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ABOUT WIJAR

Westcliff International Journal of Applied Research (WIJAR) is a multidisciplinary, double-blind peer-reviewed, open access journal pioneered by the faculty at Westcliff University. The journal was founded in 2017 and provides an opportunity for academics, industry professionals, and students to publish innovative research that offers insight into practical implementation. In order to widely disseminate new knowledge and scholarship, WIJAR advocates for all submissions to be written in a style that is accessible/available to a broad audience or readership, including those readers who may not be familiar with either research or the topic studied. The journal aligns with Westcliff University's mission to educate, inspire, and empower individuals through its dedication to supporting authors in the review and revision process to produce the highest quality content possible.

Distinguishing this journal from others similar is the strong support offered to contributors, especially first-time authors who may need additional writing or structural assistance. All contributors have access to the Westcliff University Online Writing Center where dedicated research/writing specialists are able to offer support and suggestions.

LETTER FROM THE EDITOR-IN-CHIEF

March 2025.

Dear Readers,

It is with great pleasure that I bring this issue to the attention of our readers on behalf of the Editorial Board of the *Westcliff International Journal of Applied Research* (WIJAR). We are proud to share the latest research and original perspectives that our writers have found. I hope their work encourages others to share their unique perspectives and sparks further research.

This compilation of five articles is the first group of articles accepted in 2024. I truly believe that the success of this publication is the result of the dedication and hard work of all those concerned who have collaborated to seek out new information and make a difference. This is a great chance for us to express our gratitude to everyone who has contributed to our journal.

The dedication and energy of the journal contributors inspire me. Members of the editorial board who provide vital support, reviewers who meticulously evaluate each submission, and writers who contribute insightful comments make up a vibrant academic community that propels our publication forward.

In particular, I would like to sincerely thank Dr. Evelin Suij-Ojeda, Prof. Jodi Crawford and Rachel Sieber, our respected Associate Editors, for their invaluable contributions. Their unwavering commitment to our journal's objective has played a crucial role in molding its course and enhancing its reputation within the academic community. Their remarkable knowledge, thoroughness, and constant support are genuinely priceless contributions to our team.

To conclude, I would like to invite everyone who reads this issue, faculty, staff, students, and researchers, to delve into its contents and engage with the thought-provoking ideas it presents. We have no doubt that you will think about submitting your research articles to this journal because it is an excellent resource and proof of the significant influence of scholarly work.

Sincerely,

Mary Allegra
Editor-in-Chief

ACKNOWLEDGEMENTS

The publishing of the *Westcliff International Journal of Applied Research* (WIJAR) relies on the contributions of dedicated individuals. We extend our appreciation on behalf of the journal to:

- Dr. Anthony Lee for his unwavering support and strong belief in the journal's significant value for Westcliff University and the wider academic community.
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- Every author who has dedicated their time and energy to presenting their thoughts and perspectives in this publication.
- The Marketing Department of Westcliff University for their overall participation and contributions to the journal's marketing, the development of the journal's website, and for their significant role in the publication's success.
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Thank you all!

Cognitive Technologies: Machine Learning, Artificial Intelligence, and Convolutional Neural Networks in Computer Vision

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Abstract

This research focus was motivated by the limited understanding of cognitive technologies and the growing gap between artificial intelligence (AI) and human intelligence. This is a literature review and its purpose is to simplify the meaning and processes behind cognitive technologies, notably the fundamentals of machine learning (ML) and computer vision with the intention to briefly address the alleged threat of AI taking over the job market. This research is a review of peer-reviewed articles retrieved from comparative studies, systematic reviews, meta-analysis, service research, reports, conference proceedings, experimental studies, literature reviews, scientometric analyses, books, and multi-case studies, dating from the years of 2018 to 2024. This literature review defines machine learning (ML), artificial intelligence (AI), computer vision, and convolutional neural networks (CNNs). It also compares machine learning to traditional programming and reveals the types of learning in ML models' training. ML and its correlation with AI are also discussed and details about theory of mind, self-aware AI, reactive machines, and limited memory AI are shared. The literature expounds computer vision, particularly convolutional neural network (CNN) and CNN layers. Recent cutting-edge applications of artificial intelligence including generative AI models and autonomous systems are also incorporated. Finally, the literature briefly addresses the alleged threat of AI taking over the job market. The findings of this literature review reveal that AI is becoming the new way of operating. The conclusion shows that AI models require significant computation to allow computers to learn autonomously. Thus, understanding mathematical models of data and perfecting the process of writing software could be the key to remaining employable as more jobs are expected to be shifted due to AI and tasks automation.

Keywords: Cognitive technology, artificial intelligence, machine learning, computer vision, convolutional neural networks

Introduction

Cognitive technology employs processes to identify patterns in massive volumes of data. These patterns can be interpreted, and their meanings can help to predict consumer behavior, detect fraud as soon as it occurs, analyze warranty data, and determine quality issues (Lillo et al., 2022). In cognitive computing, many methods are used to mimic human thought processes. This includes but is not limited to machine-learning (ML) and computer vision. Regardless of its benefits on society, artificial intelligence (AI) remains one of the most influential technologies altering the labor market

(Huang & Rust, 2018). AI may positively impact the labor market as much as it may lead to negative consequences (Hassani et al., 2020). From one perspective, AI could take over 45% of the current job positions, giving rise to social inequality (Berg et al, 2018; Levy, 2018). From another perspective, many jobs could become upgraded rather than replaced, and people may simply need to acquire new knowledge to remain employable (Campan & Vallée, 2019).

There is a limited understanding of cognitive technologies combined with a growing gap between AI and human intelligence. The purpose of this literature review is to simplify the meaning

and processes behind cognitive technologies, notably the fundamentals of machine learning and computer vision, with the intention to briefly address the alleged threat of AI taking over the job market.

The study was analyzed according to the following criteria: accuracy, objectivity, currency, and coverage (City University of Hong Kong, 2023). Information in this literature review is unbiased and strictly retrieved from peer-reviewed articles published within the last five years for accuracy, objectivity, and currency purposes. The last criteria used to analyze the literature review is coverage; all information was examined to determine whether it provides comprehensive coverage in alignment with the purpose of the literature review.

This literature review is thematic because it is organized by content. First, the literature defines ML and compares it to traditional programming. Second, the literature reveals the four types of learning in ML models' training along with the key elements of ML. Then, the literature discusses ML and its correlation with AI and shares some details about theory of mind, self-aware AI, reactive machines, and limited memory AI. The literature also discusses computer vision, particularly convolutional neural network (CNN) and CNN layers. Additionally, literature incorporates recent cutting-edge applications of artificial intelligence including generative AI models and autonomous systems. Finally, the literature briefly addresses the alleged threat of AI taking over the job market.

Definition of Terms

Figure 1

Machine Learning Versus Traditional Programming

Machine Learning



Traditional Programming



1. *Computer vision*: Enables computers to sense visual input in the field of artificial intelligence. Computer vision derives meaningful data from visual inputs and recommends actions based on observations and understanding of the visual input, e.g. images and videos. Computer vision is the foundation of facial recognition, object detection, medical imaging, and autonomous vehicles (Voulodimos et al., 2018).

2. *Stream processing*: Sends a message to another process, to be handled asynchronously in data-intensive applications, e.g., real-time fraud detection (Isah et al., 2019).

3. *Batch processing*: Crunches a large amount of accumulated data, periodically, in data-intensive applications, e.g., sales projections and revenue aggregation (Fowler & Mönch, 2022).

Discussion

Machine-learning (ML) enables a computer to program itself and supports businesses by allowing automation and providing accuracy. In the field of marketing, both digital advertising and personalized targeting are being automated due to machine-learning, which also provides detailed actuarial modeling (Mustak et al., 2021).

Machine Learning Versus Traditional Programming

In machine-learning, the data and output are run on a computer to build the program, whereas in traditional programming, the data and program are run on a computer to generate an output as shown in Figure 1.

Machine learning is more advanced than traditional analytics, as it provides interesting cognitive insights such as data-intensive, which handles large terabytes and petabytes of complex data that might be distributed across different locations. Data-intensive applications prioritize storage, search indexes, stream processing, and batch processing (Alpaydin, 2021).

Machine learning models are trained and can be improved over time. For instance, in healthcare, machine learning models can predict disease outcomes and identify potential areas for intervention (Davenport & Ronanki, 2018; Piorkowski et al., 2021). In addition to the ability to make predictions using data sets, machine learning models can also learn from experience (Gangal et al., 2021).

Types of Learning in Machine Learning

There are four types of learning in ML: supervised, unsupervised, semi-supervised, and reinforcement learning.

Supervised and Unsupervised Learning

In supervised learning, the datasets that are used to train the algorithms are labeled with the desired outputs, e.g. this is spam, this is not. The objective of supervised learning in the example of spam detection is to recognize anomalies or patterns in new data. A second example of supervised learning could involve a function in the form of data (x) and an output in the form of ($f(x)$). The objective of supervised learning in the second example is to learn the function for new data (x) (Hiran et al., 2021; Rajoub, 2020).

While supervised learning relies on labeled data to train models, not all machine learning tasks have access to such structured datasets. In cases where labeled data is unavailable, unsupervised learning becomes essential. So, what is unsupervised learning?

Unsupervised learning is a type of machine learning in which the datasets that are used to train the algorithms are not labeled with the desired outputs. This includes clustering, dimensionality reduction, and anomaly detection without human intervention (Rajoub, 2020).

Semi-supervised and Reinforcement Learning

In semi-supervised learning, the datasets that are used to ground predictions are labeled with the desired outputs while the rest of the datasets that are meant to shape the larger data distribution are not labeled with the desired outputs (Alloghani, et al., 2020). Semi-supervised learning combines labeled and unlabeled data to improve a model's performance. However, some AI systems require a different learning approach in which an intelligent agent interacts with an environment receiving rewards or penalties to optimize decision-making overtime, e.g., reinforcement learning (Alloghani, et al., 2020; Mahesh, 2020).

In reinforcement learning, intelligent agents, also referred to as AI-driven systems, learn from a sequence of actions through trial and error (Ernst & Louette, 2024). The feedback from the intelligent agent's actions allows learning from errors and leads to maximization of the notion of cumulative reward (Mahesh, 2020).

To sum up, supervised learning, which is also referred to as inductive learning, is used by many machine learning algorithms because it is easier than unsupervised learning. Supervised learning is the most mature type of learning, while reinforcement learning is the most ambitious type of learning.

Key Elements of Machine Learning

Although new machine-learning algorithms are being developed every year, the following three components of machine learning algorithms remain fundamental: representation, evaluation, and optimization.

The first fundamental component of machine learning algorithms is representation, which is responsible for visualizing knowledge in graphical models, instances, decision trees, neural networks, and other visualization methods. The second fundamental component of machine learning algorithms is evaluation, which is responsible for assessing hypotheses referred to as candidate programs. The evaluation of hypotheses is performed through entropy k-L divergence, posterior probability, squared error, prediction and recall, etc. The third fundamental component of machine learning algorithms is optimization, which is also referred to as the search process. Optimization is responsible for

generating candidate programs such as combinatorial optimization, constrained optimization, and convex optimization (Azevedo et al., 2024).

It is evident that machine learning focuses on the development of algorithms that allow computers to learn from data. But how does machine learning relate to artificial intelligence?

Correlation Between Machine Learning and Artificial Intelligence

Machine learning enables machines to extract knowledge from data and learn from the extracted knowledge without direct instructions (John et al., 2023). As for artificial intelligence, it is a branch of computer science engaged in the creation of intelligent machines, which are capable of performing cognitive functions similar to those of humans thanks to computer science and robust datasets. Artificial intelligence is the broader concept of allowing a machine or a system to sense, form logical judgments, take actions, and/or adapt like a human (Helm et al., 2020). In summary, artificial intelligence is the broader concept, while machine-learning is a narrow application of artificial intelligence.

Types of Artificial Intelligence Based on Capabilities

There are four main types of AI; distinguished based on capabilities: theory of mind, self-aware AI, reactive machines, and limited memory AI (Russell & Norvig, 2021). Machine learning falls under the category of limited memory AI because it relies on past data to train ML models, improve the system's performance, and make informed decisions or accurate predictions (Hassani et al., 2020).

Theory of Mind and Self-Aware AI

Theory of mind is a theoretical type of AI. It involves systems that understand human emotions, beliefs, and intentions. Theory of mind systems would be able to interact more naturally and effectively with humans by understanding and anticipating their needs (Schossau & Hintze, 2023). Similarly to theory of mind, self-aware AI is hypothetical.

Although self-aware AI is still hypothetical, it is the most advanced form of AI and it is expected to possess consciousness and self-awareness combined with the ability to understand own

existence and make autonomous decisions (Chatila et al., 2018).

Reactive Machines

Reactive machines solely respond to certain stimuli and do not have a memory or the ability to learn from past experiences. Reactive machines operate based on pre-programmed rules and do not adapt or improve over time, e.g., IBM's Deep Blue and the chess-playing computer (Dorr, 2022). Contrary to reactive machines, limited memory systems have the ability to learn from past experiences.

Limited Memory AI

Limited memory systems can learn from historical data and make decisions based on past experiences. Machine learning models, which are trained on data, can improve their performance over time (Radanliev & De Roure, 2021). For instance, **AlexNet** is a limited memory type of AI. It is one of the most famous convolutional neural network models (Zhao et al., 2021); a winner of the ImageNet Large Scale Visual Recognition Challenge (ILSVRC) in 2012 that significantly outperformed previous methods in image classification tasks (Morid et al., 2021). **AlexNet** showcased how powerful deep learning models are in terms of performance upgrade with higher datasets and computational resources (Wagatsuma et al., 2022). Since AlexNet is one of the most famous convolutional neural network models with high influential architectures in deep learning, it is crucial to first understand convolutional neural networks and their role in computer vision.

Convolutional Neural Network in Computer Vision.

Neural networks are a subcategory of machine learning and are the center of deep learning algorithms (Dhillon & Verma, 2020). Neural networks consist of connected node layers: an input layer, a single or multiple hidden layers, and an output layer. Each layer has an assigned weight and threshold. The node gets activated only if its output exceeds the threshold, driving the data to the subsequent layer of network (Taye, 2023).

There are different types of neural networks: Recurrent neural networks, convolutional neural networks, etc. Recurrent neural networks treat

natural language and recognize speech, while convolutional neural networks (CNNs) perform classification and tasks related to computer vision. CNN leverages matrix multiplication and other principles in linear algebra, to determine patterns in images, recognize objects, and classify visual content. CNN requires significant computation and graphical processing units (GPU) to train models (Thakur & Konde, 2021). Additionally, it contains convolutional layers,

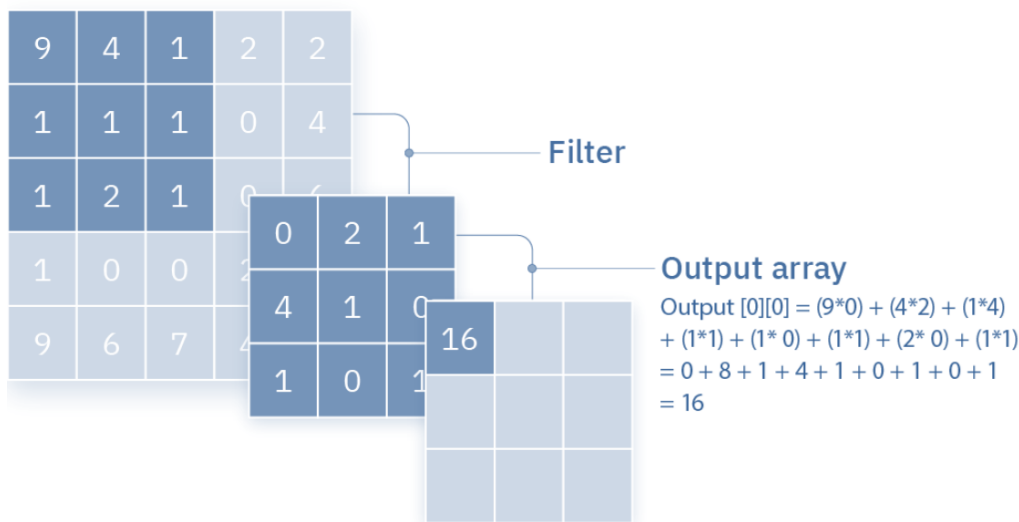
pooling layers, and fully connected layers (Gholamalinezhad & Khosravi, 2020).

Convolutional Layers.

The convolutional layer is the fundamental building block in which most of CNN computation happens (Krichen, 2023). According to Arora et al. (2020), a convolutional layer detects features such as edges or textures, and consists of input data, a feature map, and a filter (See Figure 2).

Figure 2
Convolutional Layers

Input image



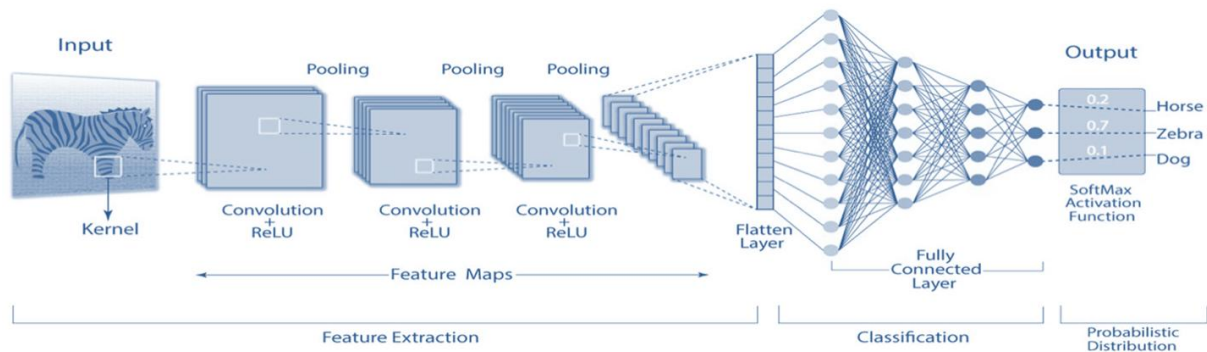
Note: From “What are Convolutional Neural Networks?” by IBM, 2024 (<https://www.ibm.com/topics/convolutional-neural-networks>). In the public domain.

