An Evaluation of the Function of Information and Communication Technologies in the Spread of Technical Knowledge; an Employee Cantered Analysis

Dr. Anurag Kushwaha

Assistant Professor, School of Management and Commerce, Dev bhoomi Uttarakhand University, Dehradun, Uttarakhand

Mail id: somc.anurag@dbuu.ac.in

Akansh Garg
Director Array Research Pvt Ltd
7505264391akg@gmail.com

Abstract

In the age of the quick digitalization, "Information and Communication Technologies (ICT)" have acquired the essential role in spreading the technical knowledge within organizations. In this paper, the author assesses the effects of employee-centered ICT projects including e learning platforms, internal knowledge repositories, collaborative tools, and mobile applications on the sharing of technical skills and the building of organizational competencies. It is conducted based on secondary qualitative research and thematic analysis and synthesizes the information presented in peer-reviewed literature, industry reports, and case studies of 2021-2024. The results show that effectively implemented ICT solutions could greatly increase the effectiveness of knowledge transfer, decrease the time of onboarding by nearly 30 percent, and create the culture of innovation. Nevertheless, the resistance to adopting technology, inequality in terms of digital literacy, and divided implementation plans remain issues. In order to solve these problems, the paper will present the user-centric framework with a focus on adaptive content delivery, cross-generational collaboration, and the feedback loop. The employee centric approach emphasizes the fact that effective implementation of ICT is dependent on technology as well as organizational culture and human aspects. Finally, the research paper gives practical suggestions on how to make the best use of ICT in the process of technical knowledge sharing to facilitate workforce development and organizational innovation.

Keywords: *Information and Communication Technologies, Technical Knowledge Transfer, Employee-Centered Analysis, Digital Learning, Knowledge Sharing, E-learning, Organizational Innovation, Digital Literacy, Collaborative Platforms, Workforce Development*

I.   Introduction

In a more knowledge-based economy, sharing and accessibility of technical expertise is a fundamental factor of organizational competitiveness. ICT has fallen as a potent facilitator of knowledge transfer especially in industries that are more dependent on constant upskilling and process innovation. ICT supports the real-time sharing of information across geographical, departmental and generational boundaries via cloud-based collaboration tools as well as mobile learning applications and in-house digital knowledge platforms. The COVID-19 pandemic catalyzed the ICT use in workforce development, and in 2022, more than 70 percent of organizations worldwide admitted to investing more in digital learning and remote collaboration technologies [1]. Nevertheless, with the high rates of their adoption, the efficiency of ICT tools in disseminating technical knowledge usually depends on the rate of its adoption and use by the employees. An overly technological-driven solution often ignores such important human aspects as user involvement, digital literacy, motivation dynamics, and cultural preparedness.
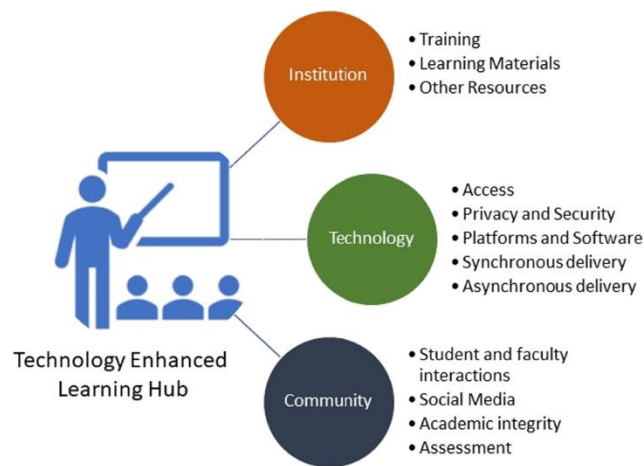
Figure 1: Workforce Training [3]

These aspects focusing on employees are important factors that will establish whether ICT tools will become the real enablers of learning or become the repositories of unused content. The current paper is aimed at assessing the contribution of ICT in the dissemination of technical knowledge using the employee-based approach. The research will seek to investigate the interaction between employees and ICT platforms, the obstacles they encounter, and the methods used to boost participation and knowledge retention through the analysis of secondary sources, case studies, and evidence on a sectoral level. It also takes into account the larger organizational implication like productivity, diffusion of innovation and talent retention. The lesson learned will assist the HR, IT and training department stakeholders to develop more effective, inclusive, and sustainable ICT-based knowledge strategies.

