ICT Integration on Mental Health Well-Being of Employees

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***Abstract*—Employee's mental health and well-being have become a major concern in the present-day workplace due to stress and workload. This paper dive into the usefulness of information and communication technologies (ICTs) as one of the strategies for improving employees' mental health. Considering that around 60% of the global population is employed and a notable portion of them is suffering from one or the other mental illnesses, the need of supports from organization and assistance to the mental health of their employees. This study seeks to understand the role of the workplace environments, including the application of ICT as an occupational stress reliever, promoter of work-life balance, and the provision of on-demand mental health services. The aim of this research is to utilize different ICTs including, e-health, automated intelligent chatbots, ICT-enabled forms to develop appropriate measures of enhancing mental health at workplaces. The results reveal that such a responsible application of the ICTs can enhance the employee involvement and other job outcome variables as well as reduce the negative impact of job-induced stress. In the end, it is the argument of this paper that the organizations have to adopt such strategies which utilize ICTs to enhance the mental wellbeing of their employees in order to create a more conducive and productive working environment.**

Keywords—Mental health, employee well-being, Information and Communication Technology (ICT), workplace stress, digital interventions, e-health, work-life balance, organizational strategies

I. INTRODUCTION

In today's fast-paced work environment, employees often face high levels of stress, pressure, and workload, all of which can adversely impact their mental well-being and, subsequently, their job performance [1]. With around 60% of the global population actively employed, mental health issues among working individuals represent a growing concern. In 2019, it was estimated that 15% of working-age adults suffered from a mental disorder, underscoring the urgent need for strategies that support employees' mental health alongside their professional productivity [2].

Economic crisis and massive competition in the industry have resulted in breach of psychological contract of employees. Most of the jobs involving remote monitoring, testing, and quality assurance have become completely automated ((The) Economic Times, 2017). Employee are also less passionate for technological innovation and acquiring new skills. But the technology in the IT/ITES sector becomes obsolete very fast, which requires rebooting and reskilling talent (Mishra, 2015). According to Mr. E. Balaji, the Chief Executive of Ma Foi Management Consultants, organizations initiating massive layoffs leave their employees with high levels of anxiety, guilt, and low morale, leading to physical and mental illnesses [3].

Oftentimes, workplace issues related to mental health come to light through concerns of other employees, the supervisor's observation of difficulties, or directly from the person themselves [4].

Information and Communication Technology (ICT) offers promising tools for improving workplace well-being, providing solutions that can help to manage stress, foster work-life balance, and enhance mental health support in real time. This research explores the potential of integrating ICT in the workplace to support mental health and create a healthier, more sustainable work environment. By leveraging ICT solutions, organizations may address mental health challenges proactively, helping employees to manage stress and pressure more effectively and ultimately improving their performance and quality of life.

It is widely recognized that technological changes, both at work and more broadly, have had an enormous impact on people's lives and that much of this influence has been constructive and beneficial, for example, by developing a ''mobile'' workforce via telecommuting technologies. Nevertheless, there are also increasing concerns about the 'dark side' of technologies and their negative impacts on levels of individual well-being. One major aim of ergonomics, for example, is to safeguard the physical and psychological health of workers by the most appropriate use of machinery and technology [5].

So, we are finding ways to help those in need because of stress and burnout, underperformance of task due to Mental Health issues, Lack of Mental Health care of Employees. This research is guided and structure by addressing these questions:

- What ICT should be integrated into the Mental Health Well-Being of Employees?

- How will it help the mental health of employees?
- How will it benefit if we implemented ICT into the Mental Health Well-Being of Employees in workplace and company in Cambodia?

II. LITERATURE REVIEW

A. *The Impact of Stress on Employee Performance and Job Satisfaction*

Research indicates that workplace stressors—such as heavy workloads, lack of administrative support, and poor work-life balance—significantly affect employee performance and job satisfaction. [3]. The study, "Effect of Stress on Employee Performance and Job Satisfaction: A Case Study of Nigerian Banking Industry," investigates the effects of stress at work on Nigerian bank employees, focusing on Access Bank in Lagos. It lists the following as the main stresses that affect employees: a heavy workload, a lack of administrative support, difficult client contacts, coworker dynamics, problems with work-life balance, and job dangers. Stress leads to reduced productivity, higher error rates, absenteeism, and health issues like anxiety and depression. To address these, the study recommends providing better support, managing workloads, and defining responsibilities, and offering greater support—all of which can raise employee satisfaction and performance in the banking industry [6]. Smith and Johnson [7] further explore the importance of well-being and occupational health in the 21st-century workplace. They argue that a holistic approach to employee well-being is crucial for fostering a supportive work environment. Their findings suggest that organizations should prioritize mental health initiatives and integrate well-being strategies into their operational frameworks. By doing so, companies can mitigate the adverse effects of stress, thereby improving overall employee performance and job satisfaction.

This paper discusses how rapid technological changes contribute to occupational stress, affecting employees' performance and job satisfaction. It links increased accessibility and heightened productivity demands with psychological strain. By identifying behavioral reactions and stressors, it provides insights into mitigating the adverse effects of technology on workplace satisfaction and performance. Recommendations for ongoing research aim to address stress-related challenges associated with ICT [5]. The negative effects of technology and new work modalities, such as teleworking and smart working, on employees' well-being. It identifies stress-related issues like work-life imbalance, burnout, and psychological symptoms. These factors directly impact job satisfaction and overall employee performance. The paper also emphasizes the importance of addressing these stressors through practical remedies, including HR policy adjustments and leadership awareness [8]. The COVID-19 pandemic worsened working conditions for healthcare workers, increasing stress and leading to job dissatisfaction and burnout. It discusses how emotional intelligence can mitigate stress and enhance work ability, leading to better job satisfaction. The "Vibe Tracker" serves as a tool to identify emotions, thus addressing work-related stress and improving the overall well-being of employees. This focus on stress reduction and emotional management aligns with the broader theme of improving job satisfaction and employee performance [9].