Input data could be a colored image that is formed by a matrix of pixels in three dimensions (3D) with height, width, and depth. The colored image goes through the process of convolution when the kernel moves across the receptive fields of the image to verify if a feature exists (Thakur & Konde, 2021). The kernel is a two-dimensional (2D) array with a typical 3x3 matrix size (Chen et al., 2020). The kernel is sometimes called a filter and is considered a feature detector (Zafar et al., 2022).

In convolution, the kernel is placed in one area of the image to calculate the dot product between the kernel and input pixels. The dot

product is then sent to the output array as shown in Figure 2. The kernel continues shifting from the initial area of the image to the next area, repeating the same process of calculating the dot product between the kernel and the new input pixels, until it sweeps across the whole image. The final output is made of a series of dot products called a feature map or a convolved feature (Ketkar et al., 2021). The convolutional neural network applies a rectified linear unit (ReLU) transformation to the convolved feature after each convolution operation as a means to introduce nonlinearity to the model, as shown in Figure 3 (Thakur & Konde, 2021).

Figure 3
Convolutional Neural Network



Note: From “Fundamental of Neural Networks,” by A. Thakur, and A. Konde, 2021, *International Journal for Research in Applied Science and Engineering Technology*, 9(VIII), p. 421. (<https://doi.org/10.22214/ijraset.2021.37362>). Open Access.

Pooling Layers.

Pooling layers, also referred to as down sampling, reduce dimensionality by decreasing the number of parameters in the input. The pooling operation in pooling layers is similar to the one in convolutional layer, as it also sweeps a filter across the entire input. Nonetheless, the pooling operation in the pooling layers does not have any weight to populate the output array. The output array is generated by the aggregation function applied by the kernel to the existing values in the receptive field (Jie & Wanda, 2020). Pooling could be maximum or average. While moving across the input, the filter could either select the highest value pixel to be sent to the output array, or it could calculate the average value within the receptive field and send it to the output array. Max pooling is often used compared to average pooling (Sabri et al., 2020).

Fully-connected Layers.

Fully-connected (FC) layers classify images according to the extracted features obtained from the preceding layers and filters. Each node in the output layer of fully-connected layers is completely linked to a node in the preceding layer (Basha et al., 2020). To properly classify inputs, FC layers often leverage a SoftMax activation function, creating a 0 to 1 probability (Ketkar et al., 2021).

Fully connected layers play a crucial role in deep learning models used in limited memory AI, which falls under the broader classification of narrow AI. To better understand the broader

classification of narrow AI, it is essential to distinguish between all three types of artificial intelligence based on functionality: narrow AI, general AI, and super AI.

Types of Artificial Intelligence Based on Functionality

There are three types of AI; distinguished based on functionality: Narrow AI, general AI, and super AI (Banafa, 2024).

Narrow AI

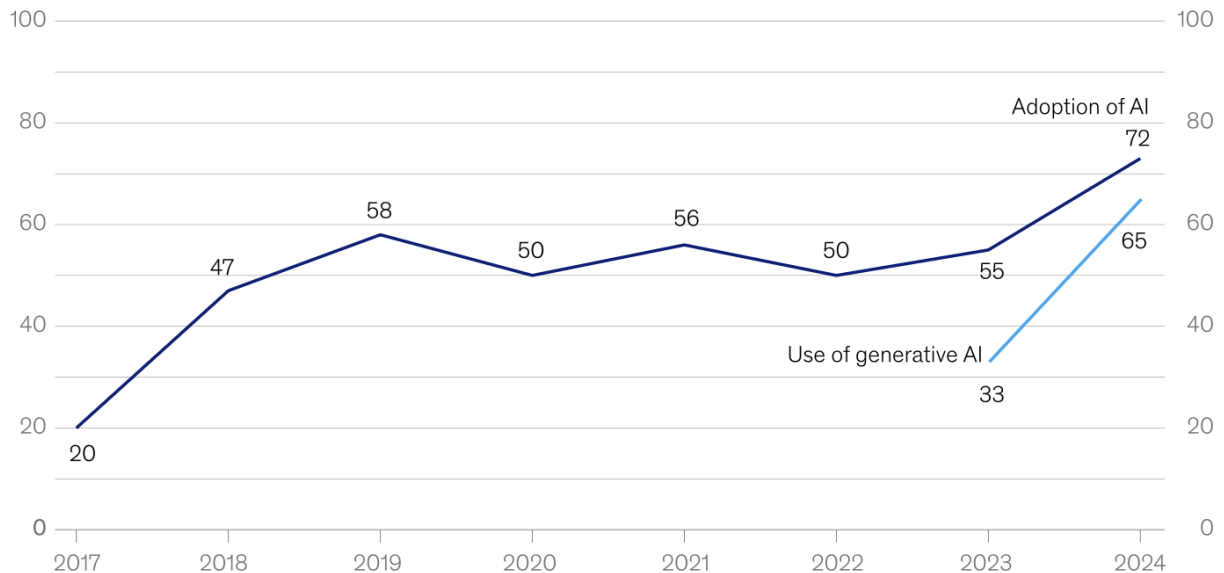
Narrow AI, also referred to as weak AI, is the most practical and real-world type of AI based on functionality (Banafa, 2024). Narrow AI is designed to perform specific tasks, such as virtual assistants like Siri and ChatGPT (Damar et al., 2024). One of the most recent cutting-edge applications of artificial intelligence that is part of narrow AI, is generative AI models.

Generative AI Models.

Generative AI models are a class of artificial intelligence designed to create new content, including text, images, audio, video, and code. These models generate outputs by learning patterns from large datasets, leveraging deep learning techniques, particularly neural networks, to produce human-like content (Banafa, 2024).

According to McKinsey’s report, businesses’ interest in AI is growing. In fact, 72% of businesses adopted at least one form of artificial intelligence in 2024, as shown in Figure 4 (Singla et al., 2024).

Figure 4
Adoption of AI by Businesses



Note: From “The State of AI in Early 2024: Gen AI Adoption Spikes and Starts to Generate Value,” by A. Singla, et al., 2024, *McKinsey & Company*. (<https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai>). Public domain.

McKinsey’s report highlights a particular increase in interest in generative AI between the years of 2023 and 2024 (Singla et al., 2024). So, let us explore the types of generative AI that businesses could be using.

Types of Generative AI Models.

The primary types of generative AI models include transformer-based models, diffusion models, generative adversarial networks (GANs), variational autoencoders (VAEs), and recurrent neural networks (RNNs) (Madaan, et al., 2024).

Transformer-Based Models.

Transformer-based models utilize self-attention mechanisms to process and generate text. For instance, GPT-4 generates texts, while BERT understands text, and T5 transforms text-to-text through reformulation (Madaan, et al., 2024).

Diffusion Models.

Diffusion models, such as DALL-E and Stable Diffusion, generate images by refining random noise into meaningful patterns. These

models of generative AI are widely used for image synthesis and artistic creation (Madaan, et al., 2024).

Generative Adversarial Networks.

GANs consist of two neural networks: a generator and a discriminator, which compete to produce realistic outputs. This type of generative AI model is used for deep fake videos, image synthesis, and digital art (Madaan, et al., 2024).

Variational Autoencoders.

VAEs encode input data into a compressed form and reconstruct it with variations. These models are used for image generation and data augmentation (Madaan, et al., 2024).

Recurrent Neural Networks.

RNNs and long short-term memory networks (LSTMs) are the oldest generated models for sequential data, e.g., music and speech synthesis. However, RNNs and LSTMs have largely been replaced by transformer models in many applications (Madaan, et al., 2024).

While generative AI falls under the category of narrow AI, some AI systems, known as autonomous systems, can span both narrow AI and, potentially, general AI if advancements allow for more sophisticated decision-making capabilities in the future. So, what is general AI?

General AI and Super AI

General AI, also referred to as strong AI, is hypothetical because it aims to replicate human-like cognitive abilities. Similarly, super AI is purely theoretical although it has the potential to surpass human intelligence in all aspects (Banafa, 2024). One of the most recent cutting-edge applications of artificial intelligence, part of both narrow AI and potentially general AI, is autonomous systems.

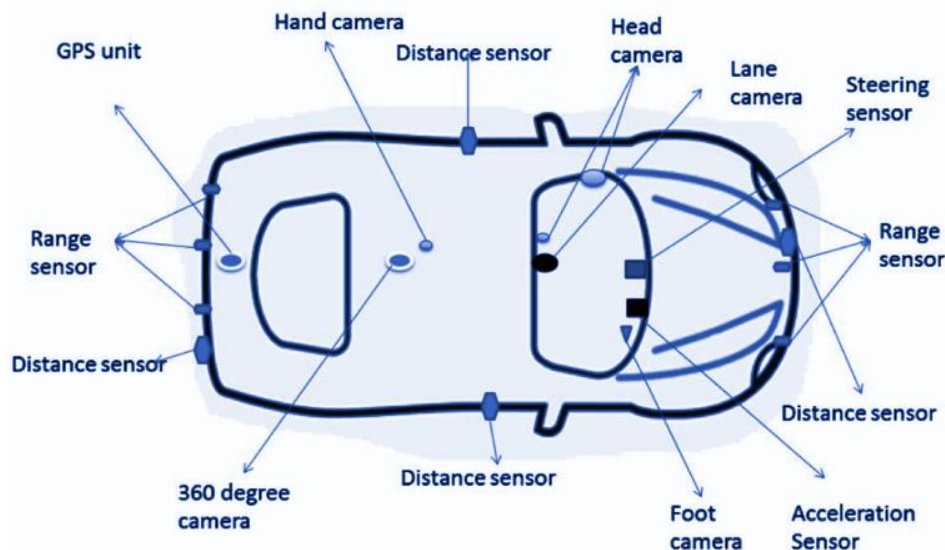
Autonomous Systems.

Autonomous systems are AI driven systems capable of performing tasks with minimal to no human intervention. These systems leverage advanced machine learning, computer vision, and real time data processing to make decisions and adapt to dynamic environments. Two prominent examples of autonomous systems are self-driving cars and autonomous drones (Roth & Sims, 2019).

Self-Driving Cars.

Self-driving cars, also known as autonomous vehicles, use a combination of sensors, cameras, LiDAR, and AI algorithms to navigate roads safely without human drivers, as shown in Figure 5 (Manoharan, 2019).

Figure 5
Architecture of Self-Driving Cars



Note: From “An Improved Safety Algorithm for Artificial Intelligence Enabled Processors in Self-Driving Cars,” by S. Manoharan, 2019, *Journal of artificial intelligence*, 1(02), p. 96. (<https://doi.org/10.36548/jaicn.2019.2.005>). Open Access.

Companies such as Tesla, Waymo, and Cruise are developing and testing self-driving technology to improve road safety, reduce traffic congestion, and enhance mobility. These vehicles rely on deep learning models for object detection, route optimization, and decision making in real-time traffic conditions (Thadeshwar et al., 2020). Self-driving cars is one of the most prominent examples of autonomous

systems. Another notable example is autonomous drones.

Autonomous Drones.

Autonomous drones are unmanned aerial vehicles (UAVs), capable of performing tasks such as delivery, surveillance, and search-and-rescue operations without direct human control. These drones use AI driven flight control

systems, GPS navigation, and computer vision to navigate complex environments, detect obstacles, and complete missions efficiently (Chitra & Saleem Raja, 2025). Companies like Amazon and DJI are integrating AI technology into drones to enhance logistics, environmental monitoring, and disaster response efforts (Mandloi et al., 2024).

AI Architecture of Autonomous Drones.

The AI Architecture of autonomous drones consists of several key components that enable real time decision-making and adaptive control. These components include a perception system, navigation and path planning, a flight control system, communication and networking, and autonomous decision-making (Roth & Sims, 2019).

The perception system uses computer vision, LiDAR, and infrared sensors to detect obstacles, recognize objects, and interpret environmental data. The navigation and path planning system, implements GPS, inertial measurements units (IMUs) and simultaneous localization and mapping (SLAM) techniques to determine optimal flight paths and avoid obstacles (Roth & Sims, 2019). The flight control system integrates deep reinforcement learning and sensor fusion techniques to stabilize flight, adjust speed, and respond dynamically to changing conditions (Roth & Sims, 2019). The communication and networking system employs edge computing and 5G connectivity to facilitate real-time data processing, remote control, and autonomous coordination with other drones (Roth & Sims, 2019). Finally, the autonomous decision-making system uses AI algorithms such as neural networks and fuzzy logic, to make real-time decisions based on incoming sensor data and predefined mission objectives (Stefik et al., 2021).

With its autonomy and potential to automate tasks, artificial intelligence, including machine learning and computer vision, is believed to be a threat to the job market (Roubini, 2023).

Impact of AI on the Labor Market

AI comes in various forms; analytical, functional, interactive, textual, and visual (Sarker, 2022). Intelligent machines may take over some of the tasks that human workers used to perform traditionally. However, this does not mean that

cognitive technologies will cause human workers to be jobless (He et al., 2018). The systems that are part of cognitive technologies perform repetitive tasks rather than entire jobs (Badet, 2021). Hence, cognitive technologies that helped to create intelligent systems are leading to an increase in higher value-added activities by saving employees' time. Moreover, intelligent systems are performing narrow tasks within broader jobs and are proven efficient at duties that were not necessarily completed by humans in the past. This includes but is not limited to big-data analytics, which is the process of gathering, inspecting, and analyzing large structured, unstructured, and streaming/batch data sets using advanced analytic techniques to discover trends, patterns, correlations, and insights that lead to data-informed decisions (He et al., 2018; Lillo et al., 2022). Nonetheless, at the present time, humans do a better job than machines in terms of understanding younger customers' preferences and designing upcoming trends, especially within the fashion industry.

Based on the reports provided by the World Economic Forum, tasks automation through AI could shift approximately 85 million jobs. Simultaneously, AI could create up to 97 million new job positions throughout the chain of command across several industries (Jumaev, 2024). Taken together, AI will have a significant impact on the future of human resource management (HRM) (Malik et al., 2021) as well as the future of education systems, notably in industrialized countries which did not prepare their workforce properly for the advent of AI and tasks automation (Campan & Vallée, 2019). Currently, there is a shortage of skilled workers capable of mastering intelligent machines, therefore, education systems and training programs should be adjusted; AI-focused courses should be introduced to children in schools and to adults in workplaces, with a new culture of lifelong learning, as lifelong learning is becoming the norm with continuous advances in technology (Campan & Vallée, 2019).

Recommendations

Based on the findings of this literature review, the systems that are part of cognitive technologies could shift more jobs. In the meanwhile, the gap between AI and human intelligence is growing, and future quantitative

research studies with the purpose of statistically proving or rejecting the hypothesis of AI taking over the job market can build upon the findings of this literature review. Other qualitative research studies with the purpose of simplifying the meaning and processes behind other subfields of machine learning, such as deep learning and/or other types of neuronal networks including recurrent neural networks, would also help to fill the gap in the literature.

Conclusion

The purpose of this literature review was to simplify the meaning and processes behind cognitive technologies, notably, the fundamentals of machine learning and computer vision, with the intention to briefly address the alleged threat of AI taking over the job market. Prior to convolutional neural networks, manual, time-consuming feature extraction methods were used to identify objects in images. Today, CNNs provide a more scalable approach to object detection, facial recognition, medical image analysis, and other classification tasks in computer vision. Although some information might get lost in the pooling layer of convolutional neural networks, pooling layers still decrease complexity, enhance efficiency, and limit risk of overfitting. Tasks automation through AI and its applications, including machine learning, has an undeniable economic impact. Some jobs might get upgraded, while some jobs might be lost as human intelligence is replaced by artificial intelligence in specific sectors.

The findings of this literature reveal that AI models require significant computation to allow computers to learn autonomously. These findings should matter because understanding mathematical models of data and perfecting the process of writing software could be the keys to remaining employable. AI is strongly emerging; 72% of businesses adopted artificial intelligence in 2024 and most people are using AI applications on a daily basis without realising it. This includes but is not limited to Siri and Alexa. Since AI is becoming the new way of operating, educating people, notably the workforce, about emerging cognitive technologies, e.g., generative AI and autonomous systems, or at least about the fundamentals of ML, computer vision, and AI, is crucial. The workforce must be prepared for the inevitable change in the job landscape.

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Enhancing English Language Teaching through Virtual Workshops on Digital Learning Materials

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Abstract

The main objective of this intervention research was to enrich the teaching strategies of a group of English as a Foreign Language (EFL) teachers through four online workshops on digital learning materials (DLMs). Pre-survey questionnaires were administered to determine to what extent participants master certain DLMs and the instructional purposes they consider when incorporating DLMs into their classes. The data collected paved the way for designing and developing these workshops. Zoom was the virtual classroom for this intervention research, and Google Classroom functioned as the Learning Management System (LMS). Goals and indicators were set to evaluate their effectiveness along with feedback forms conducted at the end of each workshop. Results showed that all the goals and most indicators set to reach these goals were successfully met. In addition, participants' responses indicated that the workshop content was beneficial for teaching EFL in a virtual environment, and they plan to integrate it into their classes. Finally, incorporating interactive activities into the workshop content fosters engagement.

Keywords: Online workshops, digital learning materials, virtual classroom, English as a foreign language

Introduction

This intervention research was conducted at a language institute devoted to teaching English as a Foreign Language (EFL) to children from ages 8 to 12 years, predominantly from disadvantaged backgrounds. This institute is located in Venezuela and offers both blended and online classes and is sponsored by a foundation. In addition, most of their teachers were undergraduate students, majoring in English Language Education, who volunteer to teach EFL to these kids.

This group of teachers masters some digital learning materials that are useful for teaching EFL, yet their students can benefit from interacting with new DLMs aimed at developing their English language skills in a virtual

environment. These participants can gain knowledge on integrating digital interactive activities, gamification, virtual reality, and other resources into their online classes to enhance English language instruction. Indeed, employing Information and Communication Technology (ICT) is beneficial for effectively learning English as a Second Language (Lazebna & Prykhodko, 2021). For example, platforms such as YouTube, Quizizz, and Wordwall have features that boost successful teaching and learning (Said, 2023).

In addition, teachers should possess the pedagogical skills to successfully integrate technology into the teaching and learning process to better support students. Technology by itself does not improve pedagogy; its adequate integration depends on the ways that digital

resources are used and incorporated into instruction to foster fruitful learning (Keengwe & Georgina, 2012). Specifically, “digital materials are not an end in themselves” (Aller, 2019, p. 41). Having students download a PDF document does not improve learning, for example.