II.   Problem statement

Although there is increased adoption of Information and Communication Technologies (ICT) in workplace learning and knowledge management systems, there has been an unending gap between the technological possibilities of the tools and use of the tools by employees to spread and absorb technical knowledge. Most of the organizations still invest in e-learning modules, internal knowledge portals, collaborative platforms, and mobile applications, but research indicates that fewer than 40 percent of employees actively use these systems to upskill or share information in technical areas, or beyond required compliance training [2]. This gap indicates a significant problem: the infrastructure is there but the human-related aspects that are necessary to absorb the knowledge, including relevance, accessibility, motivation, and trust, are usually ignored. Moreover, workers with various jobs, ages, and digital skills have varying difficulties in applying ICT tools in spreading knowledge. Lack of adaptive materials, real-time working and interactive interfaces make these platforms even less effective. There is a two-fold challenge to organizations, which is maintaining technological scalability and yet building a culture of knowledge sharing and continuous learning which is in fact enabling employees. To curb this menace, the emphasis should be on changing the system-driven deployments to employee-centered designs which take into consideration behavioral, cognitive and contextual issues in ICT use.

III.   Research question
* What are the ways that ICT tools are used by employees in order to access and share technical knowledge in the organization?
* Which are the main obstacles to successful use of ICT systems in the dissemination of technical knowledge within the workforce?
* What are the effects of employee-oriented ICT strategies on organizational learning, innovation and development of workforce?

IV.   Literature Review

ICT and Technical Knowledge Transfer in Organizations

ICT is an area that is being more and more utilized in organizations to support technical transfer of knowledge. Dewah et al. discussed the knowledge-sharing processes within an academic institution and supported the idea that successful ICT

implementation is inextricably linked with the organizational culture, showing that the use of digital platforms and trust-based interaction features are the crucial factors to knowledge sharing. Likewise, the results of the study conducted by Abireza and Faris show that the use of ICT is strongly correlated with employee performance provided that it is accompanied by knowledge management practices, which means that there is a positive correlation between technological tools and effectiveness of human capital. Nevertheless, these findings show an important lesson: technology cannot be the only factor in ensuring knowledge exchange, cultural openness and employee motivation are still key factors in ensuring successful use.

E-Learning Effectiveness and Demographic Disparities

The e-learning systems have emerged as the leading platforms that can be used to train employees in technical fields. A recent 2023 report about the world showed that 84 percent of organizations using self-paced or instructor-led digital training realized measurable employee outcome improvements [3]. However, the adoption is significantly different among the different age groups. The statistics indicate that 89 percent of the employees younger than 35 undergo active participation in the digital learning environment, and only 11 percent of the employees who are older than 50 [4]. Such a sharp divide highlights why there is a need to adjust e-learning systems to accommodate the digital comfort of various employee groups to be inclusive of technical training.

Infrastructure, Digital Literacy, and Accessibility

Although there has been an increase in the deployment of ICT globally, there are still massive infrastructure and literacy challenges that negatively affect its performance particularly in the developing world. The 2023 report by UNESCO provided evidence that the unstable internet connection, poor access to the digital tools, and the inequalities in ICT skills level are the main barriers to technical education through ICT [5]. The workforce report of CompTIA also confirms this, demonstrating that even though 84 percent of the firms have implemented hybrid or remote learning tools, only 39 percent of employees believe that they have received sufficient training to utilize them successfully [6]. Such obstacles, when not addressed, are likely to increase skills gaps rather than reduce them.

