		

Software Development	80	48.48%
Customer Support	50	30.30%
Others	35	21.21%
Hierarchical Level		
Executive	50	30.30%
Manager	60	36.36%
Technical Staff	55	33.33%
Experience in ICT		
Less than 1 year	30	18.18%
1-3 years	50	30.30%
3-5 years	45	27.27%
More than 5 years	40	24.24%
Company Size		
Small (1-50 employees)	55	33.33%
Medium (51-500 employees)	65	39.39%
Large (>500 employees)	45	27.27%
Geographic Location		
Mumbai	60	36.36%
Pune	50	30.30%
Nagpur	35	21.21%

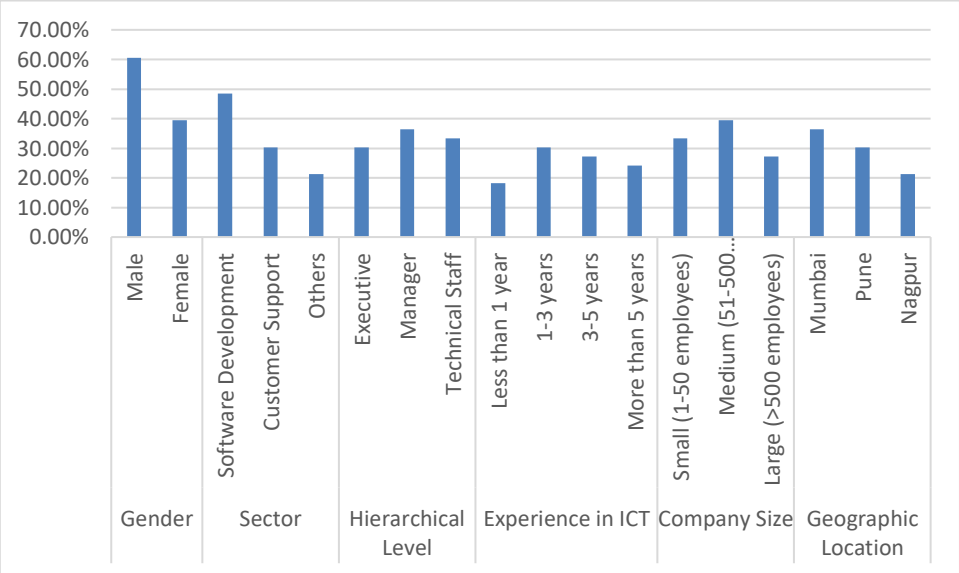

Figure 1: Demographic Profile

The data reveals a workforce that is mostly male (60.61%), with a substantial proportion of female employees (39.39%). The industry leader is software development (48.48%), with customer support (30.30%) and others (21.21%) following. The three groups at the top of the hierarchy are technical workers (33.33%), executives (30.30%), and managers (36.36%). ICT experience varies, with the most typical band being 1-3 years (30.30%). The majority of businesses are medium-sized (39.39%), followed by small (33.33%) and big (27.27%) businesses. The most talented people are drawn to big cities like Pune (30.30%) and Mumbai (36.36%). The information in this data may be used to develop focused workforce management plans.

4.2. Hypothesis Testing

- **Extent of ICT Utilization**

Null Hypothesis (H0): There is no discernible variation in the degree to which information and communication technology (ICT) is used by IT/ITES companies in the state of Maharashtra.

Alternative Hypothesis (H1): There is a substantial disparity in the degree to which information and communications technology (ICT) is used by IT/ITES companies in the state of Maharashtra.

Table 2: ANOVA

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F statistic	p-value
Between Groups (Treatments)	40.0	2	20.0	16.194	<0.001
Within Groups (Error)	33.3667	162	0.206		
Total	73.3667	164			

- **Challenges Faced in Integrating ICT:**

Null Hypothesis (H0): IT/ITES companies don't experience any major obstacles while incorporating ICT into their daily operations.

Alternative Hypothesis (H1): IT/ITES companies encounter several obstacles while attempting to incorporate ICT into their daily operations.

Table 3: One-Way ANOVA

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F statistic	p-value
Between Groups (Treatments)	5.4	2	2.7	6.75	0.002
Within Groups (Error)	7.2	27	0.266		
Total	12.6	29			

Interpretation

- The F statistic is 6.75.

• The p-value of 0.002 suggests that the degree of ICT use among Maharashtra's IT/ITES enterprises varies statistically significantly.

Let's now examine the difficulties in integrating ICT by moving on to the contingency table and chi-square test for independence for the second hypothesis.

4.3. Hypothesis testing

	Sig. value	Decision
H0A	<0.001	Reject
H1A		Accept
H0B	<0.002	Reject
H1B		Accept

5. CONCLUSION

With variances caused by criteria such as business size, industry, and geographic location, the research reveals that there are considerable discrepancies in the level of information and communication technology (ICT) utilisation among IT/ITES enterprises in the state of Maharashtra. As indicated by the major obstacles that were found in the research, these results highlight the need of focused interventions to overcome the issues that are preventing successful integration of information and communication technologies. Because of the complexity of the technology and the resistance of the organization, these difficulties need individualized methods that are targeted at supporting organizational change management, boosting resource accessibility, and promoting technical literacy. IT and information technology service providers in Maharashtra may better harness the potential of information and communication technology tools to generate innovation, efficiency, and competitiveness in today's digital world if they solve these challenges. This will eventually encourage sustainable growth within the sector.

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