To promote student engagement, using technology effectively boosts interconnectivity and communication in the classroom and allows learners to interact, collaborate, and engage with class materials through different means (Negoescu & Boștină-Bratu, 2016). Therefore, these teachers should enhance their digital and pedagogical skills to use, adjust, and create DLMs with clear learning objectives, focusing on the English skills their students need to develop. This workshop series can represent an opportunity for this group to fulfill this goal. Therefore, the primary research question is: How does incorporating online workshops on digital learning materials in virtual classrooms impact TEFL practices?

Literature Review

Digital Learning Materials (DLMs)

A Digital Learning Material is a virtual resource implemented in the teaching and learning process, including any online class materials used by a teacher or student during a course such as notes, syllabus, teaching guide, tutorial, etc. (Fernández-Pambillón et al., 2012). Moreover, they are electronically accessible to students and teachers but do not entail a complete curriculum (Tosh et al., 2020). In language teaching and learning, examples of DLMs include online flashcards, podcasts, digital worksheets, graphic organizers, online dictionaries, and other resources, as long as they are in digital format.

Area (2019) outlines the characteristics of the DLMs from two perspectives: technological and pedagogical. Based on their instructional component, the author describes that the digital learning materials: a) provide access to various sources of information, b) promote experiential learning, c) create social and communicative environments, d) involve formative and constant assessments, e) boost motivation through gamification or playful learning, f) enable students to construct learning, and g) facilitate customization and adjustment.

Virtual Classroom vs. Learning Management System (LMS)

A virtual classroom is an application for delivering live and classroom-like lessons via the web (Aberdour, 2011). This definition implies that it is utilized for synchronous learning. In addition, a virtual classroom is considered a digital instructional environment that allows students to access all course materials and offers a contextual, dynamic, and interactive learning space (Rufai, Alebiosu, & Adeakin, 2015). It can be software-based, which involves running an executable file, or web-based, accessed via a portal (Siddiqui, 2013). In synchronous learning, virtual classrooms enable real-time communication between teachers and students through audio, video, digital whiteboards, polls, breakout rooms, instant messages, and other features (Martin & Parker, 2014). Zoom constitutes the virtual classroom for this intervention research and is employed to promote real-time interaction between participants, the instructor, and workshop materials.

A Learning Management System (LMS) contains features and resources to support instruction such as course management tools, virtual group discussions, class material, presentations, videos, grades, and course feedback and evaluation (Fathema, Shannon, & Ross, 2015). Area (2019) categorizes LMSs as a type of digital learning material, while Priora (2021) mentions that an LMS is a virtual classroom. Is Google Classroom a virtual classroom or a learning management system? Kraus et al. (2019) consider Google Classroom a virtual classroom, whereas Dash (2019) labels it as an LMS. However, the terms LMS and virtual classroom are used interchangeably in Dash's (2019) research. Considering the features outlined by Fathema et al. (2015), Google Classroom falls under the category of Learning Management System.

Additionally, LMS promotes ubiquitous learning (u-Learning), and is described as a daily educational environment assisted by mobiles, wireless connections, and embedded systems (Ogata et al., 2009). Integrating an LMS platform like Google Classroom into workshops is beneficial. It allows participants to access instructional materials and presentations, read announcements, participate in online discussions, and complete workshop feedback

from their mobile or computing devices anytime and anywhere, promoting u-learning. In short, the virtual classroom (Zoom) mostly facilitates synchronous learning while the LMS (Google Classroom) mainly fosters asynchronous learning.

Methods and Materials

This paper employs the intervention research methodology since it centers on determining the most effective strategies for improving outcomes by drawing conclusions based on the relationships between an intervention and its outcome (Melnyk & Morrison-Beedy, 2018). In this study, an intervention was designed and implemented to enhance the teaching practices of a group of EFL teachers. To achieve this, the participants' needs were first identified, followed by the creation and implementation of activities.

Finally, the outcomes were derived through the evaluation and reflection on the intervention.

Objectives, Goals, and Indicators

The main objective of this paper is to examine the role of workshops on digital learning materials (DLMs) in enhancing TEFL practices. To reach this objective, the study focused on the following specific objectives: 1) Analyze the use of DLMs in the creation of EFL content, 2) Examine the role of DLMs in promoting student participation in the virtual classroom, and 3) Explore the integration of DLMs for assessing English language acquisition. In addition to these objectives, setting goals and indicators was also fundamental for designing, delivering, and evaluating this workshop series. The table below shows the six goals that guided this intervention research and their respective indicators used to measure each goal.

Table 1
Goals and Indicators

Goals	Indicators
Create and manage a class in Google Classroom	<ul style="list-style-type: none"> ● Invite participants to join a class in Google Classroom ● Create topics in Google Classroom to organize content ● Upload digital learning resources and presentations to this platform weekly ● Add feedback forms to gather reflections ● Make announcements to communicate important information
Design interactive activities in Google Slides	<ul style="list-style-type: none"> ● Design at least two get-to-know-you activities in Google Slides ● Develop vocabulary and grammar exercises using Google Slides ● Design a virtual field trip and a comic strip using Google Slides ● Include at least three graphic organizers ● Create an exit ticket in Google Slides
Create interactive activities in Google Jamboard	<ul style="list-style-type: none"> ● Create a get-to-know-you activity using Jamboard ● Design at least five activities to develop English language skills ● Develop an interactive notebook using Jamboard ● Design an exit ticket activity in Jamboard
Choose learning activities designed for learning English as a foreign language using specific digital tools	<ul style="list-style-type: none"> ● Select gamified activities aimed at learning English on Quizizz, Quizlet, and Blooket ● Include physical activities using fitBoost to use them as a brain break ● Select clips about American Sign Language on www.lifeprint.com

	<ul style="list-style-type: none"> ● Incorporate a digital activity about mindfulness ● Include a digital scavenger hunt activity ● Choose two videos on YouTube that can be used as brain-break activities in class ● Choose a virtual field trip on Nearpod to promote English culture
Deliver four workshops on digital learning materials to enhance English language skills	<ul style="list-style-type: none"> ● Schedule workshops on Google Calendar ● Keep track of attendance ● Record live sessions ● Build a connection with participants through the incorporation of get-to-know-you activities ● Present all the digital learning materials planned for each workshop ● Engage 80% of participants with the workshop content ● Answer possible participants' questions
Set up activities for data collection to evaluate the effectiveness of the workshops	<ul style="list-style-type: none"> ● Organize a follow-up session with participants after completing the four workshops to evaluate how they plan to employ the workshop content in their classes ● Design a feedback instrument in Google Forms to gather useful information to measure the impact of each workshop ● Review participants' responses

Research Context and Participants

The total number of participants was eight (8) Hispanic members from Venezuela: six (6) women and two (2) men. Seven (7) participants were undergraduate students from the same pedagogical university, while the other was a recent graduate. Their major was Teaching English as a Foreign Language (TEFL), and they were volunteer teachers at the institute where the study was conducted. They were invited to participate in this workshop series and willingly accepted to be part of this research. Similarly, the research and workshop trainer was a Venezuelan male teacher with experience in TEFL and educational technology.

An initial survey was administered to determine to what extent this group of eight (8) attendees mastered certain digital learning materials (DLMs) and use technology in teaching English as a Foreign Language. This instrument contained demographic questions, 22 items with a Likert scale of 5 levels, and two open-ended questions. The eight (8) interviewees were asked to rate their level of familiarity with some educational resources such as Flipgrid, Nearpod, Padlet, and Quizlet, as well as the level of utilization of technology in education including gamification, virtual reality, podcasts, and other

tools. The purpose of the open-ended questions was to identify other possible DLMs the participants master and use in their classes.

The data collected indicated that none of the participants knew about ClassDojo, Flipgrid, Jamboard, Nearpod, or Pear Deck. A total of 66.7% of the survey respondents did not know how to use either Genially or Padlet whereas 33.3% did not know how to use Kahoot. Eighty percent of the participants indicated not knowing Google Earth while half of them mentioned not knowing how to use Quizlet or Quizizz. On the contrary, the level of mastery of Google Classroom was notable, with 83.3% of respondents knowing how to use it. The level of knowledge of Google Slides varies among participants, with one-third reporting having a high mastery of this tool.

After identifying the DLMs that this group of teachers was more familiar with, a second survey instrument was designed to determine the instructional purposes for which they use these DLMs in their classes. These purposes included activating prior knowledge, content delivery, group activities, classroom participation, assessment, reviews, and closing activities. Participants needed to indicate whether they

used the chosen digital learning materials during these stages.

The data showed that PowerPoint is mainly employed for content delivery and activating background knowledge. Half of this group mentioned using Kahoot to promote student participation while 16.7% used Google Slides and Padlet for the same purpose. All participants stated that they employ WhatsApp for diagnostic and formative assessment, whereas half of them use it for summative assessment. On the other hand, none of the participants implement Kahoot, Liveworksheets, Padlet, Quizizz, or Quizlet for content delivery, or Canva, Google Slides, Liveworksheets, or Padlet for student assessment.

Planning of Activities

Organizing a successful workshop requires a lot of effort, and the more meticulously the workshop phases are detailed and planned from the beginning, the better the outcomes will be (Radić-Bojanić & Pop-Jovanov, 2018). This intervention research encompasses four stages: the diagnostic phase, design, delivery, and evaluation.

During the pre-planning phase, it is essential to know who the participants are, their current knowledge level of the content, and the needs the workshop intends to address (Belay, Ruairc, & Guérandel, 2019). The phone interview with the principal, and two surveys conducted in the diagnostic stage served this purpose. The data collected provided the participants' level of mastery of some DLMS and how they use them. This information guided the design of the workshop content to meet the participants' needs, including new resources to make the content more meaningful.

The design stage required the most work and time since it involved the creation of DLMS. To begin with, get-to-know-you activities were created and incorporated into the workshops. Facilitators should incorporate icebreakers and humor so that participants feel comfortable and engaged (Belay, Ruairc, & Guérandel, 2019). For this reason, get-to-know-you activities were integrated into the content to foster a connection between the instructor and the participants. Moreover, participants can implement them to build rapport between teachers and students in the virtual classroom.

Most of the workshop materials promote interaction, which is a key element to engage learners. The more students interact with their peers, digital resources, and teachers, the more interaction will contribute to their learning (Alvarez, 2021). In addition, tools like Quizizz, Quizlet, and Nearpod offer interactivity. This enables students to explore digital scenarios to solve problems and tasks, face challenges, and complete activities or interactive games (Aller, 2019). Therefore, participants can enhance their teaching strategies by incorporating interactive activities into their classes.

Brain breaks are physical and mental exercises that last approximately 10 minutes. They are important in the classroom as they provide "opportunities for students to breathe, relax, recharge and refocus" (Weslake & Christian, 2015, p. 39). Students may feel fatigued during online classes. Thus, FitBoost activities and dance song videos were incorporated to promote physical movement in the virtual classroom and help learners concentrate. Moreover, learning American Sign Language (ASL) can serve as a brain break activity; therefore, ASL videos were included in the third workshop.

Virtual field trips allow learners to visit different locations, communicate with experts, and engage in interactive activities within a classroom setting (Meyer, 2016). A way to incorporate culture into lessons is by having students explore English-speaking countries and complete interactive tasks using virtual reality. Nearpod offers pre-designed lessons that the participants can use and adapt to teach about these countries. Google Earth is another tool that can be employed to take students on virtual field trips. Both tools were introduced in the fourth workshop.

Gamification promotes student engagement. A study by Mohammed and Ozdamli (2021) found that the enjoyable features of game-based applications like amusement, fun, and emotional gratification boost student participation in learning tasks. For this reason, gamified activities on Quizizz, Quizlet Live, and Blooket were integrated into the workshop content.

Exit tickets were included in the workshops as closing activities. An exit ticket is an assessment tool employed at the end of a lesson that can be beneficial for outlining ideas and

concepts (Akhtar and Saeed, 2020). They also communicate to students that their reflections are valued (Leigh, 2012) and are mainly used as formative assessment. Incorporating exit tickets into lessons can help students reflect on their learning, and teachers can use this information to plan future lessons. In this study, exit tickets were created using Google Slides, Jamboard, and Google Forms.

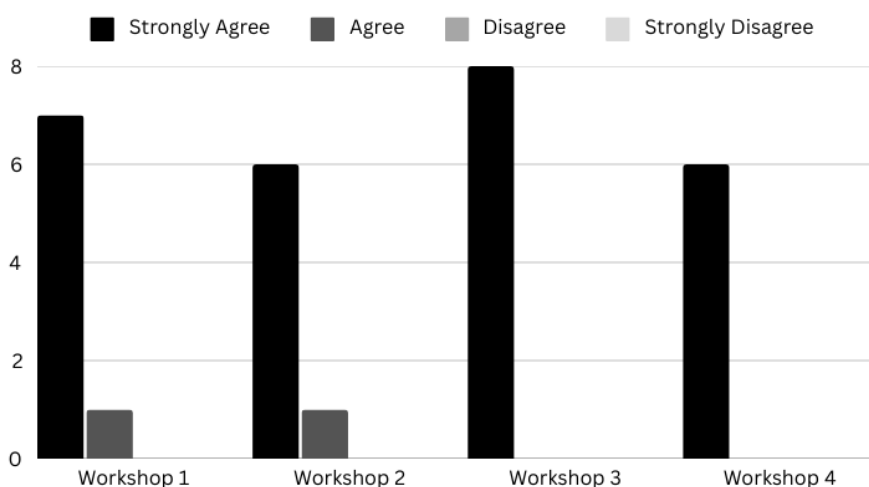
Finally, designing an evaluation form for participant feedback or personal reflection is a way to evaluate the workshop (Radić-Bojanić & Pop-Jovanov, 2018). Also, to enhance online learning, students' suggestions can offer insights for improving aspects such as time management, participation, resources, content, and more (Alvarez, 2021). A feedback form was created using Google Forms to meet these purposes and to be used at the end of each workshop. The first question asked participants to rate the workshop using a 4-point Likert scale. It also included three open-ended questions and a section for final comments.

Results

Data was obtained from participants' feedback, research observations and an analysis of goals and indicators. Beginning with their feedback, the following are some of the items that attendees rated: 1) The content of the workshop contributed to the improvement of my English language teaching strategies in the virtual classroom, 2) This workshop provided me with tools for creating digital content for English language teaching, 3) This workshop gave me strategies to promote student participation in the virtual classroom, and 4) This workshop provided me with strategies for assessing my students in the virtual classroom.

For the first item, all participants strongly agreed that the content of the third and fourth workshops was useful for enhancing their EFL teaching strategies in the virtual classroom, while nearly all strongly agreed that the first and second workshops served the same purpose. The categories that disagree and strongly disagree were not selected in any of the four workshops (see figure 1).

Figure 1
Contribution to TEFL Strategies



The figures 1, 2 and 3 show the participants' responses for the second, third and fourth items, respectively. Overall, most participants strongly agreed, while others agreed that the workshops were useful for integrating DLMS to create

content, promote participation and assess students. Particularly, all participants strongly agreed the workshop on brain breaks accomplished these three purposes.

Figure 2
Tools for Content Creation

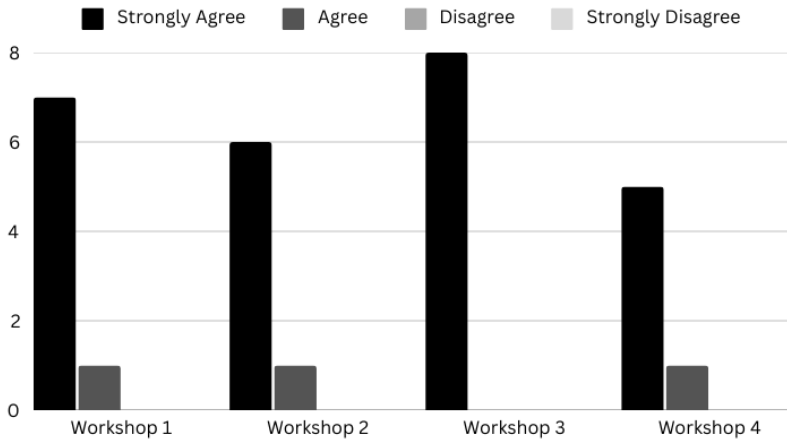


Figure 3
Fostering of Participation

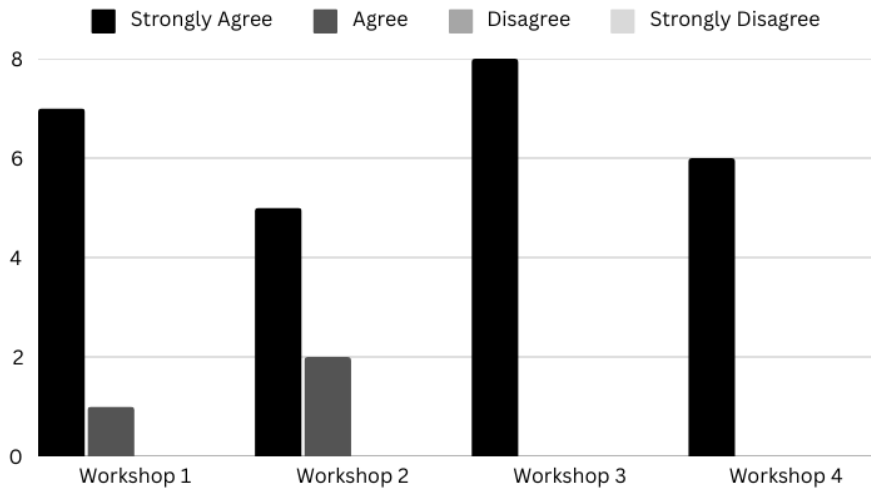
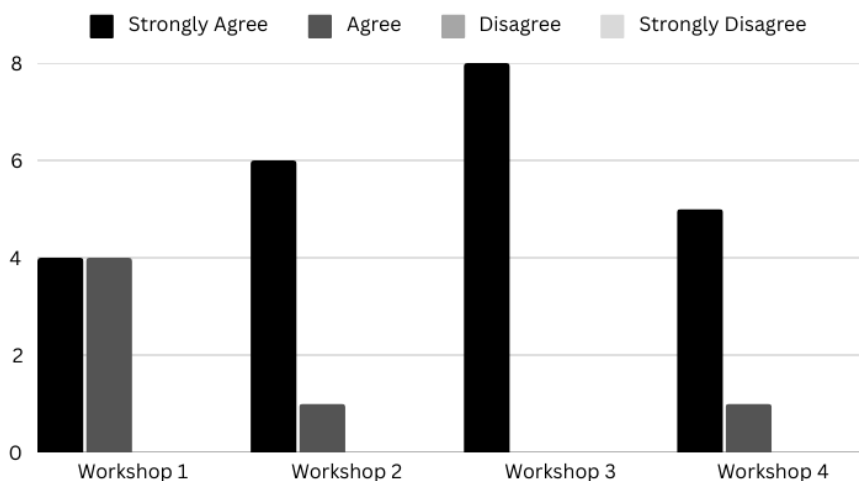


Figure 4
EFL Student Assessment



Furthermore, some final responses indicated that the workshops were beneficial, and participants expressed that they plan to integrate the content into their classes. These are some of their translated responses:

- Excellent workshops. I am really thankful for the opportunity to participate, and I can implement these useful resources to support our students. Thank you so much for your time and dedication.
- Thank you for this opportunity and your teaching. This will make an impact on us and we are already planning how to incorporate what we have learned.