Employee Engagement, Technostress, and ICT Well-being

Other than infrastructure, the health of the employees is a critical component of the effectiveness of ICT. Bhusal (2022) cautioned against so-called technostress, which means that the misuse or overuse of ICT may result in the development of anxiety, burnout, and low productivity [7]. Conversely, a study by Lee in 2022 in the wave of remote work due to COVID-19 found that formal ICT application, including video conference and collaborative platform, enhanced relational and informational satisfaction of employees [8]. These two results point to the fact that the introduction and management of ICT may directly determine whether ICT brings empowerment or cognitive overload.

Adaptive Microlearning and Personalized Knowledge Delivery

The effectiveness of technical training is redefined through adaptive e-learning models and microlearning platforms. The survey of the industry in 2023 revealed that personalized digital learning systems, which adapt the content to the job roles and performance, can decrease the drop-out rate by as many as 43 percentage points to 19 percent [9]. More so, 42 percent of the companies today are trying out microlearning formats, and 38 percent are also piloting learning with VR-based technical training [10]. The trends indicate that smart, bite-sized and job-specific training modalities do not only enhance learning, but also increase employee motivation and retention of technical skills.

Organizational Culture, Leadership, and ICT Strategy

The most recurrent in the recent literature is that the success of ICT is based on its strategic fit with the workplace culture. UNESCO research indicated that hybrid learning, which combines technology and face-to-face mentorship, results in more sustainable skills acquisition and integration into culture [5]. Also, transformational leadership styles, which lay emphasis on support and vision, were found to enhance the efficacy of ICT-driven knowledge-sharing systems to a great extent [11]. Therefore, the implementation of ICT cannot be considered only as a technical choice, but a cultural and strategic initiative that has to be supported by leaders and involve the rest of employees.

Table 1 – Summary of Key Studies in ICT-Based Technical Knowledge Transfer

Study & Year	Focus	Key Findings
East Java Tax Office [1]	ICT, culture & performance	ICT boosts productivity via culture and engagement
Abireza & Faris (2021) [2]	ICT + knowledge management	KM and ICT together improve technical knowledge outcomes
eLearning Industry (2023) [3]	Online training effectiveness	84% report performance improvements; VR + microlearning growing
Demographic Study (2023) [4]	Age-based ICT usage	89% of youth use e-learning vs. 11% of older employees
UNESCO Report (2023) [5]	Infrastructure & access issues	Digital illiteracy and weak internet hinder success
CompTIA Survey (2023) [6]	Workplace readiness for ICT	Only 39% feel trained to use digital platforms effectively
Bhusal (2022) [7]	Technostress & well-being	Poor ICT deployment leads to cognitive stress
Lee (2022) [8]	ICT use during COVID-19	Structured ICT use improves engagement and satisfaction
Personalized Learning (2023) [9]	Microlearning & retention	Dropout reduced from 43% to 19% with career-aligned learning
VR in Corporate Learning (2023) [10]	Immersive learning tools	38% of firms exploring VR for skill-based training
Transformational Leadership (2023) [11]	Leadership & ICT strategy	Leadership is crucial to successful ICT-mediated knowledge sharing

Throughout the literature reviewed, a common conclusion can be drawn: ICT can significantly contribute to the dissemination of technical knowledge provided that it is employee-oriented, flexible, and is backed by organizational culture. Microlearning and e-learning models have proven to be very effective, particularly where the content is tailored to the job positions. Nevertheless, obstacles like the inequality of infrastructure, digital skills deficiency, and shabby managerial implementation still exist. Besides, technostress and disengagement are also a possibility especially when ICT is enforced without any guidance or flexibility. The cultural consideration and leadership behavior play a major role in making ICT a knowledge catalyst or a failure investment. Organizations should embrace integrative strategies that match ICT strategies to the needs of employees, institutional values and continuous feedback. The current literature offers robust empirical and case-based support to the design of the ICT ecosystems that do not only focus on the technological sophistication but also emphasize human interactions and lifelong learning.