B. *The Dual Nature of ICT in Employee Well-being*

The relationship between work-related ICT uses and employee well-being is complex. While ICT can create resources that enhance engagement, it can also impose demands that lead to burnout [4], [5]. ICT use was estimated differently by the publications used. Mostly, it was categorized as the percentage of working time using ICT (mainly computers) or the hours spent working with ICT. Only a few studies examined more specific ICT-related topics, such as Internet use, email, separate analysis for laptop and desktop use, smartphone use, and ICT experience. These variations in ICT usage and measurement highlight the need to better understand how ICT contributes to both positive and negative workplace outcomes [10].

Managers often feel ill-equipped to handle mental health issues within their teams, which can lead to frustration [11]. Despite these challenges, ICT holds significant potential for positively impacting employee well-being. The integration of ICT can facilitate anonymous communication platforms, encouraging open dialogue and reducing stigma around mental health issues [12]. ICT positively impacts employee well-being by increasing autonomy and engagement, offering flexibility and enhancing collaboration. It also facilitates anonymous communication, encouraging openness and reducing mental health stigma. When used appropriately, ICT supports work-life balance and strengthens workplace connections. A review finds ICT's impact depends on how and when it's used, but results vary across roles and settings [13].

The dissertation "Technological Availability and Employees' Well-being: A Pathway to Responsible Digitization" by Katharina Ruth Schneider explores this dual nature. It highlights how ICT improves flexibility but also increases stress and burnout due to constant availability. Schneider developed tools like the Availability-Monitor and Availability-Manager, which significantly improve work-life balance and reduce stress by aligning employee preferences with actual availability. These findings emphasize the importance of responsible ICT use to balance its benefits and drawbacks, fostering a healthier work environment [14].

According to the Job Demands-Resources (JD-R) Model, job demands are tasks that require physical, cognitive, or emotional effort, which can lead to strain if they exceed an individual's capacity. Overuse or poorly managed use of ICT can lead to more stress and burnout at work, especially when employees feel forced to always stay connected or handle too many demands. However, ICT tools like mindfulness apps, online therapy, and virtual support groups act as job resources, helping employees manage stress, improve coping strategies, and build resilience. These tools improve mental health and increase employee engagement by lowering anxiety, depression, and burnout [15].

In a study with in-service elementary teachers, Cross and Hong (2012) found that knowing that they had school support to implement innovation was comforting to the teachers. Furthermore, the teachers who were more satisfied with the degree of support provided by the administrators showed more positive attitudes toward teaching [16]. ICT can facilitate both work and personal responsibilities, potentially alleviating some demands created by work intensification [17]. However, the stressor-detachment model suggests that job stressors can impede psychological detachment from work, making it difficult for employees to recover during non-work time [18].

This dual role of ICT highlights the need for responsible ICT-based solutions that align with employee availability preferences, as emphasized in recent studies [19]. The concerns around job security and worker dynamics could be related to how ICT increases or redistributes workloads, leading to psychological and emotional strain [8]. The study's findings on the relationship between ICT adoption and increased anxiety and insomnia (but not depression) directly align with the themes of work-related strain caused by ICT. Specifically, Workplace ICT adoption has intensified work demands, fostering an "always-on" culture and the pressure to continually update skills, leading to increased stress and anxiety [20]. The integration of ICT in the workplace presents both opportunities and challenges for employee mental health. While ICT can enhance communication and flexibility, excessive reliance can lead to increased stress and anxiety [20]. Organizations must navigate these complexities by fostering a culture that prioritizes mental health and establishing clear ICT usage guidelines, allowing them to leverage technology's benefits while minimizing its adverse effects [21].

This paper examines how advancements in mobile technology affect workers' psychological well-being, particularly through occupational stress. It highlights the dual nature of ICT, which increases accessibility and productivity expectations while posing challenges for mental health. The discussion on facilitators and barriers to ICT adoption underscores its potential to both harm and enhance employee well-being. The paper emphasizes the need for a balanced approach to integrating technology into the workplace [5]. The dual nature of ICT, acknowledging both its benefits and drawbacks in the workplace, especially in the post-COVID era. The increased use of digital tools and remote working has led to positive changes, such as flexibility, but also contributed to negative outcomes like smart working fatigue, hyper-connection, and psychological distress. The paper highlights the need for a balanced approach to technology adoption, integrating strategies to protect employee well-being while leveraging technological advancements [8]

Exploration of employee reactions to digital transformation (DT) through attribution theory, focusing on how employees' perceptions of technology influence their acceptance. It highlights how internal and benevolent attributions lead to positive outcomes during digital transformation, while other perceptions can create resistance or stress. This aligns with the dual nature of ICT in employee well-being, where the implementation of digital tools can either enhance or hinder employee experiences based on how they perceive technology's impact on their roles and work environment [22]. The study examines both the positive and negative impacts of AI adoption on employee well-being, showing that while AI adoption itself does not directly cause burnout, it increases job stress, which in turn contributes to burnout. This highlights the dual nature of ICT, where technological advancements like AI can both create stress and offer opportunities for growth, depending on factors such as self-efficacy in AI learning and organizational support for managing stress [23].

A further but less significant theme that emerged from the data was higher workload due to ICT use. In this context, participants particularly referred to social media applications, most likely because these have extended the fields of work in the areas of advertising, public relations, and journalism and have become an integral part in these professions. These findings were categorized as increased workload. However, despite the additional workload caused by social networks, three participants also emphasized the benefits and described that social networks are an additional platform for being active, spreading stories, or generating awareness [24].

C. Digital Technology and E-Health Interventions

Digital technology plays a transformative role in workplace mental health initiatives, offering innovative solutions to address growing demands. It provides scalable, accessible, and stigma-reducing support through various tools, including e-health interventions, AI-driven technologies, and hybrid care models.