Discussion/Implications

To respond to the research question of this study, how does incorporating online workshops on digital learning materials in virtual classrooms impact TEFL practices?, the research outcomes were analyzed and interpreted. One important finding is related to the participants' responses about the implemented workshops. Since the term *participation* frequently appears in their responses, it can be determined that the main purpose participants might incorporate the workshop materials into their lessons is to foster student participation. All participants strongly agreed that the DMLs presented in workshops

three and four provided them with activities to promote student participation, while nearly all strongly agreed that the first two workshops were also beneficial for the same purpose. Furthermore, the DLMs presented in the third workshop were those that participants found most useful for student assessment. Their responses also showed that they could implement the workshop content into their classes such as icebreakers, projects, vocabulary presentations, content delivery, gamified activities, and concept reinforcement.

Continuing with the goals and indicators, all the indicators for the first goal, designing and administering a class in Google Classroom, were fully met. A class was created in Google Classroom, and eight participants were invited to join. This number of participants is beneficial since keeping groups small enables individual attention and the opportunity to be heard (Ørngreen & Levinsen, 2017). The institute created the Zoom meetings and recorded the live sessions. Collaboration among instructors, participants, and the institute is a key element in the workshop development. This aligns with one of the workshop features described by Radić-Bojanić and Pop-Jovanov (2018) who highlight that workshops are collective because teamwork is required.

A study by Kraus, Formichella, and Alderete (2019) on utilizing Google Classroom as a tool to support in-person training found that survey respondents stressed this platform facilitates u-learning, enhances communication between instructors and learners, and supports material organization. This study aligns with those findings. Four class topics were created and labeled according to each workshop. Each topic included a presentation, digital learning materials (DLMs), and a feedback form. A total of six (6) announcements were made during the intervention to send reminders, answer questions, and share important information.

During the workshops, some concerns arose, and they were addressed via Google Classroom. For instance, participants found Google Earth and Nearpod engaging, but they expressed that integrating these tools into their educational context might not be viable due to students' unstable internet connection and limited access to technology. To offer another alternative for using virtual reality in the classroom, a video was created to demonstrate how to use this feature using YouTube and was posted in Google Classroom. In addition, participants have access to all the workshop material on this platform. This benefits their teaching practice as they can review the DLMS anytime and use or adjust them to meet their students' needs.

The second and third goals were to design interactive activities using Google Slides and Jamboard, and all indicators for these goals were fully met. Twelve activities were created in Google Slides and thirteen in Jamboard. These included get-to-know-you activities, graphic organizers, vocabulary flashcards, a comic strip, video response activities, the four corners strategy, philosophical chairs, the see-think-wonder strategy, listening and writing activities with pictures, interactive notebooks, and exit tickets.

The fourth goal involved choosing learning activities designed for teaching English as a foreign language using specific digital tools. Four activities were chosen on both Quizizz and YouTube. One activity was included for each of the following tools: Quizlet, Blooket, Nearpod, fitBoost, Waterford.org, Lifeprint.com, and Math-play.com. Additionally, three activities were selected on Google Earth, along with a scavenger hunt in PDF format. This demonstrates that all the

indicators for achieving this goal were successfully reached.

Four workshops on digital learning materials (DLMS) aimed at enhancing English language skills were conducted, and most of the indicators for this goal were successfully achieved. Although the workshops were not scheduled on Google Calendar, participants joined the Zoom meetings weekly, at the agreed time and day. A formal attendance record was not taken, but it was not necessary because the group was small. One participant served as co-host and recorded the live sessions. All participants engaged in the DLMS and participated actively during the workshops. This exceeded the expectation of engaging 80% of the participants with the workshop content.

While most planned activities were completed during the live sessions, a few could not be carried out due to time constraints. During the first workshop, participants could not complete the Quizizz activity because it seemed their internet connection was not strong enough to access this tool. As a result, it was decided to replace Blooket with Quizizz in the third workshop. This time, participants completed the gamified activities. Additionally, a power outage occurred 20 minutes before the end of the first workshop, but participants reconnected via their phones to resume the workshop. These issues disrupted the workshop agendas.

Participants did not have enough time to complete the exit tickets or discuss employing this assessment method during the virtual meetings. This was a missed opportunity for them to explore a DLM that can be used to assess students at the end of a lesson. However, since all the DLMS are available in Google Classroom, participants can still access the content that was not covered during the synchronous sessions. This highlights the importance of having an LMS like Google Classroom, where learners can explore the material asynchronously.

The indicators for the final goal, setting up activities for data collection, were successfully met. After the workshops, a follow-up session with the participants was conducted. The purpose of this session was for the participants to discuss how they plan to integrate any of the DLMS studied in the workshops into their classes. Some presented activities they had created using Quizizz. Additionally, a feedback form was

provided for each workshop, and most participants completed these forms. Their responses were useful for making the observations below.

Conclusion

One of the key achievements of this intervention research was that all participants were engaged in completing the workshop activities. This was possible because of opportunities to interact with themselves, the instructor, and the workshop materials, both synchronously and asynchronously. During workshop delivery, a student-centered approach and interactivity should be expected (Belay, Ruairc, & Guérandel, 2019), along with active learner participation in practicing methods, skills, cases, and so forth (Ørngreen & Levinsen, 2017). The dynamic of the workshops enabled participants to take on the role of students, explore the workshop resources, ask questions, practice their English language skills, make suggestions, and reflect on their teaching practices. Moreover, the get-to-know-you activities helped nurture a connection between the facilitator and the participants in a virtual environment. Therefore, social and interactive activities are highly recommended to foster engagement.

The participants' design of activities on Quizizz was another key success. During the diagnostic phase, half of them indicated they had heard about this tool, and during the workshops, they mentioned they had never created a quiz using it. After the workshops, teachers created three activities on Quizizz and expressed that they plan to use them in their classes. One participant indicated that she would share her gamified activity with other teachers. This demonstrates teacher collaboration and integration of the workshop content into their lessons.

To continue with the achievements and the Action Research methodology, all the workshop stages were completed: diagnosis, design, implementation, and evaluation. Initially, a phone interview and two survey questionnaires were conducted to determine areas of professional growth. This data was used to select, create, and adjust the workshop materials, as well as to set the main objective, goals, and indicators that guided the course of the workshops. Then four

workshops were conducted and most planned activities were covered in the synchronous sessions. Participant feedback revealed that the workshop content enhanced their teaching strategies for teaching English as a Foreign Language (EFL) in a virtual environment.

On the other hand, one main concern is that students' unstable internet connectivity and access to technology can hinder their opportunity to engage with digital learning materials. Participants' feedback suggested considering these aspects in the workshop content. They even experienced some technological issues when using some tools. This reinforces the importance of ensuring students have the necessary technology that enables them to use the planned tools (Alvarez, 2021). Therefore, when planning to use DLMs, it is important to consider this point. The principal also recommended the facilitator deliver a workshop on DLMs in contexts with limited internet access, as most of their students might face this issue. Not having consistent internet connectivity and decent technological devices was the major concern for integrating new technology at this institute.

Based on these factors, it is important to leave room for flexibility in the synchronous sessions when planning a workshop or a lesson. Learners may need extra time while checking equipment or reconnecting to the live session. Besides technical difficulties, they might spend more time getting ready to use a new resource or figuring out how it works. Therefore, it is good practice to plan adequate flexibility so that the real-time session can be successful even though initial goals are not met (Terry, Taylor & Davies, 2019).

Moreover, asynchronous learning is an alternative to overcome unreliable internet connection since students can access content once their network is steady (Sari & Puspitasari, 2021). Tools like Quizizz, Quizlet and Nearpod have a feature that allows teachers to assign activities asynchronously. Thus, learners can still benefit from using them to practice their language skills. Virtual field trips were introduced in the workshops using Nearpod and Google Earth. One option for using virtual reality to explore places is to assign virtual field trips in the asynchronous mode on Nearpod, for example. Another way to incorporate virtual reality is by

using videos with this component on YouTube. Asynchronously, students can be asked to watch some clips and respond to these videos through Google Docs. If their internet is slow, they can pause the video while it loads and then replay it. Finally, if students are unable to connect to a digital resource during a live session, they can still participate by writing their responses in the chat box.

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Evaluating and Analyzing the Innovative Branding and Marketing Strategies of International Brand: A Study of Kellogg's Pringles

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Abstract

Due to the rise of industrialization and world trade, numerous global companies are venturing into the food marketing industry, which is seeing rapid growth and intense competition worldwide. This review article extensively studies Kellogg's Pringles, a leading brand in the snack industry. It sets the stage with an introduction to marketing management, and it discusses Kellogg's acquisition of Pringles, which is later followed by a company overview that encompasses the firm's history, products, and market position. The SWOT analysis indicates Pringles' strengths, weaknesses, opportunities, and threats, such as brand identity, worldwide presence, and competitive arena. Moreover, the PESTEL analysis looks into the external forces affecting Pringles' operations, such as regulatory, economic, and technological factors. This study delved into Pringles' marketing strategy, utilizing the marketing mix elements: product, price, promotion, and distribution. Through an in-depth analysis, the research focused on how Pringles is positioned within the snack food industry and, more importantly, how it creates and maintains its competitive advantage. Monumental achievements demonstrate the company's focus on product innovation, dynamic pricing strategies, one-of-a-kind promotional campaigns, and wide distribution. This study has underlined the brand's ability to employ these factors in maintaining its market supremacy and recommended ways of increasing its marketing strategy in the future.

Keywords: Branding, marketing strategy, Kellogg, Pringles, SWOT analysis, PESTEL analysis

Introduction

Marketing management is an instrumental function within any organization, essential for overcoming the challenges posed by the quickly evolving consumer preferences and market rivalry (Felix, 2015). However, while many global firms have struggled to comprehend the demands of their target consumers and the unique traits of the market, only a few companies have managed to successfully establish their brands in the food industry by diligently studying the needs of their target audience before introducing their products.

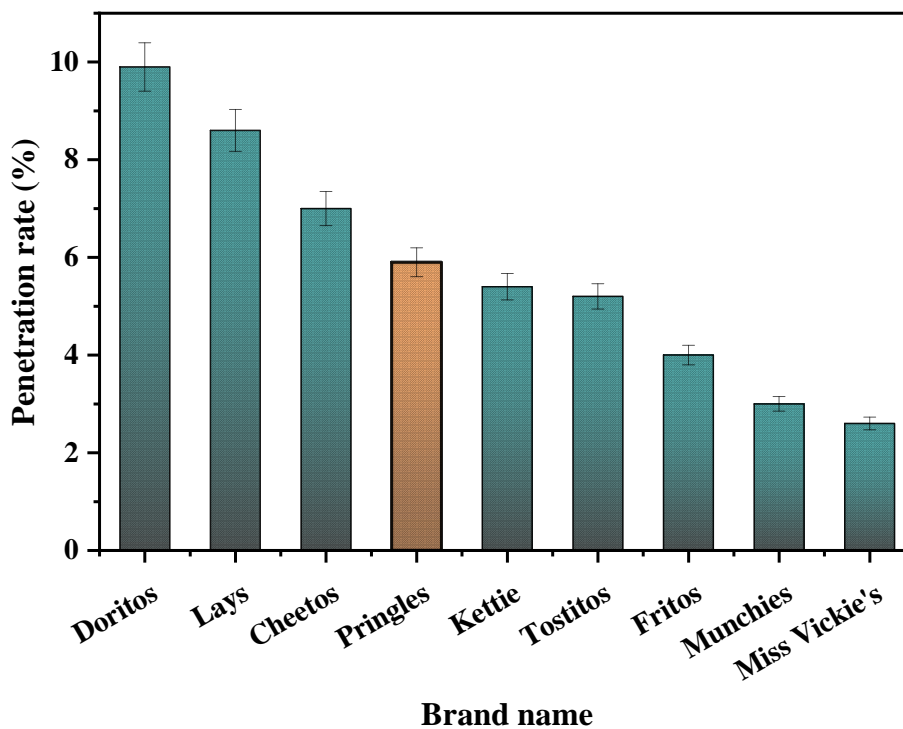
This research is an analysis of the marketing management techniques of Kellogg Company, one of its brands called Pringles. The Pringles brand of Kellogg's is an effective example of how marketing management excellence can lead to success in a highly competitive market. The Kellogg Company, a well-known global food industry company, used its marketing expertise to develop the Pringles brand, which became the first choice among consumers of savory snacks (Habibi Savadkouhi & Herman Jut, 2020).

The potato chips sector has shown downward consumption trends and stronger

competition with other healthier alternatives and private-label products in the last five years. However, industry leaders have responded by developing exotic, premium products that have led to the reduction of classic potato chip sales. The five-year projected industry growth rate is 1.5% annually, driven by the anticipated rise in potato chip consumption among people who want to switch their unhealthy snack choices for a healthier alternative (Tumu et al., 2023). This brings a projected growth of 0.6% in the said year. In 2017, the statistics revealed that potato chips were the most consumed, with around 41% of Australians snacking on potato chips instead of nuts, chocolate bars, or biscuits.

Pringles is a definite item of ingenuity, which gives the original picture. The shape of the cylinder is also one of the highlights of the marketing of the brand because it makes it unique and easily distinguishable from other brands that use a traditional logo right on the front (Swaminathan et al., 2020). Instead of the usual foil bag package, the founders of Proctor and Gamble wanted to change how most potato chips are packaged. Figure 1 portrays the market penetration rate of various chip brands in the US region in 2022.

Figure 1
Market penetration rate in the US food market in Q4 2022 (Report, 2022)



In 2012, Kellogg company acquired Pringles from Procter & Gamble for \$2.695 billion, significantly enhancing its position in the global snack market (Bar & Haviv, 2023). This acquisition nearly tripled Kellogg's international snacks business, making it the world's second-largest savory snacks player (Bar & Haviv, 2023). Pringles distinguishes itself with its unique cylindrical packaging and uniformly shaped chips, offering a wide variety of flavors that cater to diverse consumer preferences. This distinctive design and consistent quality have been pivotal in establishing Pringles as a globally recognized brand.

Kellogg has effectively leveraged its marketing expertise to enhance Pringles' market presence. However, the snack industry remains highly fragmented, with numerous competitors vying for market share. Through strategic marketing initiatives and a deep understanding of consumer behavior, Kellogg has successfully positioned Pringles as a leading brand in the global snack market (Swaminathan et al., 2020).

The research will investigate Pringles' external and internal factors, as well as identify the macro-environmental factors that have been used to determine a key importance that must be considered.

Significance of this Study

This review paper explores the details of marketing management, getting into the specifics of SWOT (strengths, Weaknesses, Opportunities, and Threats), PESTEL (Political, Economic, Social, Technological, Environmental, and Legal), Competitive analysis, and implementation of market strategies Kellogg used to elevate Pringles to its present prominence. A key element in the growth of Kellogg Company's Pringles has been successful marketing management. Incorporating marketing functions such as market research, product development, branding, advertising, and distribution together has made Pringles the most preferred choice of consumers worldwide (Khan & Lee, 2020). This research will examine how Kellogg's marketing management strategies have influenced Pringles' market positioning and sustained the company's competitive advantage. For this purpose, this study will offer a comprehensive analysis of Kellogg's marketing strategies for Pringles, focusing on market conditions and consumer perceptions that influence the brand's positioning. It also evaluates the effectiveness of Kellogg's marketing efforts in

shaping Pringles' market share and brand image. By conducting this analysis, this paper seeks to understand the pivotal contribution of marketing management toward brand success within the highly competitive snacks industry. By dissecting Kellogg's approach to marketing Pringles, this study intends to elucidate the best practices and strategic frameworks that can be applied broadly in marketing management.

History and Background of Kellogg

Kellogg Company developed in 1906 when Will Keith Kellogg founded the Battle Creek Toasted Corn Flake Company, located in Michigan, USA (Myers & Parcell, 2022). Innovation of the company's product lines started with Kellogg's Corn Flakes, a new breakfast cereal that inspired people to have a new morning routine. The company has gradually expanded its product line to contain several kinds of cereals, snacks, frozen foods, and vegetarian options. After acquiring Pringles, it was Kellogg's first entry into the savory snacks sector, the acquisition of which greatly extended its global reach.

Kellogg's Pringles brand has expanded its product line with the introduction of healthy alternatives that include reduced fat and low-sodium versions which still taste great, and this addresses the needs of consumers who are health conscious without compromising on taste. Pringles from Kellogg's has a very strong bond with the advertisement from which it has also collected a huge population of loyal customers all over the world (Swaminathan et al., 2020). Creativity and innovativeness are the markers of Pringles' marketing. The brand is associated with current popular celebrities, participates in core events, and uses interactive advertising to be in line with its audience. Developing trends and listening to the voice of the customer are the effective techniques that allow the Pringles brand to maintain its image, which is liked by the current customers and attracts others (Khan & Lee, 2020). Kellogg's Pringles seems to accomplish its purpose quite well in 140 countries. The distribution network of supermarkets, convenience stores, airports, and online platforms expands the market for Pringles products and makes them easily available to consumers from different corners of society and age groups (Tumu et al., 2023).

Research Methodology

This review study involves a comprehensive approach that integrates

qualitative and quantitative techniques to analyze the subject matter effectively. Data collection is carried out through primary and secondary sources through published articles by renowned publishers. The research incorporates a SWOT analysis to evaluate strengths, weaknesses, opportunities, and threats associated with the subject, allowing for a strategic understanding of internal and external factors. In addition, a PESTEL analysis is conducted to examine the political, economic, social, technological, environmental, and legal influences for a better understanding of the branding and marketing strategies of an international brand, Kellogg. These analytical frameworks provide a structured means of assessing both micro and macro environmental factors that shape the research domain.