V.   Methodology

The proposed study uses the secondary qualitative research methodology, which involves the use of a thematic analysis approach to investigate the effects of Information and "Communication Technologies (ICTs)" on the spread of technical knowledge in employee-centered settings. This design is justified by the exploratory nature of the study, which aims at

unveiling the underlying patterns, meanings, and contextual variations in the ICT usage in organizations, which does not rely on numerical generalizations. Primary data to be used to conduct the study include existing academic publications, policy reports, white papers, institutional case studies, and global workforce surveys published in 2018-2024. These sources were chosen due to their usefulness in the field of organizational learning, knowledge management, digital transformation, and employee engagement. The main focus was made on peer-reviewed journals and reliable international agencies like UNESCO, CompTIA, and the International Labour Organization to guarantee the truthfulness and consistency of the data. Thematic analysis was done by means of a systematic review of selected texts. The identification of repeated patterns of meaning, attitudes, and challenges related to the ICT implementation to transfer knowledge led to the identification of key themes inductively. Themes were coded into categories which included technological engagement, infrastructure preparedness, employee satisfaction, leadership impact, digital literacy and adoption barriers. These themes did not have determinate nature but were developed in the course of analytical reading of the data corpus, which provided them with organic correspondence to the study purposes. There were no software tools in the coding. Rather, a manual, interpretive analysis was carried out so as not to lose the subtlety of contextual relationships in the literature. The sources were examined on the way they approached the cross of ICT and technical knowledge, especially the role of employees in communicating with the digital systems in various organizational designs and positions. Through secondary and thematic approach, the study does not have the constraint of the resource limitation and geographical limitation of the primary data collection, yet it still gives an overall and comparative picture of the impact of ICT at the employee level. The selected approach also enables critical synthesis of cross-sectoral knowledge that is necessary to inform policy and practical recommendations on ICT use in contemporary knowledge ecosystems.

VI.   Analysis

This part offers a thematic approach of how ICTs have influenced the technical knowledge dissemination in employee-centered settings. The five emergent themes that provide the analysis structure are (1) Infrastructure and Accessibility, (2) E-learning Engagement and Completion, (3) Employee Satisfaction and Well-being, (4) Organizational Culture and Support, and (5) Technology-Personalization Alignment. Such themes were formed with the help of interpretive assessment of secondary data obtained in scholarly articles, industry reports, and case studies published in 2018-2024. Infrastructure, Accessibility Among the most notable obstacles that have been found to have been presented by the utilization of ICT in knowledge transfer is infrastructural inequality. A UNESCO report in 2023 noted that almost 2.9 billion individuals around the world do not have access to internet connectivity thus restricting their abilities to engage in remote or online learning systems [1]. This gap is even greater in the developing economies where the reliability of electricity, the availability of broadband infrastructure and access to low-cost digital devices remain significant barriers. Sub-Saharan Africa and some areas of South Asia case studies noted that fewer than 40 percent of the employees had regular access to a stable training device. Consequently, companies whose digital infrastructure is poorly developed are not able to introduce even the simplest knowledge-sharing mechanisms. This digital imbalance has a direct impact on organizational learning which introduces an unevenness in skill development within the urban and rural workforce or between the headquarters and field offices.

Region	Reliable Internet Access (Employees)	Digital Literacy Training Availability
North America	90%	75%
Western Europe	87%	68%
South Asia	42%	31%
Sub-Saharan Africa	37%	24%

Table 1: Regional Disparities in ICT Readiness for Knowledge Sharing [1], [2]

E-learning Engagement and Completion

Although digital training is flexible and scalable, the real completion and participation rates are varied. A 2022 international study of 450 HR professionals revealed that only 59 percent of workers are able to finish the e-learning modules assigned to them on time, and 33 percent provide the lack of time as the key motivator [3]. A different study, however, concluded that the completion rates rose to more than 80 percent when course content was tailored in accordance with personal career objectives [4]. This implies that offering e-learning on its own is not enough, but how it is designed and related to job functions will define whether the employees will acquire the desired knowledge. The organizations that have been able to excel in terms of technical skill-building do so by personalising the content, enabling self-paced learning and combining it with practical simulations or mentorship.