As a tool, technology makes users' activities easier or more efficient to do, e.g., leads through processes or performs calculations (improves abilities or lowers barriers). As a medium, it provides interactive and engaging experiences, e.g., simulations of behaviors, and it can be used for boosting self-efficacy, skills learning, or improving motivation. In the role of a social actor, technology mimics a living entity by modeling its behaviors, e.g., by providing feedback or social support [25].

E-psychology operations aim to support and connect key target groups. These include the individuals receiving psychological care and the therapists or psychologists delivering the care. Through an ICT-based e-psychology environment, therapists gain valuable tools and resources that enable them to perform their tasks effectively and provide optimal support for their clients. This approach leverages digital technology to enhance both the delivery and accessibility of mental health services [26].

CBT helps employees by teaching them to identify and change negative thinking patterns, improving coping strategies and emotional regulation, especially for those struggling with anxiety or depression. Cognitive-Behavioral Therapy (CBT) is a treatment approach that focuses on modifying behaviors related to obesity, such as eating habits and physical activity, by using strategies like self-monitoring, goal setting, stimulus control, cognitive restructuring, stress management, and social support. Although CBT is beneficial in the short term, its lack of long-term results indicates that continuous care is needed. Combining CBT with physical activity and support systems can help. Despite these challenges, CBT is still an important tool in treating obesity, with new approaches focusing on improving overall well-being, mental health, and physical fitness [27].

The research on Mental Health Ingenuities and the Role of Computer Technology on Employees show that E-health interventions, such as web-based cognitive-behavioral therapy (CBT) and mobile applications, provide accessible resources that help reduce stigma and improve engagement [28]. A meta-analysis of digital interventions categorized into CBT, Stress Management, and Mindfulness reveals positive impacts on mental health, particularly for mindfulness-based methods. A meta-analysis of 23 studies shows these methods have positive effects, especially Mindfulness. However, applying these results to workplace settings can be tricky due to differences in interventions and employee groups. The study suggests eHealth tools are promising but should match employee needs and specific symptoms for the best results [29]. However, the generalizability of these results to workplace environments is challenging due to variations in

intervention types and applicability across different employee populations. Matching intervention types to employee needs is critical for maximizing effectiveness [29], [30].

Digital tools like AI chatbots, big data systems, and telehealth platforms played an importance role to support mental health during the pandemic. These tools enhance early detection, remote care, and scalable interventions, particularly in lockdowns. Current work includes NLP in AI chatbots and predictive analytics for mental health. However, challenges such as privacy concerns, scalability, and cultural adaptability limit broader application. These findings underscore the need for ethical and targeted integration of digital tools in mental health care. AI chatbots utilize natural language processing (NLP) to provide automated and interactive mental health support. Platforms like Wysa and Woebot offer cognitive behavioral therapy (CBT) sessions for individuals dealing with conditions like depression or anxiety [31]. Chatbots, integrated into Mental Health First Aid (MHFA) programs, offer 24/7 confidential support, aiding in early detection of mental health issues and creating a judgment-free space for employees [32], [33]. Chatbots, using AI or predefined rules, provide conversational support for conditions like depression, anxiety, and stress in clinical, educational, and community settings. Although chatbots have shown effectiveness in reducing symptoms of depression and stress, their impact on anxiety remains inconsistent. They are viewed as complementary tools to professional interventions, expanding access to care and improving mental health outcomes [33].

The research Digital Mental Health Challenges and the Horizon Ahead for Solutions examines how digital tools can address growing mental health demands. It highlights innovative frameworks like Explainable AI (XAI), which ensures AI systems are transparent, interpretable, and understandable to humans [34]. And another solution called hybrid care models, which combine digital tools with traditional in-person mental health care to provide a comprehensive approach for real-time screening and treatment [34], [35].

Cloud-based big data systems aggregate and analyze information from diverse sources, such as social media platforms, IoT devices, and online search queries. These systems are used to detect early warning signs of mental health issues like depression, anxiety, and stress by monitoring behavioral patterns across populations [31]. For example, ecological momentary assessments (EMA) leverage real-time data from mobile devices to track mood changes and stress levels. While these systems offer valuable insights for early intervention, they raise concerns about privacy, ethical data use, and the need for high-quality data to ensure accurate predictions [35].

Although the paper does not focus directly on health interventions, it discusses the implications of digital transformation, which includes the integration of digital technologies into workplace settings. This can extend to health-related technologies in the workplace, such as e-health interventions, by examining how employee perceptions of these technologies affect their well-being and acceptance. The findings on employee reactions to digital transformation contribute to understanding how e-health technologies, as part of broader digital initiatives, can be effectively implemented to improve workplace health and well-being [22].

D. Innovative Approaches: AI and Machine Learning

The use of ICT-based solutions, including smartphone apps and wearables, which are innovative tools aimed at improving employee well-being. The focus on using wearable devices to track physiological data and support well-being reflects the emerging role of innovative technologies, such as AI-driven health tracking, to monitor and enhance employee experiences [14]. Technological innovations (like ICTs enabling remote work) influence employee well-being. The focus on flexible work arrangements and their effect on different dimensions of well-being connects to the broader context of technological impact on employees' work experiences and outcomes [36].

Emerging technologies, such as AI and machine learning, are being leveraged to detect and address workplace depression among IT employees. These systems utilize mood detection, chat agents, and activity recommendations to create a supportive environment that enhances mental well-being and productivity [37], [38]. The discussion on STARA (smart technology, artificial intelligence, robotics, and algorithms) highlights AI's dual impact on job creation and displacement, emphasizing its role in workplace innovation and dynamics [39].

The emphasis on reskilling and mental health initiatives tied to AI adoption aligns with efforts to use technology for employee support . According to a systematic review on machine learning and natural language processing in mental health, these technologies can effectively analyze large datasets to identify patterns associated with mental health conditions, providing insights that can inform personalized interventions [40]. While not explicitly about interventions, this paper can inform strategies for addressing the mental health impacts of ICT use. Future recommendations on targeting vulnerable subgroups for tailored support align with this category [20].