Furthermore, a competitive analysis is performed to identify key market dynamics, industry trends, and potential challenges that could influence the study's findings. By

assessing competitors, industry benchmarks, and best practices, the outcomes of this review work aim to establish a comparative framework that highlights critical differentiators. Through this structured methodology, the study achieves a well-rounded perspective, providing valuable insights and strategic recommendations based on empirical and analytical assessments.

Results

SWOT Analysis

SWOT analysis is a strategic tool for assessing a business or product's strengths, weaknesses, opportunities, and threats (Siddiqui et al., 2023). For Kellogg's Pringles, the SWOT analysis method will supply necessary information about the brand's inner strengths and weaknesses and external environment. Figure 2 briefly illustrates the results of the SWOT analysis, which is further elaborately described in this study.

Figure 2

Result of SWOT Analysis



Strengths.

Pringles, a Kellogg's brand, has a solid international identity and recognition. Moreover, the interesting saddle-shaped chips, stylish cylindrical packaging, and range of flavors ensured a strong brand image for all age groups. These features offer Pringles a competitive advantage over Lay's (PepsiCo), Kettle Brand (Diamond Foods), and Doritos (Frito-Lay), which offer similar products. The

innovative design of the Pringles brand, conforming to its stacking ability and guaranteeing freshness, distinguishes it from other potato chip brands. Pringles features numerous flavors, varying from classical, like Original and Sour Cream & Onion, up to limited editions and seasonal ones (Myers & Parcell, 2022). This broad taste variety meets the customer's taste buds and lets Pringles readily adapt to rapidly changing consumer behavior.

Kellogg's Pringles has increasingly had a strong local presence, with distribution and support in over 140 countries. Pringles benefits from Kellogg's Company's distribution network that covers supermarkets, retail outlets, and online channels (Tumu et al., 2023).

Weaknesses.

Besides being a market leader, Pringles has faced some backlash for its high-sodium and artificial flavor ingredients. This can be a problem when trying to reach health-conscious consumers who are looking for satisfying snack products. The following are the repackaging design defects or problems that will affect the perception of consumers or the brand's consistency. Despite the varied Pringles flavors offered, the restriction applies to diets like gluten-free or vegan options. Market penetration will be facilitated by bringing more product variants that reflect the trends in the consumer market. Though Pringles has a powerful brand identity, some consumers might still think it is less natural than regular potato chips because of its consistent shape and manufacturing processes.

Opportunities.

The trend of consumers switching to healthier snacking allows Pringles to launch healthy alternatives like reduced-fat or organic chips to attract health-conscious customers (Ozumba & Okon, 2023; Sobuz, Al, et al., 2024). The company can benefit from its growth potential through Pringles' adaptation of flavors and marketing strategies to the local tastes. The continued efforts of Pringles to develop flavors and innovation in packaging technology can make Pringles stand out from the crowd of competitors and make it suitable in an aggressive market environment. A huge share of e-commerce platforms lets the Pringles brand use it and communicate with a wider audience. Digital marketing investments help the brand to interact with customers and increase its visibility.

Threats.

Pringles faces severe competition as traditional potato chip brands and substitute snack alternatives make inroads. Competitors can threaten Pringles' market share by using the same packaging innovation or delivering similar flavor varieties (Abuselidze et al., 2023). Changes in the tastes and preferences of people who want healthy and natural snacks might cause Pringles to lose its market share.

Failure to adjust to advancements in consumer behavior could lead to revenue reductions. Disruptions in the supply chain, like a shortage of raw materials or difficulties with transportation, may impact on the production system and the delivery, resulting in inventory problems or delivery delays. Conducting a SWOT analysis of Kellogg's Pringles would reveal positive internal factors and negative internal factors of the brand and market opportunities and market risks of the snack sector. Pringles benefits from a good image, unparalleled package, and international business but conflicts with consumer perceptions, product variants, and rapidly changing market trends. Sustaining and strengthening the brand's position among many players, Pringles has to leverage health trends, product innovation, and emerging markets as its distinct business opportunities.

Through the strategic use of its strengths and the foresight to deal with issues, Kellogg's Pringles will be able to master the difficulties of the snacks industry and continue to triumph in the international market.

PESTEL Analysis

Overcoming weaknesses, including product components, brand perceptions, and limited product versions, would be the key factors to growing competitiveness and thereby meeting various needs of the customers (Jameel et al., 2023). From exploiting its strengths to actively addressing difficulties, Pringles will successfully tackle the complexity and remain a player in the world market. Implementing a comprehensive strategy that correlates with market tendencies and consumers' preferences will provide Pringles with a competitive advantage and safeguard it against possible threats. Therefore, Pringles will remain indispensable and profitable in the dynamic snack industry.

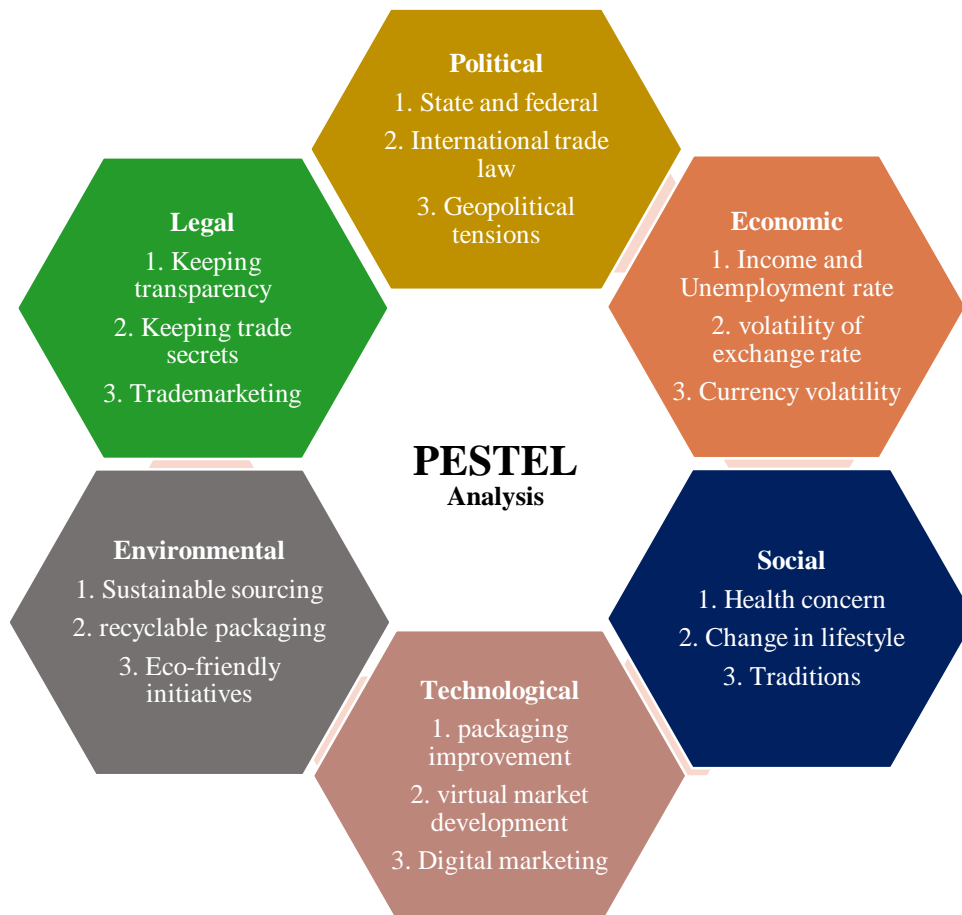
A PESTEL analysis is a strategic tool to evaluate the external macro-environmental factors that may affect a business or industry (Nandonde, 2019). Through political, economic, social, technological, environmental, and legal influences, this analysis gives a generalized notion of the bigger factors that affect Kellogg's Pringles' operating environment. The outcomes of the PESTEL analysis are illustrated in Figure 3 below. Here, all the factors considered for PESTEL analysis are mainly sorted from an extensive literature review of previous studies, recent market statistics of Kellogg, and other research articles

that analyze marketing strategies of snack and food industries.

As seen in Figure 3, trade policies, import tariffs, and food safety regulations influence global distribution, requiring Kellogg's to navigate varying compliance standards (Tumu et al., 2023). On the other hand, inflation and

currency fluctuations impact raw material costs and pricing strategies, which pushes the brand to optimize supply chain efficiency economically. Furthermore, shifting consumer preferences toward healthier snacks has led to innovations like reduced-fat and protein-enriched Pringles (Chauhan et al., 2024).

Figure 3
PESTEL Analysis Output



Technological advancements in AI-driven marketing and e-commerce expansion have strengthened direct consumer engagement, enabling personalized promotions and data-driven product development (Hossam, 2022). Environmentally, Kellogg's is pioneering sustainable packaging with biodegradable canisters and reducing its carbon footprint through energy-efficient production (Hossam, 2022). Last of all, the brand ensures strict adherence to labeling, advertising, and

intellectual property laws to legally maintain market trust (Chauhan et al., 2024).

Competitive Analysis

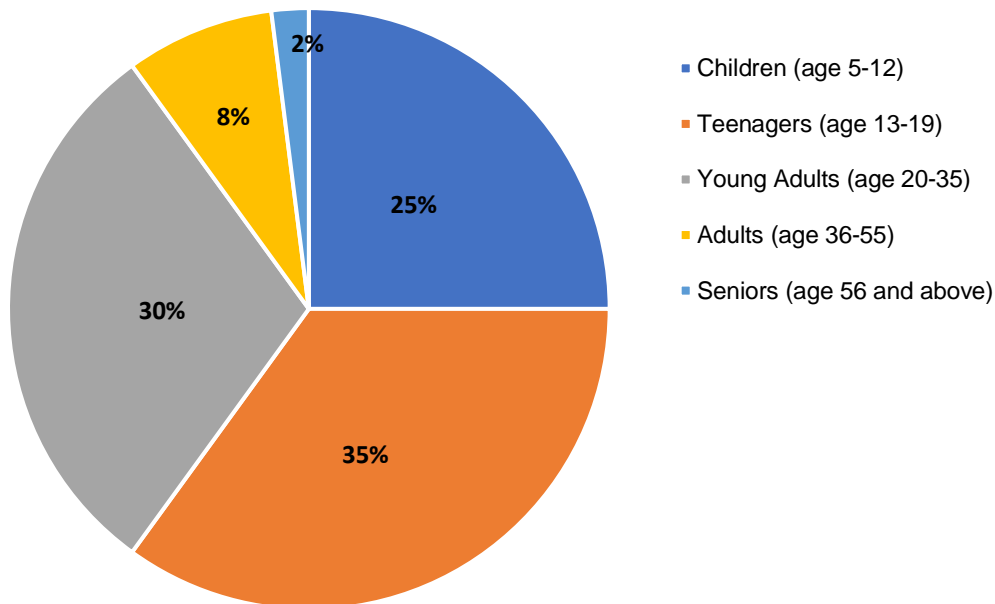
Pringles' brand positioning and competitiveness in the snack market will be illustrated in this competitive analysis. This analysis aims to unveil the strategy behind how the company segments, targets, and positions Pringles to tap into the target audience (Segura & Villar, 2023).

Segmentation.

One of the demographic segments Pringles concentrates on is children, teenagers, and young adults. Hence, these age groups are vulnerable because of the convenience, portability, and flavor variety provided by Pringles chips; these age groups are their target market (Valderrama et al., 2023). Pringles understands that it is important to start reaching out to the younger audience because their brand preferences and purchase decisions influence future purchase behavior. Pringles commits to the age group of children, teenagers, and young adults, creating a positive market image and building long-lasting relationships with the target group.

Besides the age group, Pringles also takes into account income level as another factor for segmentation. The brand ensures that its products are available at prices competitive enough to attract consumers from different backgrounds. In this way, Pringles can compete in various income segments, thereby increasing their availability in both the mass market and the niche market. Figure 4 portrays the fundamental age-based market segmentation for Pringles marketing. As can be seen, teenagers and young adults are the main target for this product.

Figure 4
Age-Based Market Segmentation (Beacom et al., 2021)



Targeting

The marketing fundamental to Pringles would be the application of segmentation and then personalizing not only the products but also the messages to match the wants of the probable customers. Pringles mainly targets kids, teenagers, and young people as the primary target market, understanding the importance of these age groups as the significant consumers of snack foods. These

consumers include people who like the innovative packaging, unique chip design, and wide range of flavors that make Pringles the choice among youth snackers. Pringles is also aware that talking to the youth segment is crucial because, most likely, their future consumption patterns will be similar to present patterns. However, the demographic and demographic-based target market for Pringles marketing is shown in Table 1.

Table 1
The Target Market of Pringles (Confos & Davis, 2016).

Target market	
Demographics	Children, Teens, and Young Adults. This target group likes snack food and is also not very health-conscious. Low to medium-income earners. Both male and female.
Geographic	Across the globe (Pringles is present in over 140 countries). Main focus on American continent, Australia and Netherlands.

Positioning

Positioning is one of the cornerstones of the strategic marketing plan of Pringles that places the brand in the consumers' minds compared to competitors. Pringles' brand is to be a distinct and unique snack that offers convenience, a wide variety of flavors, and the best quality to their consumers. This chosen position is supported by some promising elements that develop and reinforce the brand identity of Pringles.

The chips' particular layout and package are among the crucial identifiers of the brand. While regular potato chips are usually sold in a bag, Pringles come in a distinctive tubular shape that prevents them from cracking and preserves their just-fresh flavor. This packaging makes Pringles distinguishable on the shelf and increases awareness of the brand as a premium and innovative snack variety. In addition to its packaging, Pringles uses its undeniable flavor capacity and product innovations to position itself. Pringles features an impressive range of flavors, from the well-loved Original to the more adventurous options such as Pizza to Jalapeno. This variety enables Pringles to reach consumers with different tastes and preferences, becoming the leading brand in the snacks market.

Discussion

Innovative Marketing Target Plan

The marketing plan of Pringles is intended to establish strategic targets and tactics to be

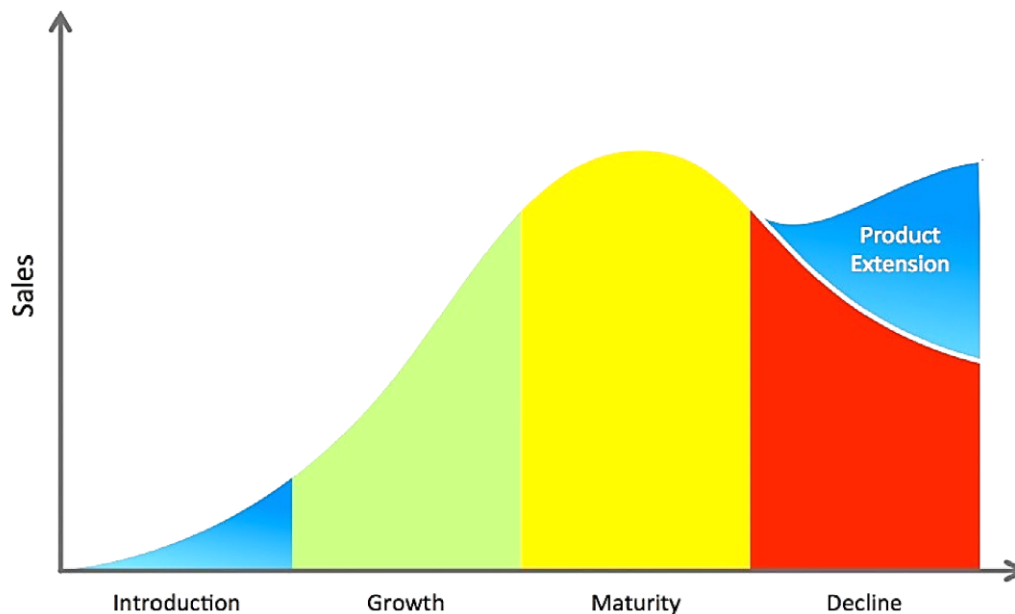
employed by the brand in different phases of the product lifecycle, as seen in Figure 5. This part would be a thematic of Pringles' goals, which are meant to start from the introduction, growth, maturity, and decline stage. Every stage of the lifecycle of a brand features a set of problems and strengths tied to the marketing goals that aim at putting the given brand on the market leader's list. Based on the goals of Pringles in different lifecycle stages, we see the brand's strategic plan as well as the initiatives to reach and maintain its long-term competitiveness, growth, development, and consumer appeal in an ever-changing snack food market.

At the introductory stage, Pringles aims to reach a considerable portion of the market by applying some smart measures. In this stage, the primary aim is to make the brand name recognizable through a diverse range of promotional activities. Pringles plans to use advertisements, product sampling, and digital marketing tools to raise awareness and attract consumers' attention. In the context of the competitive snacks market, Pringles seeks to catch its audience and become one of the leading brands.

Besides expanding the market share, Pringles has another focus at the stage of development which is to improve the product line. The brand realizes that what keeps the consumer interested and the brand to thrive is innovation.

Figure 5

Lifecycle stages of Pringles marketing strategy (Aybeniz Akdeniz, 2013)



When Pringles reaches the maturity stage in the product life cycle, the key issue is how to maintain or even increase the market share and become the brand to beat in the snacks industry. Pringles achieves this by widening its marketing scope to enhance customer brand awareness. Brand recognition and campaigns that are recognizable and appealing, this is what Pringles wants to keep in mind for consumers to maintain leadership in the market in anticipation of competitors' developments. When Pringles enters the closure stage of its product lifecycle, the focus shifts towards the stabilization of the product and minimizes its impact on the corporation as a whole. There is a need to harmonize product offerings and eliminate underperforming ones to set up the product portfolio for better performance by focusing resources with higher profits.

Advanced Strategy of Mix Marketing

The mixed marketing strategy consists of product, price, place, and promotion, comprising the fundamental elements of the Pringles marketing strategy. The marketing strategy of Pringles and its contribution to the success of the company may be recognized by examining how Pringles embraces the marketing mix as a means of competing

effectively in the highly dynamic snack food industry.

Product

Pringles strategically uses product differentiation as a mode to stand out in the oversaturated snack market, where there is a lot of competition. Pringles chips satisfy their consumers with novel product elements such as exclusive flavor combinations, limited edition series, and insuperable packaging designs that ensure excitement and uniqueness surrounding the product, ultimately leading to increasing demand and purchase intent. The production of Pringles encompasses many varieties and flavors that can appeal to different types of consumers hence, Pringles can take the lead in the snack food industry.