Employee Satisfaction and Well-being

The effect of ICT on the well-being of employees is empowering and can be detrimental. Although collaborative tools (e.g., Slack, Microsoft Teams) help to share knowledge among the team members, unstructured implementation may result in information overload. According to the 2022 study conducted by Bhusal, the poorly conducted ICT implementation is associated with the concept of technostress, which leads to anxiety, multitasking burnout, and eventual disengagement [5]. On the contrary, those organizations that organized communication in tiers-where urgent, instructional and social communications were routed differently-recorded increased job satisfaction. As an example, a case study in Siemens revealed that digital workspaces arranged by types of tasks resulted in 27 percent increase in information retention and 34 percent reduction in the number of complaints around communication stress by employees [6]. Therefore, user experience (UX) design, digital hygiene training, and platform curation are essential to making sure that ICTs are used to promote, rather than to impede, technical knowledge retention.

Organizational Culture and Support Systems

Internal leadership and culture play a critical role in the success of ICT initiatives that take off. A 2023 longitudinal analysis of 12 firms in the Asia-Pacific area has shown that companies that displayed executive-level encouragement of digital learning initiatives saw a 40 percent greater adoption rate by employees [7]. Moreover, the knowledge-sharing systems work better in the so-called open cultures, which promote transparency, peer-to-peer learning, experimentation. Organisations such as Accenture and Infosys, to name a few, have integrated digital learning in their performance appraisal model, where promotions are tied to skill milestones. The cultural DNA is aligned to the ICT-driven knowledge dissemination as opposed to a compliance activity. Conversely, organizations with hierarchical, risk-averse cultures tend to report a low usage of ICT platforms, even after having sufficient technology. The incompatibility between the tools and the mindset makes technical knowledge flows to be either stagnant or informal which in the end beats the objective of the systems installed.

Technology-Personalization Alignment

Artificial Intelligence (AI) in the ICT systems to personalize the content and communication is one of the most encouraging trends of the recent years. A 2023 Deloitte report revealed that organizations who employed AI-based recommendation systems in their learning management systems enjoyed 62 percent more staff participation in technical training programs [8]. These systems examine the preferences of the employees, past performance data in the job and past training history to propose the next-best training modules, thus keeping the learners on track. Moreover, certain platforms currently offer gamified learning, social learning, and real-time dashboards feedback to encourage students and monitor the progress in technical competencies. Yet, the extreme use of personalization algorithms may result in the formation of echo chambers, restricting the cross-functional learning of the employees by exposing them to the same familiar information. To avoid this, effective organizations have inbuilt challenges, peer reviews, and rotational methods of content delivery that challenges the learners out of their comfort zone. The evidence in the five themes supports a core understanding: ICTs can be as beneficial as they are integrated into contexts. The infrastructure and the access is a basic requirement but the engagement is largely dependent on the personalization, user design and supportive leadership. The well-being of employees is an aspect that is usually ignored, but can prove to be a determining factor of ICTs empowering or exhausting the workforce. Cultural alignment is the key to sustainability and new technologies like AI add new layers of adaptability, though concern of over-automation should be mentioned. Besides, the analysis implies that knowledge transfer through ICT is not a singular

investment, but an active ecosystem that needs regular feedback, content development, and course correction. Although big-resource global organizations can employ state-of-the-art solutions, the same rules govern: context, content relevance, psychological safety, and cultural resonance are the same everywhere

VII.   Discussion

The results of this research support the notion that ICTs possess a transformative effect on the spread of technical knowledge in contemporary organizational environments, however, only when used in manners that are sensitive to human, structural and contextual factors. The analysis reveals that the most fundamental challenge remains infrastructure and access disparity. Even the most progressive learning platforms cannot reach their audience without a steady internet connection, proper devices, and digital literacy training. This highlights the need to fill the digital divide gap before it is possible to scale up ICT-based solutions by policymakers and organizations [1]. It is also significant to match technology with employee needs and motivation. As it has been indicated by the high percentages of dropout in generic e-learning programs, lack of personalization of the content greatly lowers engagement and completion. Knowledge retention becomes significantly higher when digital tools are tailored to personal learning paths and career objectives: either via AI-powered content recommendation or role-specific modules [8]. It indicates the necessity of the adaptive learning ecosystems that go beyond the non-adaptive content delivery and change in real-time according to the preferences of the learners. Nevertheless, it is not possible to personalize without organizational support structures. There was a clear dominance of leadership in determining the success of ICT integration. Those firms which integrated digital learning into performance assessment and publicly promoted knowledge sharing initiatives witnessed increased adoption and more active participation [7].