Transdiagnostic approaches in mental health focus on addressing shared challenges found across different disorders, such as anxiety and depression, rather than treating each condition separately. These methods target common issues like managing emotions or coping with stress, making them flexible and effective for addressing multiple problems at once. Combining these approaches with digital tools, like apps that track your mood in real time, can make care more personalized and accessible. However, they don’t always address symptoms unique to certain disorders, like PTSD, and applying them can be tricky since they need to balance general strategies with individual needs [35].

E. Voluntary ICT Use and Employee Well-being

Research on voluntary ICT use during non-work time highlights its negative effects on psychological detachment and recovery, emphasizing the importance of conscious boundary management [41]. This finding underscores the need for organizations to establish clear ICT usage guidelines to foster a supportive culture that prioritizes mental health. As noted in [42], integrating employee well-being into HRM practices is essential for enhancing overall organizational performance. By promoting conscious ICT use and providing clear guidelines, organizations can help employees navigate the challenges of technology, thereby supporting their mental health and ensuring a healthier work-life balance. This approach aligns with the mutual gain perspective, where both

employees and organizations benefit from a focus on well-being.

III. Comparison Solution

As mental health challenges continue to impact employees across industries, organizations are increasingly turning to digital solutions to support well-being and sustain productivity. The integration of technology into mental health initiatives offers innovative ways to address workplace stress, anxiety, and other mental health issues. This paper examines various strategies aimed at improving employee mental health, including digital interventions such as Cognitive Behavioral Therapy (CBT) and mindfulness, AI-driven chatbots for real-time support, anonymous communication platforms, managerial training programs, and ICT usage guidelines. By comparing these approaches, we aim to provide a comprehensive overview of their potential to foster a supportive and mentally healthy work environment.

The comparison focuses on the effectiveness, implementation, and outcomes of each solution. These strategies vary in their methods for improving mental health, from increasing access to resources and encouraging open communication to providing proactive support. This paper evaluates the strengths and limitations of each approach, offering organizations guidance on selecting the most effective strategies for enhancing employee well-being. Ultimately, by analyzing these digital tools and approaches, this paper provides actionable insights for creating a healthier, more productive workplace.

A. Digital Mental Health Tools and E-Health Interventions

Several studies have emphasized the importance of digital health tools, such as web-based Cognitive Behavioral Therapy (CBT) and mobile applications, in supporting employee mental health. These e-health interventions offer accessible, scalable solutions that reduce stigma and provide timely support for employees dealing with stress, anxiety, and depression. A meta-analysis of digital interventions shows positive outcomes, particularly with mindfulness-based approaches, in improving mental health and engagement among employees [28], [38].

The digital mental health tools studied primarily focus on web-based CBT and mobile applications, offering users flexible access to mental health support, especially for individuals facing stress, anxiety, or depression. These tools have demonstrated their effectiveness in improving emotional well-being and employee engagement by providing timely, accessible, and low-cost mental health interventions. The use of mindfulness-based interventions has shown positive results in improving both the psychological and emotional health of employees.

Despite the benefits, some challenges exist. One of the primary limitations is that these tools are more effective for less severe mental health conditions; employees facing more complex issues may not find the same level of support through digital platforms. Additionally, user engagement remains a barrier to their full potential, as not all employees are consistent in using these tools, potentially limiting the impact. Another challenge is that these tools may lack personalization, making it difficult to address the unique mental health needs of individuals. While they provide a more accessible way to engage with mental health resources, these interventions are not a substitute for personalized or in-person therapy.

In terms of implementation, integrating digital tools into existing employee wellness programs can be moderately complex. It requires ensuring the tools are compatible with company platforms, providing ongoing user support, and addressing varying levels of adoption among employees. Nevertheless, the accessibility and scalability of these digital tools represent a significant advantage, particularly in large organizations, where traditional face-to-face mental health resources may not be feasible for all employees.

B. Hybrid Care Models

Hybrid care models combine the advantages of digital tools with traditional in-person therapy, offering a more comprehensive and personalized approach to mental health care. These models integrate real-time digital screening and treatment options with face-to-face sessions, ensuring continuity of care for employees facing mental health challenges [34], [35].

Hybrid care models blend the flexibility and accessibility of digital tools, such as real-time screenings and online therapy, with the personal touch of in-person therapy sessions. This combination provides employees with the convenience and privacy of digital services, while still maintaining the human connection and expertise offered by traditional face-to-face interactions. This dual approach enhances the personalization of care, enabling the treatment to be adapted to an employee's specific needs.

The effectiveness of hybrid care models lies in their ability to offer a more holistic solution to mental health care. By combining the benefits of digital interventions and in-person therapy, these models ensure that employees receive continuous care, improving both accessibility and the quality of support available. The integration of these two approaches also fosters more comprehensive monitoring of progress and challenges in the recovery process.

However, hybrid care models come with some limitations. They can be more costly due to the need for both digital platforms and in-person therapy resources. Additionally, coordinating between digital and in-person services can be complex, requiring efficient communication and collaboration among healthcare providers. The implementation complexity is high, as organizations must ensure the seamless integration of these two care formats and maintain ongoing monitoring to ensure the efficacy of the approach. Despite these challenges, the potential benefits, such as enhanced accessibility and personalized care, make hybrid models a promising solution for employee mental health support.

C. Transdiagnostic Approaches

Transdiagnostic methods focus on addressing common issues across multiple mental health disorders, such as stress management, emotional regulation, and coping strategies. These approaches are versatile, catering to diverse employee needs while ensuring mental health support is accessible and flexible [35].