Price

Pringles may be an expensive brand, but it still has line prices like similar products (Al Mahmud et al., 2024; Borkovsky et al., 2017; Shahana et al., 2024). Pringles can use brand segmentation to satisfy the needs of specific customer groups and attract consumers who prefer top-class brands to common or generic labels.

Pringle applies pricing methods strategically to exert pressure on sales and

customers. The brand often employs promotional prices, such as buying one and getting another one for free or giving multiple packs with minimum purchase, to incentivize buying and to test the products among customers. Not only are low-priced customers, but also those customers who think the brand is very attractive and urgent, which plays a role in sales increase and brand loyalty boost.

Promotion

Pringles uses a variety of promotional tools across several channels to interact with the target market, increasing its brand awareness and grabbing the attention of a competitive market in the snacks market niche (Habibi Savadkouhi & Herman Jut, 2020; Rakibul Hasan et al., 2024). An important promotional strategy is advertising, under which Pringles spends predominantly on traditional and digital media platforms to reach its targeted audience with its key thoughts and messages. Pringles creates witty commercials that convey the message of the company through a comical pitch, memorable slogan, and eye-catching imagery to create brand awareness. Advertising serves as the main channel for Pringles to establish brand value and convey its products' attributes and uniqueness to the consumers, which leads to heightened brand awareness and preference.

Place

Pringles utilizes a multi-channel distribution strategy incorporating traditional retail and e-commerce platforms to reach its target audience and penetrate the market. Besides the traditional retail store outlets, the Pringles Company also inculcates e-commerce websites as a vital channel of distribution to meet the demands of young shopping individuals. Brand partners with leading online retailers and marketplaces, such as Amazon, Walmart.com, and grocery delivery services, to make its products available for online purchase and home delivery for its customers.

With e-commerce platforms, Pringles' potential customers can be expanded to the digital-savvy public who prefer online shopping for ease of access and convenience; therefore, Pringles' products can be purchased from anywhere at any time. Pringles articulately engages in both geo expansion and market penetration strategies to boost its distribution

area and tap into new consumer niches and geographical markets.

Recommendations

The future of Pringles' marketing strategy undoubtedly relies on a few more recommendations that would further enhance its development and profitability. Firstly, the brand should strengthen product innovation by investing in research and development to formulate new flavor options, pack designs, and product innovations that accommodate evolving consumer tastes and trends.

Secondly, digital marketing campaigns comprising social media advertisements and influencer partnerships will be invested in interacting and communicate with the target audience in a society increasingly adapting to the digital environment. Improving distribution channels by making the product findable and purchasable at traditional retailers and online stores. Aligning with modern technologies, many different sectors that AI and algorithms already rule can be a good example of applying strategies to improve the market plan (Akid et al., 2021; Jabin et al., 2024; Rahman Sobuz et al., 2023; Sobuz, Joy, et al., 2024; Sobuz et al., 2025; Sobuz, Khan, et al., 2024; Sobuz, Khatun, et al., 2024).

Conclusion

Analyzing Pringles' marketing strategy shows that it efficiently uses different tools of the marketing mix to remain a step ahead of its counterparts in the snack food industry. The Pringles brand's product, price, promotion, and place methods can be analyzed to see that it has positioned itself as a special and creative brand that its target audience feels is its own. The brand's promise to develop periodic product enhancements, strategic pricing policies, unusual packaging, and constant promotion has played a major part in sustaining its lead position among competitors.

Moreover, customer retention can be successful by providing mainly loyalty programs and individualized promotions, leading to longer customer relationships and brand loyalty. The unceasing monitoring of market trends, buyer preferences, and competitor activities can give Pringles the ability not to be affected by rapid changes in the dynamism of the market and enable our marketing strategy to be always efficient in the long run.

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Social Media and Mental Health in Adolescents

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Abstract

This study employs a quantitative research approach to investigate the relationship between social media use and adolescent mental health. The evolution of social media has revolutionized communication, becoming an integral part of daily life. Numerous studies have shown that adolescents (ages 12-19) spend significant time on social media platforms, impacting mental health. (Kaur et al., 2022) in India. In the case of Nepal, adolescent students spend a good amount of time on social media. However, the impact of using social media by adolescent students is not systematically investigated. (Kharel, 2023) This research study aims to examine the relationship between social media use and adolescent mental health. It has conducted a structured survey with 260 participants from Kathmandu Valley and Dang Valley in Nepal. It has defined various factors as well-being, psychological, risk, value, and perceived factors. Responses were recorded on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Cronbach's alpha test (0.94) confirms strong internal consistency. While conducting the sampling, a 95% confidence level was assumed, with a desired margin of error set at 5% and an expected population proportion of 0.2. Results indicate no significant gender differences (ANOVA $p = 0.56$), but linear regression analysis reveals a mental health outcome of 12.5. Cronbach's alpha test (0.94) confirms strong internal consistency. The findings indicate no significant gender differences but emphasize the need for targeted interventions to mitigate social media's negative impact on adolescent mental health. Mental health professionals should focus on early detection, its impact, and preventive strategies to support adolescent mental health.

Keywords: Social media impact, adolescent mental health, social media and mental health, positive and negative impact of social media, mental health survey

Introduction

This quantitative study examines the relationship between social media and adolescent mental health. Mental health plays a great role for adolescents in molding their future. According to mental health survey reports, it has

been continuously increasing day by day in recent times. Mental health issues can cause anxiety, stress, mood disorders, addiction, and personality disorders. (Braghieri, 2022). With growing concerns about mental health, quantitative research is being used to perform

diagnostic analysis and understand its relationship with social media. During adolescence, the brain undergoes significant changes. This period is the most valuable for influencing an adolescent's mental health.

Humans are social creatures who require companionship from others to lead a healthy life. Social media is exponentially taking over human spaces rapidly for communication and interaction. It is becoming a need as well as an essential activity in daily life. Due to the affordable facility of IoT (Internet of Things), it has widespread expansion, including in remote places and all communities. In developed countries, social media is widely integrated into daily activities. Therefore, it is complex to characterize social media usage on either aspect of positive and negative concerning mental health. As per recent literature reviews, it has been mentioned that technology itself may not be the primary cause of mental health challenges, as it needs to have further examination of its impact. (Aryal & Rajbhandari, 2024). Therefore, it has drawn their urgent attention to this topic to identify the connection between social media and adolescent mental health.

During adolescence, the brain goes through considerable changes and is in an immature stage. This period is the most valuable period for focusing on one future career. Adolescence is the age between 12 and 19 years. Today's youth are occupying time in digital spaces, seeking virtual interactions, which do not fully replace real-world experiences. However, the rise of social media led to virtual identities rather than direct human connection. Quantitative research is required for early detection of social media activity to identify its pattern, trends, and impact. There are still a lot of unanswered questions regarding the relationship between social media and mental health studies of adolescence in the context of Nepal. A more in-depth examination is required to explore both the benefits and challenges associated with social media use.

Previous investigations have provided valuable insights, but still there lack the numerous factors influencing mental well-being. While this topic has been widely researched in other countries, it has seen limited attention in Nepal. In Nepal, there has been no systematic research to assess the extent to which social

media affects adolescent mental health. (Dhakal, 2023). Hence, this study seeks to determine whether social media has either a positive or negative impact on adolescents.

It has done an investigation on various factors on adolescent mental health having social media usage. The questionnaire has been developed by domain expertise, having a five-point Likert scale and a survey conducted through Google Forms. The various factors are mentioned as Well-being Factor to measure the emotional and mental stability. Psychological factors for examination of stress, anxiety levels, and mood disorders due to social media use. Risk Factor is to investigate the risk that is associated with exposure to online platforms due to addiction to them. Value Factor is to explore how social media aligns with personal and societal values. Perceived Factor is to analyze adolescents' perceptions due to influence from the use of social media.

It has checked the correlation of various factors as well-being (H0) and psychological factors (H1), risk and perceived factors, and value and perceived factors that help to identify the strength and correlation between the two factors.

This quantitative research aims to bridge a knowledge gap by examining the impact of social media on the mental health of adolescents (12 to 19 years' group) in Nepal. The investigation assesses how social media engagement affects male and female participants separately. Furthermore, it investigates contextual findings for parents, educators, and mental health professionals regarding this unknown fact of social media use and adolescent mental health in Nepal. It also helps to determine the behavior of adolescents as per various mentioned factors. Additionally, it explores how adolescents behave in society, as their behavior can vary depending on various factors which have been mentioned in this research.

Literature Review

The research is targeted to provide comprehensive knowledge of the influence of social media on mental health by combining data from surveys and social media analytics. A different literature review and its methodologies have been studied, and ideas for analyzing the works have been summarized. The researchers

have mentioned T-scores and Z-scores to measure the positive and negative outcomes of social media use. The research has taken data from the national survey of India. It shows that social media significantly impacts adolescents and increases its effect rapidly. Researchers also mentioned that adolescents put their phones under their pillows and frequently use them during sleeping time. This research explains how social media effects have been increasingly affecting adolescents in the last few years. It has been seen they use their valuable time using social media such as Facebook, YouTube, WhatsApp, TikTok, and Twitter. (Kaur et al., 2022)

Social media has occupied a space in human life unknowingly. It has been seen that the adolescence period is the time for making future decisions and the golden period. The author finds adolescents use it for their daily tasks and are more prone to addiction connected to social media. It shows the greater impact on one's personal life as well as causing disturbances to the culture, economy, and well-being of a society. Adolescence is a very critical phase of human life. This stage is referred to as bringing storms and stress to them. As per the national survey of India, as it has been seen, 73% of adolescents use social media networking sites (SNS). It has seen a 55% rise in the last three years of the survey. It has been seen from the National Survey of India that cybercrime has almost increased to the highest level in Karnataka. This behavior shows that social media impacts adolescents negatively. The data shows that excessive use of social media is harmful to adolescent psychology. In this research, a composite index has been used in data to see its impact on adolescents (Schønning et al., 2020)

Researchers have mentioned that adolescence uses social media significantly. A survey of Australian adolescents using social media sites and indicators of adjustment from 34 diverse high schools in different regions was conducted. The research shows that negative indicators have been seen in female adolescents as compared to male adolescents. Even though gender had no influence, there was a link between social network use and measures of adjustment. The complexity of the association between adolescents' usage of social networking

sites and measures of adjustment has been underlined by the author in the research study. It has been tested on adolescents from Australian high schools. While doing the survey, it has made the groups who highly spend time on social media like Facebook and adolescents who spend little time on social media. To conduct the investigation, a survey questionnaire was created to assess how often and for how long social media has been used. While engaging in the activities, adolescents responded to the steps outlined in the research, such as losing or gaining appetite when in an upset mood, feeling that their problems were becoming harder to handle, feeling unhappy or depressed, and sensing that nothing was enjoyable when looking forward to them due to high usage of social media platforms. (Blomfield Neira & Barber 2020). In research analysis, variance methods were carried out. As per the author, these findings have been done to explore the relationship between male and female adolescents. The regression analyses used to predict depressive mood have figured in the research. Research shows that male and female indications of adjustment are different. It may harm female adolescents, whereas positive activity is for male adolescents. It is crucial to keep in mind that such research is particularly difficult considering how social network technology influences teenage behavior. The previous study has seen an umbrella review conducted to identify the impact of social media. An umbrella review, commonly referred to as a meta-review, has been used. It has emphasized the necessity to consider risk and preventative factors and improve media-related behaviors. The researchers mentioned that social media has been impacting the mental health of adolescents for the past few years only. The adolescent period is a vulnerable period of human life as they cannot make any proper decisions, and their mind perspective way of thinking is different. They show different behaviors as they compare their lives with others on social media. Comparing it and harming themselves generates mental health issues like depression. Twenty-five reviews were found through this investigation, comprising nine narrative reviews, nine systematic reviews, and seven meta-analyses. Researchers use an umbrella review strategy of all the evidence in the research. Researchers

reviewed journal articles appraised from 2019 to 2021. The purpose of this study is to better understand how social media affects our teenagers' mental health and why parents, researchers, and policymakers need to be aware of it. The author identified the gap as risk and preventive variables that might reveal whether adolescents are most vulnerable to the impacts of social media users are not given enough consideration (Valkenburg et al., 2022). With explanations and contrasting perspectives, the gap can be located. It also makes suggestions for future research projects.

Another study uses a systematic review to examine the relationship between social media use and mental health. It has done eight cross-sectional studies, two qualitative investigations, and three longitudinal studies. This has explained that social media addiction, certain hobbies, and time spent online may all be factors in mental health issues. The purpose of this research is to analyze how using social media affects mental health. It has mentioned excessive use of social media, spending little time on social media, and those who are addicted to social media are the cause of mental health problems (Karim et al., 2020)

However, other research findings show there is less connection between social media and mental health like depression. It has been seen that adolescents are the most active users of social media. This focuses on the relationship between mental health and the use of social media among adolescents for awareness. It has underlined that more study is needed, particularly on social media interaction and its beneficial effects (Vuorre et al., 2021)

The researcher has explained and studied the relationship between online social support (OSS) and mental health. It has shown that the relationship between social media and mental

health correlates with self-esteem. It has been shown that adolescents who use social media platforms have higher self-worth. Social media offers the opportunity for adolescents to boost their self-esteem and overall emotional health. (Zhou & Cheng, 2022)

Methods and Materials

A quantitative research approach was employed in this study to identify different factors influencing mental health. A questionnaire was developed by domain expertise to identify different factors influencing mental health. The survey was Conducted on Google online Forms. A five-point Likert scale was used to determine response of adolescence. The study focused on five factors as below:

Well-being Factor: It measures the emotional and mental health stability of a person.

Psychological Factor: This factor helps to find out the stress, anxiety level, and mood disorders related to the use of social media.

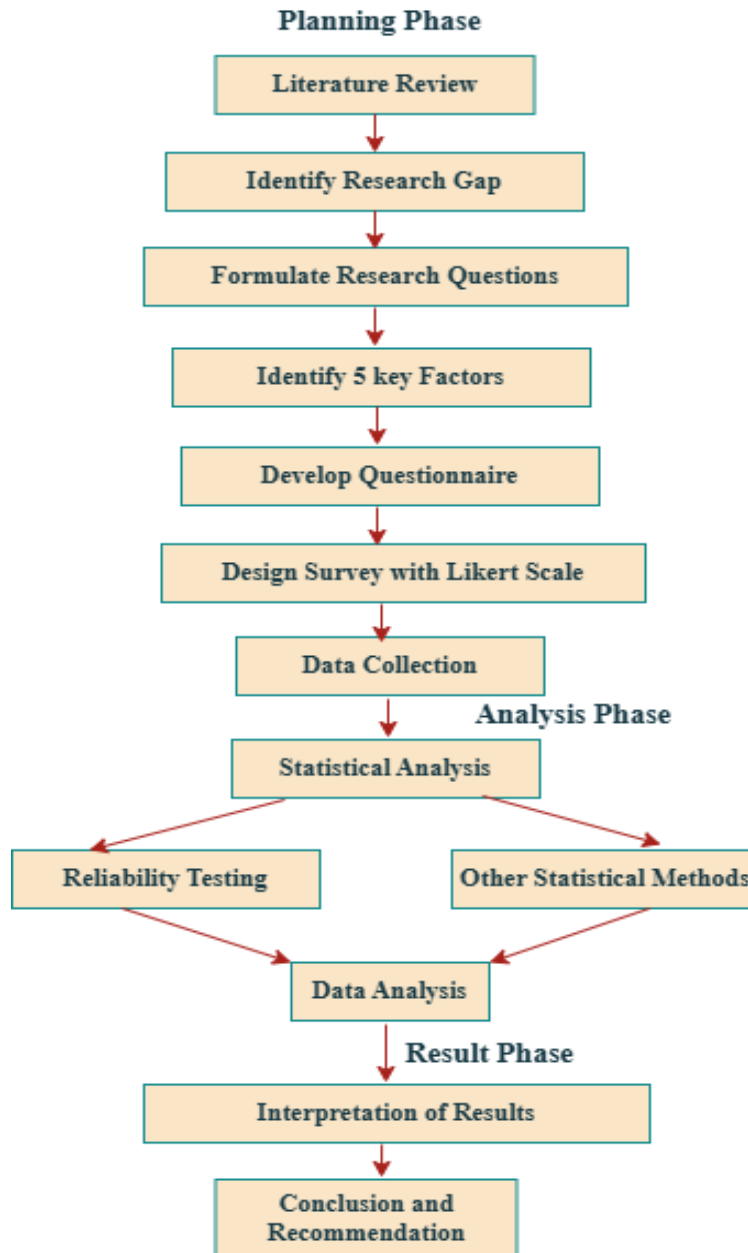
Risk Factor: It is an investigation into online harassment exposure and addiction to social media usage.

Value Factor: It finds out how the social media use aligns with personal and societal values.

Perceived Factor: It investigates adolescents' perceptions as impacted by the use of social media.

It has the use of linear regression method to determine mental health outcomes. It has conducted data reliability testing using a crunch-based algorithm for data compression and optimization. Cronbach's alpha test confirmed strong internal consistency, ensuring the validity of the questionnaire. A total of 260 responses were collected, with a calculated sample size of 246.

Table 1
Methodology and Analysis Flow



This flow chart outlines the research methodology having concept definition, literature Review, data collection and survey process, data validation and analysis.

Evaluation criteria

All participants' privacy and confidentiality were maintained throughout the survey and questionnaire process. It strictly adhered to the ethical guidelines. Primary was collected through surveys and questionnaires, ensuring reliability. A total of 20 questions were used to assess the outcomes across different factors, with four questions dedicated to each factor. It has

Well-being factor, Psychological Factor, Risk Factor, Value Factor, and Perceived Factor.

It was graded on a point scale (1 = strongly disagree to 5 = strongly agree).

Cronbach's alpha is used to determine internal consistency and reliability of the scales. It gives the internal consistency of the questionnaires. A value of 0 indicates no internal consistency, while a value of 1 suggests perfect consistency between the questionnaires.