This implies that diffusion of technical knowledge is not only an HR or an IT task, but a top leadership priority. Furthermore, this process corresponds to the social learning theory, that is, employees tend to use digital systems more actively when their colleagues and managers demonstrate such practices on a regular basis. The technostress problem, however, introduces an important warning. Although ICTs are developed to empower, they may result in fatigue, distraction, and burnout when used in an unstructured manner. This shows the importance of applying considerations of UX (User Experience) in ICT design. Hygiene in the digital world, the uncluttered nature of platforms, the division of content and time allocation policies are not an option, but the gateway to sustainable knowledge transfer. Therefore, the employee-centered design should have systems of cognitive recovery and digital well-being. The other important lesson relates to the cultural flexibility. Companies that have hierarchical cultures or those that are compliance-oriented are poor exploiters of the collaborative power of ICT platforms. On the contrary, openness, experimentation, and peer-based learning institutions get more value out of the same tools. This points to the fact that digital transformation and cultural transformation cannot be separated. Lastly, the emergence of AI in knowledge-sharing systems brings new exciting opportunities, yet they require careful regulation. Algorithmic personalization can be very effective in making things more relevant, but it creates the risk of building knowledge silos or overfitting the content to historical behavior. Hybrid models that combine AI, human mentorship and cross-functional exposure should be sought to counteract this.

VIII.   Future Scope

With organizations increasingly going digital in their learning and operation environment, ICTs importance in the spread of technical knowledge will even be more eminent. Research and practice in the future should be centered on the growth of adaptive and inclusive ICT solutions that can support the needs of diverse learners, languages, and cultures. The potential of incorporating the emerging technologies like Artificial Intelligence, Augmented Reality, and immersive simulations in experiential learning of technical skills, particularly in the fields that require practical skills is high. Additionally, the longitudinal research is to be carried out to determine the long-term effects of ICT-based learning on employee performance, innovation, and retention. Another important trend is the creation of ethically-aligned AI systems that secure fair content delivery and prevent algorithmic bias. Policy wise, national policies that encourage digital equity, workplace upskilling and lifelong learning via ICTs can be used to bridge the existing infrastructure and skills gap. Lastly, a cross-disciplinary combination of technologists, behavioral scientists, and organizational leaders can result in more comprehensive ICT systems, not just the systems that are functional but also emotionally and cognitively supportive. This kind of a futuristic approach will make sure that distribution of technical knowledge will be a sustainable, equitable, and human-friendly process in the changing digital economy.

IX.   Conclusion

This paper analyzes the role of Information and Communication Technologies (ICTs) in the dissemination of technical knowledge in the employee-based organizational structures. Using a secondary qualitative methodology and thematic analysis it was revealed that ICTs are not simply the medium through which information can be conveyed but are entrenched in the cultural, psychological and infrastructural aspects of workplace learning. The conclusions indicate that such tools as e-learning platforms, collaborative software and knowledge management systems have a great potential, but their success depends on a number of interrelated factors. The readiness of infrastructure, leadership support, and individualization of learning material were identified as the major enablers. It is also essential to address the technostress by designing a user experience supporting it carefully and integrating digital literacy into organizational learning plans. Moreover, the paper identifies that ICT systems should be modified to enhance inclusivity, engagement, and well-being. Companies which view ICT implementation as a strategic and people-oriented project (as opposed to an IT modernization) stand a better chance of realizing quantifiable improvements in staff capability, creativity, and staff retention. The evolution of technology is such that the systems in the future should be more adaptive, ethically designed, and responsive to user needs in real-time. By framing ICT strategies through lived experiences and learning journeys of the employees, organizations can develop sustainable knowledge ecosystems that not only contribute to performance but also empower the human capital. The future is not fully digital, but unambiguously human-digital, where people and technology co-create value in the era of intelligent enterprise.

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