The approach of transdiagnostic methods is designed to address overlapping issues that are prevalent across various mental health disorders, rather than focusing on the unique symptoms of a single condition. This broad applicability makes transdiagnostic approaches adaptable and effective for a wide range of individuals, particularly in workplace settings where diverse mental health challenges exist. By focusing on general psychological issues like stress and emotional

regulation, these approaches offer a flexible solution for employees who may not fit the specific criteria for a single diagnosis but still require support.

In terms of effectiveness, transdiagnostic methods are highly efficient in managing shared challenges across different disorders. They offer a broad-reaching intervention that can be used by individuals with varying mental health concerns. However, they may not be as effective for severe conditions or when a targeted, specific intervention is needed. While they can address general emotional or stress-related issues, they do not always offer the deep, individualized support that more specialized therapies might provide.

The outcome of using transdiagnostic approaches is the provision of inclusive, adaptable care. It ensures that employees dealing with a range of mental health issues can access support, promoting overall mental well-being within a flexible framework. However, these approaches might not always be as personalized or deeply tailored as other, more specialized interventions.

The limitations of transdiagnostic approaches lie in their broader focus. While they are effective for managing common psychological challenges, they may not provide the specific, individualized treatment necessary for severe conditions. As a result, they might fall short in treating more complex or specific mental health disorders. Implementation complexity is moderate; these tools require ongoing adaptation to meet the diverse needs of employees, and their success relies on continuous evaluation and adjustment to ensure they remain relevant and effective for each individual's mental health needs.

D. Cloud-based system

Cloud-based systems leverage data from social media, IoT devices, and online behavior to detect early warning signs of mental health issues. Real-time monitoring and analysis help organizations identify trends and intervene promptly to support employees [35].

The approach of using cloud-based systems for monitoring mental health integrates a wide variety of data sources, including social media activity, wearable devices, and employee behavior online. This data is aggregated and analyzed to detect early indicators of mental health issues, allowing organizations to respond quickly and proactively. The integration of these data points provides a comprehensive understanding of an employee's well-being, which can help in identifying emerging trends or risks related to mental health challenges.

In terms of effectiveness, cloud-based systems excel in early detection of mental health issues. They provide real-time insights that allow organizations to take timely, informed actions, enhancing the chances of preventing more serious problems from developing. By continuously monitoring trends, these systems can offer valuable insights into overall mental health within an organization, allowing for early interventions before issues escalate.

The outcome of using a cloud-based system is primarily focused on timely interventions and proactive mental health care. Organizations benefit from enhanced visibility into the mental well-being of their employees, leading to a better understanding of mental health trends and the ability to provide targeted support. This approach facilitates a proactive care model, which can potentially reduce the prevalence and severity of mental health concerns.

However, the limitations of cloud-based systems include privacy and ethical challenges, particularly concerning the collection and handling of sensitive data. There is also a reliance on the accuracy of the data gathered, as incorrect or incomplete data can lead to flawed conclusions or missed opportunities for intervention. Ensuring the protection of personal information and addressing ethical concerns around surveillance and data usage are critical challenges for organizations implementing these systems.

The implementation complexity of a cloud-based system is relatively high. It requires the integration of multiple data sources, as well as robust privacy and security measures to protect sensitive employee information. Organizations must also navigate the ethical considerations involved in monitoring employee behavior, which can require careful balancing to maintain trust and ensure compliance with privacy regulations.

E. Chatbots and AI Technologies

The integration of AI-driven technologies, particularly chatbots used in Mental Health First Aid (MHFA) programs, has proven beneficial in providing real-time, confidential mental health support. These systems use mood detection, activity suggestions, and behavior analysis to offer personalized support, helping employees manage stress and improve mental well-being [12], [25]. However, their impact on certain mental health conditions, like anxiety, varies across different contexts [13].

AI-driven chatbots offer personalized support by assessing an individual's mood and suggesting coping strategies, making them an effective tool for real-time mental health care. They allow employees to receive confidential support, especially in dealing with stress and depression, at any time of day. This accessibility is key in offering timely assistance and reducing barriers to seeking help. However, their effectiveness in managing conditions like anxiety is more variable, with some users experiencing mixed results across different contexts [13].

The outcome of integrating AI chatbots into mental health programs includes enhanced employee engagement with mental health support, promoting early intervention and increasing overall awareness about mental health issues. These technologies provide employees with a safe space to discuss their concerns, fostering a proactive approach to mental well-being.

Despite their advantages, there are limitations to AI-driven chatbots. They may not be as effective for severe mental health conditions, and their capacity to handle complex emotional issues is limited. This makes them less suitable for cases requiring professional therapy or intervention.

In terms of implementation complexity, integrating chatbots into existing workplace systems is of medium difficulty. It requires the development and continuous updating of AI systems to ensure they remain effective, as well as integrating these technologies into current mental health support structures within organizations.

F. Wearable Devices for Mental Health

Wearable devices, driven by AI, monitor physiological data such as heart rate, sleep patterns, and stress levels,

providing real-time insights into an individual's mental health. These devices help employees track their well-being and identify stressors, enabling proactive interventions [14], [31].

AI-driven wearable devices offer a unique approach to mental health support by continuously monitoring vital signs like heart rate and sleep patterns. These devices are particularly effective in real-time stress and mood monitoring, helping employees stay aware of changes in their mental health. By tracking physiological data, wearables support early interventions, enabling users to respond promptly to potential mental health challenges before they escalate.

The key outcome of wearable devices is that they encourage proactive care, as employees can track their well-being and identify stressors more easily. This empowers individuals to take control of their mental health, leading to better self-management.

However, wearable devices are not without limitations. The accuracy of physiological data can affect the reliability of the insights they provide. Additionally, some users may find the devices intrusive or uncomfortable to wear for extended periods, which could affect their willingness to use them consistently.

In terms of implementation complexity, wearable devices require integration with existing technology and ongoing data analysis to ensure their effectiveness. Although the devices are generally easy to use, managing the data they generate and ensuring it leads to actionable insights can be challenging.