An ANOVA and regression analysis were conducted to obtain mental health outcomes. After collecting survey data, it has been validated and undergone a mathematical analysis process. The ANOVA can be used to determine whether the social media impact has had a statistically significant effect on results for gender

$$n = \frac{Z^2 \cdot p \cdot (1 - p)}{E^2}$$

Where,

n = sample size

Z = Z-score corresponding to the desired level of confidence

p = expected population proportion

E = desired level of precision (margin of error)

Assuming a 95% confidence level ($Z = 1.96$), a desired margin of error of 5% ($E = 0.05$), and an expected population proportion of 0.2, these

$$n = \frac{1.96^2 \cdot 0.2 \cdot (1 - 0.2)}{0.05^2} = \frac{3.842 \cdot 0.2 \cdot 0.8}{0.0025} = 245.88$$

groups. It helps draw evidence-based conclusions about gender-related phenomena.

Correlation is used to assess the relationship between the factors. Linear regression methods were applied to examine the connection between a dependent variable, which is x and independent variables, which is Y . The result has been placed in a clear, logical, and precise manner, based on the data analysis.

$$(Y) = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5$$

According to the UNFPA (United Nations Fund for Population Activities) in 2022, the estimated population updated on July 16, 2023, is 30,939,939. All the data has been analyzed, and further calculations have been made for the survey (United Nations Population Fund, 2022)

The adolescent population is 24 percent of the entire population of Nepal. According to the U.N. revision, Nepal's total population is 30,939,939 (nairobi-summit.org, 2022)

Sample Size

To calculate the sample size using a formula, we need to determine the desired level of precision, the desired level of confidence, and the expected population proportion. The formula for calculating the sample size for estimating the population proportion is:

values can be plugged into the formula to calculate the sample size:

The sample size (n) is approximately 245.88. Therefore, according to the formula for estimating the sample size, a minimum of 246 participants (rounded figure) is required. However, the survey

questionnaires encompass a total of 260 participants.

Results Cronbach's Alpha for Reliability Testing

$$\text{Cronbach's } \alpha = \frac{N}{N-1} \left(1 - \frac{\sum_{i=1}^k \sigma_{X_i}^2}{\sigma_T^2} \right)$$

where:

N = Total number of items or questions in the test

k = Number of items or questions

$\sigma_{X_i}^2$ = Variance of the scores on the i th item or question

σ_T^2 = Variance of the total test scores

$$\begin{aligned} \text{Alpha} &= \left(\frac{20}{20-1} \right) \left(1 - \frac{24.0}{235.3} \right) \\ &= 0.9451 \end{aligned}$$

The value of alpha is 0.9451, which indicates excellence in internal consistency and reliability.

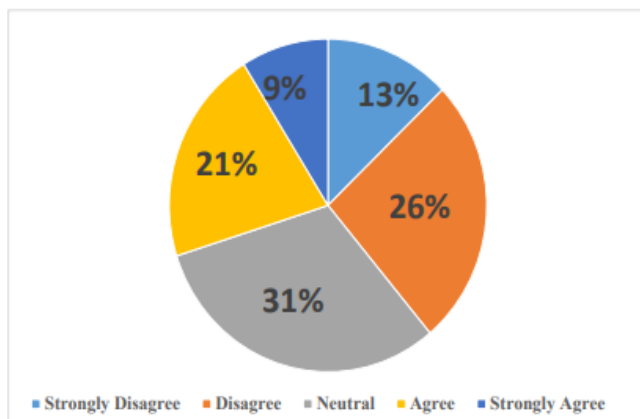
Visual Representation of Survey Results

The following figures illustrate key findings from the survey, highlighting different aspects of social media's impact on adolescent mental health. The data explores participants' responses

to anxiety and stress due to social media inaccessibility, exposure to harmful content, its effect on sleep patterns, and the balance between social media use and mental well-being. These insights provide quantitative analysis with clearer understanding of how social media influences various mental health factors. This study follows a quantitative research approach.

Figure 1

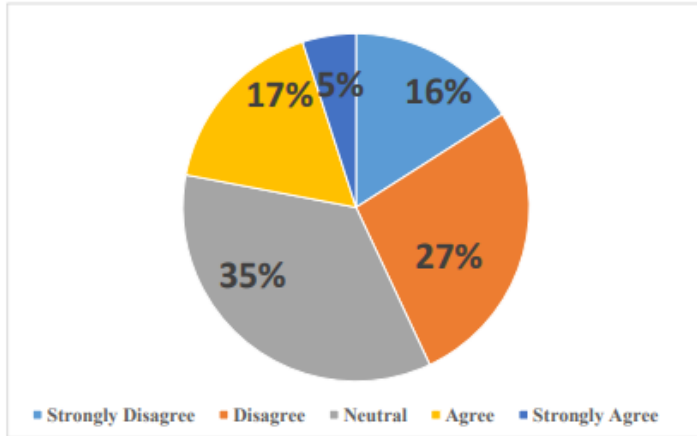
Participants' Response to Anxiety or Stress Due to Inability to Access Social Media



The chart shows survey results about feeling anxious or stressed due to the inability to access social media. The majority of participants, 31%,

remained neutral, while 26% disagreed with feeling anxious or stressed.

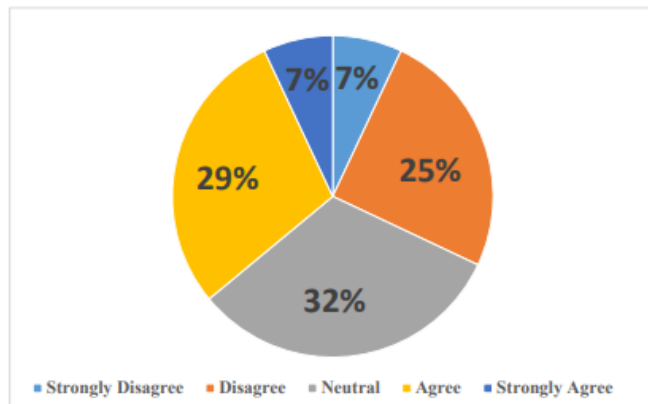
Figure 2
Participants' Exposure to Potentially Harmful or Distressing Content on Social Media



The survey result revealed that 35% of participants remained neutral, 27% disagreed, 16% agreed, and 17% strongly agreed that they

have encountered potentially harmful or distressing on social media platforms.

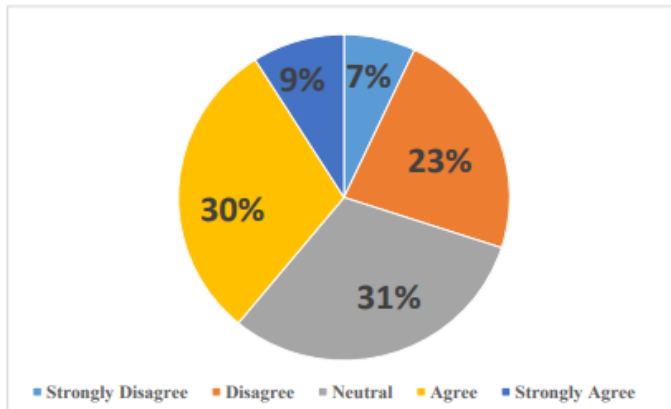
Figure 3
Impact of Social Media Usage on Sleep Patterns



The survey findings show that 29% of participants agreed, 32% felt neutral, 25% disagreed, and 7% strongly agreed that their sleep patterns were affected by social media

usage. These results suggest that a portion of respondents experienced sleep disturbances due to their social media habits.

Figure 4
Balance Between Social Media Use and Mental Health



The survey aimed to understand the connection between maintaining a healthy balance between social media use and mental health. The results showed that 30% of participants agreed, while 31% remained neutral on the issue. These findings suggest that maintaining a balance between social media use and mental health received less attention or was less prioritized by the surveyed group.

ANOVA Result

An ANOVA (Analysis of Variance) test was conducted, as shown in the figure below. The responses were measured on a 5-point scale, where 1 represents strongly disagree and 5 represents strongly agree.

Table 2
Summary of Groups

Groups	Count	Sum	Average	Variance
Male group	20	7619	380.95	443.9447368
Female Group	20	7697	384.85	524.8710526

The table shows the sum, average, and variance of the male and female groups.

Table 3
ANOVA Test Results

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	152.1	1	152.1	0.31399158	0.57852998	4.098171731
Within Groups	18407.5	38	484.4078947			
Total	18559.6	39				

$p\text{-value} > 0.05$: The null hypothesis is not rejected.

$p\text{-value} \leq 0.05$: The null hypothesis was rejected in favor of the alternative hypothesis.

Here, $p\text{-value}$ is 0.57 in an ANOVA test indicating that there are no differences in the impact of social media between the two groups. Within the group, df of 38 means that we have 38

degrees of freedom associated with the variations within each group. It shows the data flexibility within the group.

Correlation

With the help of correlation analysis, the degree and nature of the association between various factors are measured.

Table 4

Correlation Matrix: Relationship Between Well-Being, Psychological Variables, Risk Factors, and Perceived Factors

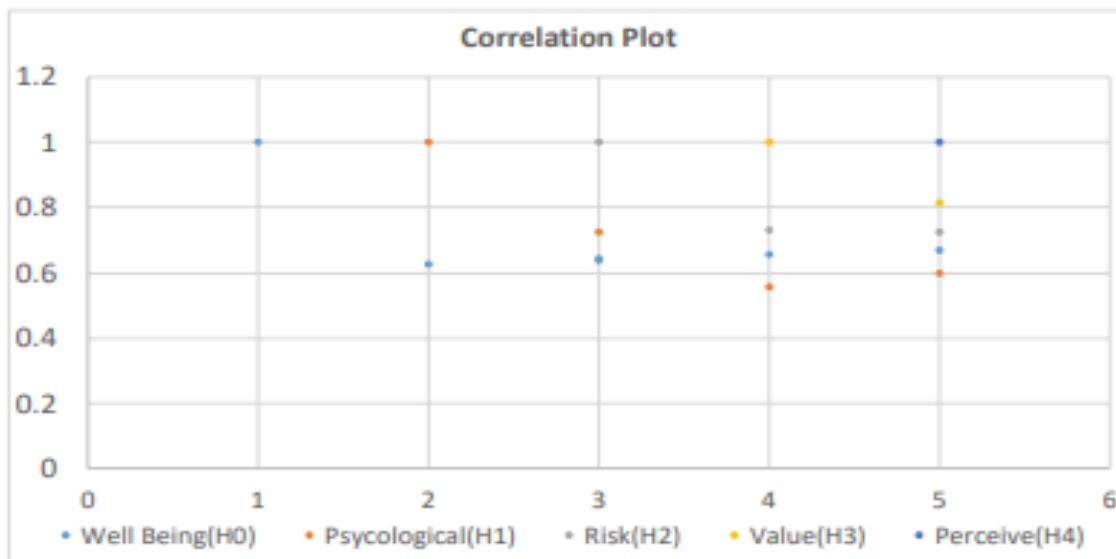
	Well Being (H_0)	Psychological (H_1)	Risk (H_2)	Value (H_3)	Perceive (H_4)
Well Being (H_0)	1				
Psychological (H_1)	0.629033113	1			
Risk (H_2)	0.641319436	0.723168909	1		
Value (H_3)	0.653928794	0.558999723	0.72919	1	
Perceive (H_4)	0.666873153	0.600896108	0.72272	0.8127458	1

The correlation between H_0 and H_1 shows 0.62, indicating a linear increase in the relationship between these two values. H_1 and H_3 correlate 0.558999723. As well-being (H_0) and psychological variables (H_1) correlate substantially positively, psychological factors might add significantly to well-being. This implies that values of H_3 (value perception) tend to grow

when values of H_1 (psychological variables) increase, and vice versa. Risk factors (H_2) and perceived factors (H_4) have a relatively significant positive correlation. This shows that the perception factors tend to grow along with the way of risk. Value and perception have a strong positive link between (H_3 and H_4).

Figure 5

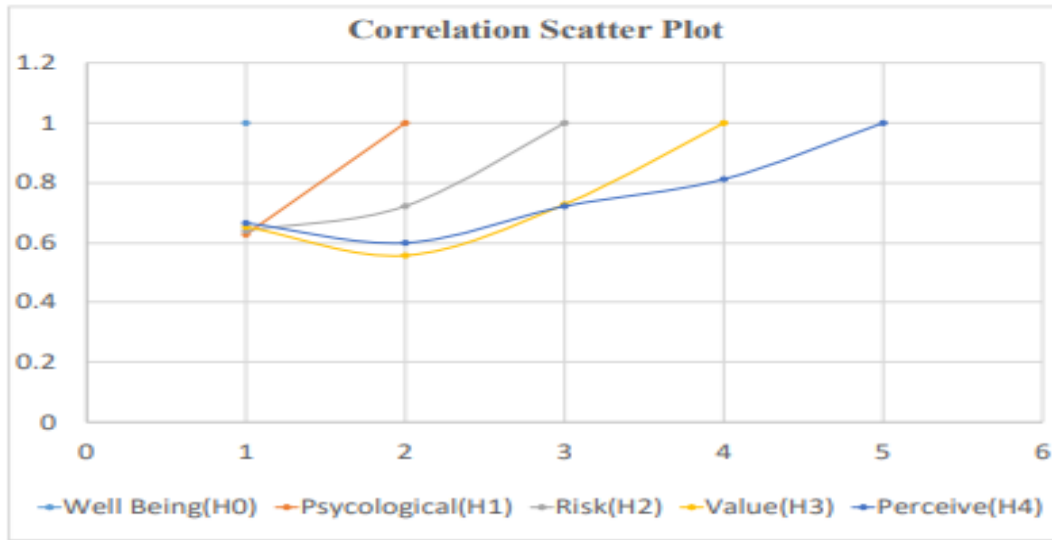
Correlation Scatter with Dot



The correlation scatter with the dot plot shows data point on various factors and their

distribution. It emphasizes specific data points and their variations across different factors.

Figure 6
Correlation Scatter with straight lines and markers



It emphasizes the trend and relationship between the factors or highlights the lines of best fit.

X4: Value factor
X5: Perceive factor
Mental health outcomes (Y) = 12.5

Linear regression

The independent variables $x_1, x_2, x_3, x_4,$ and x_5 are examined with the dependent variable with age. There is no statistically significant association between age in genders and any of the independent variables. The value of intercept and beta has been calculated.

Intercept (beta0): 11.663158894457498
Beta values (coefficients): [0.08901496, -0.08558709, 0.09070727, 0.11859358, 0.09113308]

Independent variable values are:
 $x_1 - 3.06, x_2 - 2.74, x_3 - 2.89, x_4 - 3.03, x_5 - 3.02$

Using Linear regression analysis,
Mental health (Y) = $\beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5$

$$Y = 11.663158894457498 + 0.08901496 \cdot X_1 - 0.08558709 \cdot X_2 + 0.09070727 \cdot X_3 + 0.11859358 \cdot X_4 + 0.09113308 \cdot X_5 \dots\dots\dots (1)$$

Y=12.5

Where, X1 - Well-being factor
X2: Physiological factor
X3: Risk factor

Discussion/Implications

Analysis of the Data

The result of this quantitative research study provides insights into the relationship between social media and adolescent mental health. Major things collected from this data regarding anxiety and stress: the majority of participants, 31%, felt neutral about experiencing anxiety or stress due to the inability of social media, whereas 26% disagreed with it. It means adolescents do not fully agree that social media access impacts mental health; it means there may be other factors related to mental health.

Regarding the questionnaire on exposure to harmful content, it revealed 16% agreed and 17% strongly agreed with it, whereas 35% remained neutral. This pattern indicates that there are mixed natures of experiences in adolescence on social media platforms, as some face exposure to harmful content, whereas others do not perceive it as a significant issue.

On the questionnaire about the impact on sleep due to social media, 29% agreed that social media affected their sleep. It indicates that excessive use of social media could disrupt

sleep. However, it has shown that 32% remained neutral. This pattern indicates it may be influenced by individual factors that may be lifestyle or usage habits.

Regarding the balance between social media and mental health response, it showed that 31% were neutral on it. This neutrality group shows a lack of awareness of social media's impact on mental health. By analyzing the findings on social media effects on mental health, its impact varies widely on adolescent groups.

Comparison with Previous Studies

Several previous studies have revealed a relationship between social media and mental health, that heavy use of social media increased the risk of anxiety and depression in adolescents that aligns with some findings in this study, here Participants' response to anxiety or stress due to inability to access social Media has 31% are neutral regarding anxiety and stress, and 21% agree on it. (Karim et al., 2020). It has been mentioned in another research that more exposure to disaster news through social media was associated with mental health problems, causing high levels of depression and stress (Zhao & Zhou, 2020)

On the other hand, it has been highlighted that social media use is not harmful; other factors play an essential role for the mental health of adolescents, as social media helps to boost their self-esteem and overall emotional health (Zhou & Cheng, 2022).

Regarding the finding of sleep disturbances due to the use of social media in this research activity, 29% of participants agreed with it, as social media affected their sleep patterns, as this has been found to be a problem in sleep due to the use of social media. It has been found in other research that the use of social media late at night affected the sleep of adolescents. (Blomfield Neira & Barber, 2020)

Future Research Suggestions

This study contributes valuable insights, but it needs to explore longitudinal studies as it provides clearer insights into the long-term effects on social media and mental health of adolescents. It has a small sample size in this quantitative research study, as in future research it should take in diverse populations so that it

helps to generalize more to understand the relationship between social media and mental health across different demographics. By adding qualitative research, having interviews with adolescents could provide a deeper understanding of their experience with social media and their mental health in a deeper way in this study.

Recommendations and Limitations

Recommendations

This study concluded that social media does not have a statistically significant impact on mental health difference between male and female adolescents' group. As mental health is the complex issue which is influenced by multiple other factors beyond social media usage. It has to be studied to explore the environmental conditions together with psychological elements that influence adolescent mental wellness. Longitudinal research with diverse population samples will help to discover additional psychological effects of social media use on mental health as well as relationships which social media causes indirectly. It is advised to have research on a larger population and different groups of people in the community. Schools and educators should address the potential mental health risks associated with social media by integrating health education programs. They should also encourage adolescents to maintain a balanced approach to their usage.

Limitations

This study has a few limitations that should be considered in future research. First, the sample size is relatively small, and there is a need for more extensive research with a broader scope. Additionally, adopting a longitudinal approach with long-term studies would provide clearer and more conclusive findings, helping to better understand the long-term effects of social media on adolescent mental health.

Conclusion

This quantitative research examined the impact of social media on adolescent mental health, with a particular focus on whether there were statistical variations between male and female participants. The findings revealed no

statistical variations in social media effects between male and female adolescent participants, as it suggests exploring other psychological and environmental conditions that may create significant effects on mental health outcomes. It aligns with previous research that maximum use of social media can cause stress, anxiety, and sleep disturbance in individual adolescents influenced by broader contextual factors rather than gender alone.

This research study has contributed to how adolescents perceive social media's impact on their mental health and the importance of adopting a more comprehensive approach to this. It has observed neutral responses in several aspects of the study; it should be better in future research to have extensive methods and longitudinal study for clearer understanding of social media's effect on mental health. By refining research methods and expanding the scope of investigation, future studies can provide more insight to inform policies and mental health strategies for adolescents in the digital age.

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Artificial Intelligence and Business Transition: Paving the Way for Development

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Abstract

Artificial Intelligence (AI) is steadily becoming the new normal in doing business through increasing operational performance, improving customer relations, and increasing predictive accuracy. This quantitative exploratory research employed a mixed-methods approach, integrating qualitative insights into organizational trends, best practices, and challenges with quantitative assessments of performance measures, cost savings, and business outcomes. Several surveys were administered to a diverse group of business professionals. The study, situated within the field of applied research, explores how AI facilitates business growth through change and proposes best practices for successful integration. It also studies what happens during transition periods when organizations emphasize artificial intelligence, NLP, and robotic process automation as top technologies since they contribute to completing work tasks, analyzing large data sets, and improving individual communication with clients. Besides potentially generated cost savings and a long-term increase in business value, there are several obstacles that organizations face if implementing AI, such as high initial costs and a market that requires professional knowledge on the topic. If implemented correctly, AI technologies hold huge potential for businesses going through transitions and taking advantage of AI's strengths. For this reason, it is important to describe and analyze trends like AI technology integration accurately. This article suggests best practices for applying AI in business development during transformations.

Keywords: Artificial intelligence, machine learning, business transitions, predictive analytics, robotic process automation, cost reduction, AI adoption strategies

Introduction

Artificial intelligence (AI) has started changing industries, from automating processes and analyzing data at incredibly high speeds to enabling personalized customer experiences (Brynjolfsson & McAfee, 2017). Moving toward integrating AI into business operations is no longer an option but a necessity as companies struggle to survive in the highly technological market. This transition period of a company from a traditional model to an AI-driven enterprise is the most critical juncture that will define long-term success or failure.

Recently, AI has begun transforming businesses across sectors by automating

processes, enabling data-driven decision-making, and improving customer service through targeted communication. For instance, AI-powered chatbots efficiently respond to customer inquiries, predictive analytics help companies make strategic decisions, and automated processes streamline supply chain management, reducing costs and delays. AI has the potential to disrupt industries such as retail, finance, healthcare, and manufacturing. However, this transition comes with significant challenges, including the need for large investments, reorganizing business architecture, and staffing with skilled AI professionals. While AI technologies continue to evolve, businesses

must navigate obstacles like high investment costs, workforce reskilling, and operational restructuring. Therefore, this paper explores how AI can drive operational efficiency, inform strategic decision-making, and enhance customer service, ultimately positioning businesses for long-term growth in a rapidly changing environment.

This paper discusses how the use of AI increases during business changes and considers some potential advantages, problems, and long-term effects of adopting AI. This idea then provides an overview of how AI changes conventional business regarding automation, predictive analytics, and customer engagement. The meaning and content of this perspective are profound. Indeed, they are intended to explore the good and the bad sides of AI from qualitative and quantitative perspectives and suggest opportunities for businesses to navigate the intricacies of AI adoption toward their long-term benefit.

Literature Review

The adoption of AI in businesses has been explored in research with various focuses on realizing optimal business gains through AI administration, including the improvement of efficiency, costs, and customers. However, the specific role of AI in transitioning from conventional methods to AI-driven approaches, a key phase of transformation, has not been thoroughly explored.

The research problem is to establish how AI can support change management in organizations. Specifically, key questions include: Which forms of AI are most effective for facilitating such a changeover? What challenges do enterprises face when implementing these technologies, and how can they best leverage them?

AI in Automation

Atomization is one of the most striking immediate uses of AI. With AI-assisted automation tools in place, organizations can delegate many of their mundane tasks, allowing human capital to focus on core business activities. (Ransbotham et al., 2017) identified that AI-based automation can reduce administrative workload by at least 50%. These systems encompass artificial intelligence in

customer relations, data analytics, and supply chain management. In the retail industry, for instance, AI-driven intelligent inventory management automates replenishment, ensuring products remain stocked without the risk of understocking or overstocking. Additionally, AI-powered robots are widely applied in the manufacturing process to perform various assembly tasks with high precision, thereby reducing human errors (Dwivedi et al., 2019). However, while AI-driven solutions offer efficiency, challenges such as copyright infringement and ethical concerns arise when applying AI in content creation, personalized marketing, and other tailored applications across industries.

AI in Predictive Analytics

Another crucial area where AI is making huge strides involves predictive analytics. Organizations that are using AI-driven analytics can study past trends, pinpoint a pattern, and predict some future events with very high accuracy. Predictive analytics provides businesses with the ability to anticipate market fluctuations, customer behaviors, and operational bottlenecks. For example, in the finance sector, AI-based predictive models can increase the accuracy of forecasts by as much as 85%, enabling businesses to make decisions based on real-time data.

In the finance sector, the use of predictive analytics, driven by AI, helps analyze trends in the stock market, determines credit risks, and forecasts any signs of economic decline. As machine learning algorithms help businesses identify patterns that are well beyond human capabilities, making smart decisions about investments and management of risks is possible. Retail places AI at the forefront of predicting consumer behavior, allowing businesses to optimize marketing strategies and manage inventory efficiently.

Challenges of AI Integration

Considering all the benefits of integrating AI, the transition phase possesses quite a few disadvantages. Amongst the most inhibiting factors, the investment required for integrating AI is too high. Most AI technologies require very high upfront investments in hardware, software, and human resources. "As estimated by (lyelolu et al.,

2024), depending on system complexity, the average investment cost of an AI system in a mid-sized enterprise company falls between \$500,000 and \$2 million."

Another challenge is AI expertise. The company has to hire or train experts in machine learning, data science, and AI programming. However, the demand for AI specialists now outstrips supply, hence, forcing a talent shortage that most companies have not yet resolved. According to (Manyika & Sneader, 2018), organizational structures may need to be reorganized to support AI technologies through the revision of business processes and decision-making mechanisms.

Finally, businesses need to take notes of ethical issues of data privacy and algorithmic transparency. As AI systems become more integrated into making decisions, the demand for clear-cut guidelines on ethical standards increases. To that effect, companies must ensure their AI systems are not only transparent but also in line with regulatory requirements (Dwivedi et al., 2019).

The current research, as uncovered in this literature review, found an information deficit as to the precise position of AI during the transition period in organizational business processes. Understanding what the benefits of incorporating AI are and the difficulties one can face at the same time, this research is intended to offer some recommendations to companies and organizations on how to traverse this important phase. The study will add to the literature and help organizations during the transformation to AI businesses by providing recommendations on the effective integration of AI systems.

Methods and Materials

This exploratory research used quantitative data derived from a survey of businesses that have implemented AI during the transition phase with qualitative data from expert interviews. The Director's survey quantitative data was collected from a sample of seven firms, cutting across the retail, finance, manufacturing, and healthcare sectors. Specifically, the firms included SMEs up to multinational corporations so that the researcher could understand the different appreciation of artificial intelligence.

Questionnaires containing factual questions that yielded quantitative data with a focus on

operation efficiency, cost control, customer satisfaction, and market sensitivity were developed. The questionnaire included specific questions such as:

- How would you self-rate the processes' efficiency in operations after the implementation of AI technology?
- That brings us to the seventh question: What reduction in costs have you seen since integrating AI?
- What are the more specific impacts on customer satisfaction after the application of AI technologies?
- Often, how long does it take for an average integration of the AI systems in your operation?

Further to these measures, participants were asked to state the amount of time to attain integration of the AI systems, costs spent on implementing AI, and key difficulties faced through the process.

Qualitative data collection complemented the survey's quantitative data. The author used qualitative interviews with business leaders, AI specialists, and industry practitioners. In addition to the quantitative data collected in this survey, a total of 20-25 qualitative surveys were conducted. Specific concerns and important questions posed to interviewees stemmed from these broad concerns: How should AI technologies be deployed? What are the benefits and risks associated with the implementation of AI during the change? Sample interview questions included:

- Which sort of factors do you think were wise to apply while deciding where to implement artificial intelligence in your business?
- Have you witnessed any key issues your organization experienced during the adoption of AI?
- Consequently, from your experience, what do you think are the major advantages of implementing AI technologies?

To ensure respondent anonymity, all the data which was collected during the analysis were deleted. The people managed to understand that they would remain unknown, and that is why they agreed to be interviewed and complete the questionnaires. It also created a FREE and SECURE environment that allowed the

participants to give their real responses to the questions posed to them.

Results

The data gathered suggest that AI integration positively impacted business environments in transition-phase companies since the operating efficiency improvement ranged between 15-20%. For instance, the largest improvements were identified in the manufacturing and customer service areas since the application of AI-based automation tools. For instance, those companies that adopted the use of AI in robots targeting production lines observed a considerable enhancement of production by 30% while reducing human error. This eventuality maximizes efficiency in that productivity is maximized alongside improved throughput while reducing the costs of value addition by curtailing increased cycles of work.

Besides operational effectiveness, the organization that is implementing AI in CRM noted that there was an improvement of 15% in customer satisfaction in the first twelve months. This improvement was attributed to AI's ability to

analyze customer data and deliver personalized service quickly through AI chatbots, available at any time (Badmus et al., 2024). For instance, an organization with a retail outlet decided to adopt artificial intelligence chatbots in responding to customers' inquiries, which helped reduce response time by about 70%, enhancing the experience of the customers.

Even more than that, organizations that decided to automate their business using AI in predictive analysis were observed to be more prepared to deal with the market volatility. The industry players that applied artificial intelligence-based predictive tools revealed an average saving of 15% on matters relating to inventory and disruptions of the supply chain (Loureiro et al., 2020). These assessments are due to the accuracy of the AI model in making forecasts that help the firms to better manage scarce resources to reduce high inventories. For example, Loureiro et al., 2020) describe how a logistics firm was able to use predictive models to estimate demand by cutting stockouts by 20%, which in turn boosted customer delight and service cost.

Table 1
Impact of AI Implementation on Key Business Metrics

Metric	Pre-AI Implementation	Post-AI Implementation	% Change	Summary
Operational Efficiency	65%	85%	+20%	AI-driven process optimization reduced bottlenecks and improved workflows.
Customer Satisfaction	70%	85%	+15%	AI-powered CRM and chatbots improved response times and personalized interactions.

Cost Reduction	5%	20%	+15%	AI automation minimized human errors and optimized supply chain management.
Time Spent on Routine Tasks	50 hours/week	25 hours/week	-50%	AI automation reduced manual tasks, allowing employees to focus on strategic work.
Accuracy in Market Predictions	60%	85%	+25%	AI's predictive analytics improved demand forecasting and reduced stock-outs.

Note. AI implementation led to improvements in efficiency, customer satisfaction, and cost reduction while reducing manual workload and enhancing market predictions.

Discussion/Implications

These findings suggest that, at these junctures of business transformation, AI can be transformative: in the running of operations, in customer contact, and in providing strategic foresight. Consequently, if businesses are truly going to exploit the potential of AI, then several critical factors need to be taken into consideration.

Investment in AI Talent

The quantitative and qualitative data pointed to the scarcity of qualified human capital in the field of AI. Through the survey, only 30% of the companies in the transition phase said that they experienced moderate or mild delays in the implementation of AI, and talent was scarce, which prolonged the transition phase and the costs. The same was echoed in by business leaders in interviews, more than half of whom noted that the demand for AI specialists outstrips supply. For instance, one participant clarified as follows, “We were six months late in implementing AI within our business because we could not identify talent to handle the integration processes well.”

To address this problem, 60% of surveyed businesses are engaging in internal AI training programs for employees. Other measures mentioned include the recruitment of educational institutions and AI consulting companies. An informer mentioned, Through partnerships with local universities, we have prepared our employees to fit exactly the AI model that suits our organization, thus saving a lot of costs that could have been used to hire third parties and increasing the correlation between AI implementation and organizational objectives.

These studies prove that talent crunch is an issue; however, no firm is idle and is trying to develop internal AI capabilities. The delayed work does not act as a long-term hindrance to AI integration.

Adapting Organizational Structures

It often requires organizational structure changes because of the integration of AI. Traditional hierarchical models may not be good fits for speedy decision-making and continuous data-driven processes, which AI allows. Companies must, then, transform into flexible organizational structures that allow cross-

functional collaboration and quick decision-making (Agrawal, Gans, & Goldfarb, 2018).

For example, companies that are adopting AI-driven automation should channel human resources to more strategic functions rather than routine ones. This shift calls for a change in culture wherein workers can look at AI as an addition to their work, not a replacement. Businesses that fail to adapt to technological evolution may struggle to fully benefit from AI. Inefficient workflows and decision-making bottlenecks can offset potential gains in operational efficiency.

Ethical Considerations and Data Privacy

Another important dimension of integrating AI is ethics in integrating AI into decision-making. Applications in which AI is integral to doing business pose the critical elements of transparency and accountability. Organizations are also required to ensure that the systems used are contained within the legal and regulatory parameters as well as the privacy of that data.

AI-driven decisions, especially those touching on customers, must be explainable and transparent. The main reason is that many consumers are rightfully concerned about how businesses are using their data, and businesses must be able to explain in plain English the algorithms that lie behind personal recommendations, the targeting of advertisements, etc. Indeed, such negligence may lead to a serious loss of reputation and may even invite some form of legal liability in critical jurisdictions enacting strict regulations on data privacy, as in the General Data Protection Regulation of the European Union (Kaplan & Haenlein, 2018).

The findings of the study highlight a few major implications businesses may consider when embedding AI during transition. Implications are drawn on organizations of different industries and sizes, from SMEs to MNCs.

Strategic Investment in AI for Long-Term Gains

Though AI usually can be costly when it comes to implementation, the operational efficiencies, cost reduction, and customer satisfaction then are starkly evident (Bhatia, 2024). Business organizations should look at AI adoption as an investment rather than just a

short-term cost. For instance, based on the sample data shown, companies that invested in AI-based automation and predictive analytics reported up to 15% cost reduction within a year of implementation, alongside significant improvement in productivity.

For industries like retail and manufacturing, where AI can further grease the wheels in terms of supply chain management, one would be ceding competitive advantage to nimbler rivals by failing to adopt AI. By investing in AI strategically, businesses can position themselves for long-term growth while gaining a competitive edge.

Importance of Tailored AI Solutions

While out-of-the-box solutions may present certain benefits, the most effective integrations are those crafted to meet your needs. AI solutions must be tailor-made to certain processes and objectives a company has (Davenport & Ronanki, 2018). Companies working with AI vendors, or developing in-house AI capabilities themselves, can better leverage the full potential of AI technologies.

For example, AI-based predictive analytics tools have to be estimated specifically for the financial industry to carry out the market trends for each institution. Thus, there is a need for Artificial Intelligence Customer Relationship Management systems for retail to be specifically equipped with behavior and personal preferences to provide recommendations. Hence, it has been very unrealistic to assume that there is an approach to AI that fits all the requirements.

Addressing the AI Talent Gap

The AI talent gap is the single biggest enabler for businesses seeking to integrate this technology. Where automation will remove some of the need for people to perform mundane tasks, AI requires those skilled at designing, implementing, and monitoring these systems. Investments by businesses should be in building internal AI teams that have ongoing training and development programs that retain key talent. Partnerships with universities and other tech-training programs will also serve to help bridge this gap by enabling access to emerging talent (Kietzmann et al., 2018).

The trainability of the population is critical, especially considering that governments and educational institutions provide STEM education

and training programs in AI. Those companies that are success-orientated with employee upskilling and reskilling initiatives stand ready in better measure to adapt to the rapid technological changes brought about by AI.

Ethical AI and Transparency

The current rise of AI stirs debates about ethics, primarily based on algorithmic bias, transparency, and protection of consumer data (Uzialko, 2024). Companies have to make proactive efforts in evolving ethical AI practices and ensuring that their AI decision-making is transparent. Algorithms used by the companies in driving the decision of customer service, marketing strategies, and operating processes must be carefully vetted to ensure that the inadvertent biases do not harm the brand reputation or bring regulatory penalties.

For example, AI systems that recommend credit approvals or medical treatments must be transparent in their decisions for customer-facing industries such as finance or healthcare. Furthermore, businesses must comply with data privacy regulations, such as the GDPR (Parsons, 2025), to ensure they do not compromise consumer data. Transparency in AI is not strictly a legislative requirement but also part of the trust between businesses and their consumers.

Change Management and Organizational Adoption

AI adoption goes beyond technological consideration to the organizational mindset and culture. Business leaders should realize that the impact of adopting AI will resonate immensely in their workforce, workflows, and decision-making processes (Makridakis, 2017). This eventuality calls for an efficient change management strategy in place so that managers as well as employees can assess how AI fits into their operations.

The shift to AI-powered operations, then, has the potential for resistance among employees who fear that their jobs will be displaced. Companies create a culture of innovation and learning that helps people reduce their resistance to new phenomena and think of AI as a tool, not a replacement for human work. On the business side, it is necessary to align the organizational structure to the new processes brought about by AI: the cross-functional teams must be capable of

working on projects in AI and sharing their insights across departments (Bughin et al., 2018).

Conclusion

After exploring how AI enables business development through, suggests best practices for successful integration, and studies what happens during transition periods when organizations emphasize artificial intelligence, NLP, and robotic process automation, it can be concluded that AI is one of the transformational technologies in today's businesses, revolutionizing entire industries from being capable of better operational efficiencies to better data-driven informed decisions to provide a better customer experience. Those companies that have integrated AI during their transition phases are likely to leverage new opportunities and the changing needs of consumers.

Implementational hurdles like steep costs, scarcity of talent, ethical constraints, and organizational changes are bedeviling challenges businesses have to contend with. The research has shown that with an appropriate investment in AI and its tailored solutions, companies can realize significant gains in efficiency, cost savings, and customer satisfaction.

Focusing on technological and ethical considerations in the future will remain paramount for companies. This will invoke regulatory guidelines and consumer expectations to weigh concerning existing AI systems and to train and recruit AI-savvy employees through internal training programs.

More importantly, AI is not a tool per se; it is a catalyst promising to bring growth and development in the times to come. Companies embracing AI today are sure to be in leading positions in their respective industries tomorrow.

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