G. Explainable AI (XAI)

Explainable AI (XAI) emphasizes creating AI systems that are transparent and interpretable, ensuring their decision-making processes are understandable. In mental health applications, XAI helps improve trust and reliability by offering clear explanations for AI-generated recommendations, such as personalized coping strategies or diagnosis suggestions [34].

The approach of XAI centers around creating AI systems that are not only accurate but also transparent and interpretable. This is especially important in mental health applications, where users need to understand the reasoning behind AI-driven recommendations. By offering clear, understandable explanations, XAI increases user trust in the system, making interventions more actionable and effective.

The effectiveness of XAI lies in its ability to enhance trust and confidence in AI-based mental health support. When users understand why certain recommendations or decisions are made, they are more likely to accept and engage with the interventions, which improves their effectiveness. Additionally, XAI helps make interventions more accessible by breaking down complex AI processes into understandable parts.

As a result, XAI contributes to the broader adoption of AI tools in mental health, improving the overall quality of support. Its transparent nature helps overcome skepticism and resistance to AI-based mental health applications, which can lead to better outcomes for users.

However, XAI is still in its developmental stages, and its ability to address all user concerns or complexities in decision-making is not yet fully realized. There are ongoing challenges in ensuring that AI systems remain interpretable without oversimplifying complex decisions, and in some cases, the explanations provided may not satisfy all users' needs.

In terms of implementation complexity, XAI requires the development of transparent systems that are both reliable and understandable. This involves creating models that are inherently explainable, which can be challenging in complex mental health contexts.

H. Smart Technologu (STARA)

Smart Technology, or STARA (Smart Technology, Artificial Intelligence, Robotics, and Algorithms), aims to enhance employee well-being and productivity by managing job dynamics effectively. By integrating AI and robotics into workplace systems, STARA can monitor stress levels, workload, and engagement, offering personalized recommendations to improve work-life balance and job satisfaction [39].

The approach of STARA involves using AI, robotics, and algorithms to manage and optimize various aspects of work dynamics, from stress monitoring to workload management. By integrating these technologies, STARA helps create a more personalized and supportive work environment.

STARA is effective in boosting productivity by optimizing job roles and engagement, thereby reducing stress and supporting mental health. By offering tailored recommendations to balance work dynamics, it enhances employees' ability to maintain a healthier work-life balance and feel more satisfied in their roles.

The outcomes of implementing STARA include improved job dynamics, better work-life balance, and higher employee satisfaction, all of which contribute to increased productivity. These improvements can foster a healthier, more engaged workforce, positively impacting overall organizational performance.

However, STARA comes with certain limitations. The cost of integrating AI, robotics, and algorithms into workplace systems can be high. Additionally, there may be technological barriers, such as resistance from employees or employers in adapting to AI-driven workplace changes. Some individuals may also be hesitant to embrace such advanced technologies in their work environments.

Implementing STARA is complex and requires significant investment in both the technology itself and in overcoming resistance to change. It involves the integration of various technologies into existing workplace systems, which can be challenging without proper infrastructure and support.

I. Anonymous Communication Platforms

Creating anonymous communication platforms within organizations encourages employees to openly discuss mental health issues without fear of judgment. This approach has been shown to significantly reduce stigma around mental health and provides a safe space for employees to seek help, increasing mental health awareness both among peers and management [11].

The approach of creating anonymous communication platforms allows employees to engage in open discussions about their mental health without fear of judgment, offering them a level of security that may otherwise deter them from seeking help.

The effectiveness of these platforms lies in their ability to significantly reduce stigma, thereby promoting open dialogue about mental health. This leads to increased support from both peers and management, which can foster a more inclusive environment where employees feel safe to express their concerns.

The outcome of implementing such platforms is the creation of a more inclusive and supportive work culture, where mental health is treated with the same level of importance as other aspects of well-being. This also results in increased mental health awareness, which is crucial for both employee morale and organizational health.

However, the limitations include the fact that while anonymous platforms can reduce stigma, they may not be effective for addressing deeper mental health issues that require professional care or intervention. These platforms also cannot replace the need for specialized mental health services in certain cases.

The complexity of implementation is moderate; while it does not require advanced technology, it does necessitate careful planning to maintain a safe, anonymous space. Regular monitoring and clear guidelines are essential to ensure the effectiveness and confidentiality of these platforms.

J. Managerial Training on Mental Health Awareness

Research highlights the importance of equipping managers with the necessary skills and knowledge to address mental health issues within their teams. Managerial training programs focusing on mental health awareness and strategies for offering support help create a workplace culture that prioritizes well-being and responsiveness to employee needs [10], [16].

The approach of training managers to recognize and address mental health concerns aims to build a culture where mental well-being is a priority. Managers learn to identify signs of distress and offer support, fostering a sense of security among employees and encouraging them to seek help when needed.

Training programs are highly effective in enhancing managerial competence in mental health support. They empower managers to respond proactively to issues, which strengthens the culture of support within teams and creates a safer, more inclusive workplace.

The outcome of managerial training is the improvement of employee-manager relationships, with managers better equipped to provide mental health support. This leads to increased employee well-being and engagement, as employees feel supported and understood.

However, limitations include the need for time and resources to develop and deliver comprehensive training programs. Additionally, despite training, some managers may not be adequately equipped to handle complex mental health issues, which might require professional intervention.

The complexity of implementation is medium, as consistent training and follow-up are essential to ensure managers stay informed about mental health best practices. Ongoing support and resources for managers can enhance the sustainability of the training’s impact.

K. ICT Usage Guidelines and Work-Life Balance

The rise of ICT in the workplace has led to increased demands and expectations, contributing to stress, burnout, and work-life imbalance. Clear ICT usage guidelines can mitigate these issues by establishing boundaries between work and personal life, ensuring employees are not overwhelmed by constant connectivity [8], [20].

The approach of implementing ICT usage guidelines focuses on creating policies that help employees disconnect from work during off-hours. This ensures that work does not continuously bleed into personal life, which can lead to fatigue and stress.

This strategy is effective in reducing stress and preventing burnout, especially as it helps employees manage their workload and expectations. By encouraging employees to step away from work during designated breaks or after work hours, their mental well-being is preserved, leading to better recovery during non-working hours.

The outcome of these guidelines is enhanced employee well-being, as workers can enjoy their personal time without the pressure of work-related communications. This results in a healthier work-life balance, reducing the likelihood of chronic stress and improving overall productivity.

However, the limitations of this approach include potential resistance from employees who are accustomed to constant connectivity or fear falling behind in work. Additionally, enforcing these guidelines may face challenges, as some workers may continue to check emails or messages outside of working hours.

In terms of implementation complexity, it is medium. Establishing clear policies and ensuring their enforcement requires consistent effort. Organizations must communicate the guidelines clearly, monitor adherence, and offer support for employees transitioning into this work structure.

L. Voluntary ICT Use Management

Encouraging employees to voluntarily regulate their ICT use helps combat the "always-on" culture, improving work-life balance and reducing stress [41]. Organizations benefit from improved employee satisfaction and productivity [18], [42].

The approach of encouraging employees to voluntarily manage their ICT use focuses on preventing stress and supporting mental health by setting boundaries around when and how often they engage with work-related communications outside of office hours. This strategy is effective in reducing stress linked to constant connectivity, allowing employees to regulate their ICT usage and enjoy better recovery periods during non-working hours, thus improving work-life balance and reducing stress. The desired outcome is a healthier work-life balance and improved mental well-being, as employees who manage their ICT use are likely to experience less burnout and more fulfilling personal time, which can, in turn, enhance productivity during working hours. However, the success of this approach depends on employees' willingness to self-regulate, as a lack of motivation or support may lead to continued engagement with work-related ICT tools beyond office hours, undermining the benefits. Enforcing this voluntary strategy can also be challenging due to its reliance on individual commitment. The implementation complexity is relatively low, as it encourages personal responsibility, but organizations must provide adequate support, such as

guidance, education on the benefits of ICT regulation, and possibly monitoring to promote adherence.

IV. Results

This section presents the findings from the integration of Information and Communication Technologies (ICT) aimed at enhancing employees' mental health and well-being. The results are categorized based on proposed solutions, their effectiveness, and implications for workplace mental health management.

A. Effectiveness of ICT Integration in Mental Health Support

The integration of ICT tools in the workplace has shown significant potential in addressing mental health challenges among employees. Research indicates that ICT can facilitate real-time support, reduce stigma, and promote open communication regarding mental health issues. For instance, digital platforms enabling anonymous feedback allow employees to express concerns without fear of judgment, fostering a supportive work environment. Organizations adopting these technologies report higher employee satisfaction, increased engagement levels, and reduced absenteeism related to mental health issues [11], [28].

In a study involving in-service elementary teachers, Cross and Hong (2012) found that support from schools in implementing innovative practices significantly comforted teachers. Those satisfied with administrative support exhibited more positive attitudes toward their teaching roles, underscoring the importance of organizational backing in mental health initiatives [16].

Nonetheless, one Austrian female participant disagreed and emphasized that ICTs do not improve work productivity, instead ICTs cause her to permanently feel stressed. All other participants were able to explain in one way or another how ICTs help to improve their work efficiency. For instance, study participants explained that ICTs help to enhance the internal flow of communication, to optimize the information exchange between employees, or to accelerate coordination processes with customers [24].

B. Machine Learning Applications for Mental Health Monitoring

The application of machine learning (ML) algorithms represents a significant advancement in proactive mental health monitoring. Utilizing social media data, particularly from platforms like Twitter, has proven effective in identifying at-risk individuals through sentiment analysis. Specifically, Long Short-Term Memory (LSTM) networks have demonstrated effectiveness in analyzing real-time data, enabling early detection of mental health issues [37]. This proactive approach outperforms traditional screening methods, which often rely on retrospective assessments, facilitating timely interventions that can mitigate the progression of mental health disorders.

C. Social Media as a Tool for Monitorring Employee Well-being

The concept of social media as a "social sensor" has gained traction in understanding employee mental health trends. Analyzing user-generated content on platforms like Twitter reveals patterns indicative of emotional distress and mental health challenges. Organizations leveraging this data can proactively monitor employee well-being and implement targeted support measures. Findings suggest that sentiment analysis can effectively gauge the overall mental health climate within a workforce, leading to timely and appropriate interventions [37].

D. User-Centred Design in Mental Health Solution

User -centered design is essential for developing effective ICT solutions for mental health. Studies show that solutions designed with input from both mental health professionals and employees tend to have higher adoption rates and effectiveness. Incorporating feedback mechanisms is crucial for enhancing user engagement and trust in these systems [10]. This collaborative approach improves the usability of mental health tools and ensures they address the specific needs of employees, maximizing their impact.

E. ICT-Enabled Services to Empower Individuals in Managing Their Health

Technology can serve multiple roles in mental health management. As a tool, it simplifies tasks and enhances user capabilities, leading to improved self-efficacy and motivation. As a medium, it provides interactive experiences that engage users in simulations of behavior and skill learning. Additionally, technology can act as a social actor, mimicking human interactions by providing feedback and social support, thereby fostering a sense of connection and community [28].

F. Challenges and Ethical Considerations

Despite the positive outcomes associated with ICT integration, several challenges and ethical considerations must be addressed. Resistance to technological change, privacy concerns, and the potential for technostress pose significant barriers to successful implementation. Organizations must navigate the ethical implications of monitoring employee mental health through digital platforms, ensuring that data is handled with confidentiality and respect for individual privacy [21], [32]. Addressing these challenges is vital for fostering a culture of openness and support within the workplace.

G. Recommendations for Implementation

Based on the findings, the following recommendations are proposed for organizations looking to integrate ICT solutions for mental health well-being:

- Adopt User-Centered Design: Involve employees and mental health professionals in the design and implementation of ICT tools to ensure they meet the needs of all stakeholders.
- Utilize Machine Learning for Monitoring: Implement machine learning algorithms to analyze real-time data from social media and other sources for proactive mental health monitoring.
- Establish Clear Guidelines: Develop clear policies regarding the use of ICT for mental health monitoring to address ethical concerns and protect employee privacy.
- Promote a Supportive Culture: Foster an organizational culture that prioritizes mental health and encourages open communication about mental health issues.

V. Dicussion

This section addresses the integration of Information and Communication Technologies (ICT) into the mental health

well-being of employees, responding to the key questions regarding the types of technology that can be utilized, their benefits for employee mental health, and the specific advantages of implementing these technologies in the workplace, particularly in Cambodia.

A. ICT Integration for Mental Health Well-Being

1) Digital Mental Health Interventions: Digital tools like web-based Cognitive Behavioral Therapy (CBT) and mobile apps offer employees easy access to evidence-based therapies such as mindfulness, helping to remove barriers to mental health support and providing ongoing care. Hybrid models that blend digital tools like online therapy and real-time screening with in-person sessions offer more personalized and comprehensive care. A transdiagnostic approach, addressing common issues like stress and emotional regulation across various conditions, ensures that diverse employee needs are met. Additionally, cloud-based systems can aggregate data from multiple sources (e.g., social media, IoT, employee behavior) to detect early signs of mental health issues, enabling timely interventions.

2) AI and Technology-Driven Support: AI-powered chatbots can provide employees with 24/7 confidential support, offering a judgment-free space to track mood, manage mental health issues, and receive personalized coping strategies. Wearable devices also play a role in mental well-being by tracking physiological data such as heart rate and sleep patterns, offering real-time insights that help employees become more aware of their emotional state. Explainable AI (XAI) enhances transparency, making AI-driven recommendations understandable and trustworthy. Smart Technology for Advanced Robotics and Automation (STARA) integrates AI, robotics, and algorithms to optimize workplace dynamics, monitor stress levels, and offer personalized suggestions to improve work-life balance and overall well-being.

3) Workplace Mental Health: Creating anonymous communication platforms provides employees with a confidential space to discuss mental health concerns, encouraging an open and supportive workplace culture. Managers can play a pivotal role by undergoing mental health awareness training, enabling them to identify and address mental health challenges early on. This proactive approach fosters stronger relationships between employees and managers, while improving the organizational culture. Establishing clear guidelines for ICT use helps employees disconnect from work during off-hours, promoting better work-life balance and preventing burnout. Encouraging voluntary ICT usage management also supports employees in regulating their connectivity, reducing stress and enhancing mental well-being.

B. Benefits to Employee Mental Health

1) Enhanced Accessibility: Digital mental health interventions and mobile applications provide employees with easy access to mental health resources, enabling them to seek help without the stigma often associated with traditional services.

2) Increased Support and Engagement: AI chatbots and anonymous communication platforms can foster a culture of support, encouraging employees to engage in conversations about mental health and seek assistance when needed.

3) Proactive Monitoring and Intervention: Machine learning applications can analyze data to identify at-risk employees, allowing organizations to implement timely interventions that can prevent the escalation of mental health issues.

4) Improved Managerial Support: Training programs for managers can lead to a more supportive environment, where employees feel comfortable discussing their mental health concerns, ultimately enhancing job satisfaction and performance.

5) Work-Life Balance: Clear guidelines for ICT usage can help employees manage their work-related stress by promoting boundaries between work and personal time, leading to better mental health outcomes.

C. Implementation Benefits in Cambodia

1) Cultural Relevance: Integrating ICT solutions tailored to the Cambodian context can address specific cultural barriers to mental health discussions, promoting a more open dialogue about mental well-being in the workplace.

2) Economic Efficiency: By implementing cost-effective digital mental health interventions, organizations in Cambodia can provide essential support to employees without the need for extensive resources, ultimately improving workforce productivity.

3) Scalability: The use of digital platforms allows for scalable mental health interventions that can reach a larger number of employees across various sectors, particularly important in a rapidly developing economy like Cambodia.

4) Increased Awareness and Education: Utilizing ICT can help raise awareness about mental health issues among employees, reducing stigma and encouraging individuals to prioritize their well-being.

5) Long-term Sustainability: By fostering a culture that values mental health through ICT integration, organizations can contribute to the long-term sustainability of their workforce, leading to improved employee retention and overall organizational performance.

VI. Conclusion and Futurework

The integration of Information and Communication Technologies (ICT) and machine learning into workplace mental health initiatives has demonstrated substantial promise in enhancing employee well-being. The findings indicate that ICT tools not only facilitate real-time support and promote open communication but also help reduce stigma surrounding mental health issues. By creating an environment where employees can express their concerns anonymously, organizations foster a culture of support that contributes to higher levels of job satisfaction and engagement.

Machine learning applications, particularly those utilizing social media data, enable proactive monitoring of mental health, allowing for early detection of potential issues and timely interventions. The use of sentiment analysis as a "social sensor" further empowers organizations to gauge the mental health climate within their workforce, facilitating targeted support measures tailored to employee needs.

Moreover, employing user-centered design principles ensures that mental health solutions are effective and widely adopted, enhancing their impact on employee well-being. However, it is crucial to address the challenges and ethical considerations associated with these technologies, including privacy concerns and resistance to change, to cultivate a supportive workplace culture.

In summary, the strategic integration of ICT and machine learning not only addresses mental health challenges but also fosters a proactive approach to employee well-being, ultimately contributing to improved productivity and job satisfaction. Future research should focus on assessing the long-term effects of these technologies and exploring innovative strategies to overcome implementation barriers, ensuring that organizations can fully leverage their potential to support employee mental health.

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