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An Investigation on the Effects of Artificial Intelligence on Pharmaceutical Product Brand Management Strategies (PPBMS)

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Abstract: The term "artificial intelligence" (AI) refers to a group of technologies used in the health sector that enable robots to sense, comprehend, behave, and acquire the ability to carry out clinical and administrative tasks. Human-machine cooperation is the way of the future, and as technology develops, human clinical professionals will also need to adapt, learn, and develop. It is the evolution of medicine, not its extinction, even though future experts will need to be both technologically and medically knowledgeable. Pharmaceutical applications include a wide range of AI and machine learning uses, such as disease detection and diagnosis, tailored therapy and behavioural modification, drug development and manufacturing, radiology and radiotherapy, smart electronic health records, epidemic outbreak prediction, branding, sales and marketing, and predictive analytics, among others. Additionally, advertising benefits greatly from AI and ML-based analytics, especially as successful advertising frequently requires a high degree of judgment and numerous continuous, complex decisions. In 2021, the AI health sector is estimated to generate $6.6 billion in revenue at a 40% compound annual growth rate. In the next ten years alone, the medical AI market is likely to grow by almost ten times. Soon, procedures that are more intelligent, quicker, and less expensive could be made possible by AI and machine learning. Better insights are provided by artificial intelligence, which supports regular duties. Enhancing efficiency and furnishing the marketing function with more profound insights and reliable data facilitates the selling process. Artificial Intelligence provides consistency, economy of scale, decision-making, and data loss prevention. This article deals with the advancement of innovation, global healthcare, and the supply of treatments that change and save countless lives on a global scale are all dependent on pharmaceutical firms. Their research, development, and distribution of medications and therapies are critical to addressing health concerns, guiding medical progress, and considerably enhancing societal well-being. In this changing context, the integration of artificial intelligence (AI) is becoming a revolutionary force that is changing preconceived notions. AI has the unrivalled ability to foresee market trends, recognize consumer behaviour, and optimize strategies. It can also increase brand equity, customer engagement, and market penetration. The purpose of this study is to assess how artificial intelligence has affected pharmaceutical product brand management procedures. This study employed the Wilcoxon one-sample signed rank test methodology. Artificial intelligence has a significant influence on the branding of pharmaceutical products through brand image, brand engagement, brand consistency, brand positioning, brand loyalty, brand reputation, brand perception, brand trust, and brand advocacy.

Keywords: Artificial intelligence, health care pharmaceutical products, brand management strategies, AI in health care.

0. Introduction:

Artificial Intelligence (AI) is being used in the pharmaceutical sector at a rapid rate, and it is becoming a crucial aspect of digital marketing. Artificial Intelligence (AI) holds great potential to transform pharmaceutical companies' client interactions and enhance their Branding strategies through the quality and standardization of pharmaceutical products through marketing tactics. This article will examine the various branding functions of artificial intelligence (AI) in pharmaceutical digital branding, as well as its benefits, adaption, usage, and impacts of AI on the branding of pharmaceutical products.

1. Meaning of Artificial Intelligence:

Artificial intelligence (AI) is a subset of computer software that mimics human intelligence and gains knowledge from its experiences. It can solve complicated issues, identify patterns, and make decisions. Processes can be automated with AI to boost productivity. Retail, banking, healthcare, and other industries all employ AI. Artificial Intelligence has the potential to enhance client interaction and optimize branding quality for marketing strategies in the pharmaceutical sector. Pharmacies may develop more specialized advertising and a deeper understanding of their clients with the use of AI. AI can also be used to automate tasks like tracking consumer interactions and answering customer questions with other feedback for pharmaceutical growth at various levels[36].

2. Definition of AI:

There are many different meanings for the word "artificial intelligence." AI, often known as machine intelligence, is defined by Wikipedia as "intelligent behavior displayed by machines as opposed to the natural intelligence displayed by humans and animals."[38]

As per SAS analytics, "Machines can learn from their past performance, adjust to new inputs, and perform tasks that humans would typically perform. These are all made possible by artificial intelligence [AI]."[39]

3. Historical Background of the Study:

The current state of marketing is altered by technological advancement. The widespread use of the internet has led to the marketing of goods and services on digital platforms, focusing on a brand's awareness in international markets (Davenport et al., 2020)[12]. Businesses may do business online using platforms like social media and e-commerce websites to reach a wider audience and encourage them to purchase brands of goods (Chen, 2019)[13]. Nowadays, a lot of artificial intelligence (AI) is being utilized for operational marketing, which includes "risk assessment, client targeting, brand promotion, and price optimization" to maximize revenues (Marinchak et al., 2018)[14]. Through marketing communication and channels, In the digital age, artificial intelligence has grown and changed significantly (Qiao et al., 2019)[15]. According to academics and industry experts, AI is becoming more popular because of advances in big "data analysis, machine learning, social media analysis, algorithmic decision-making, simulation modeling," and other methods for increasing brand visibility in international markets (Singh et al., 2019; Syam & Sharma, 2018)[16]. As a result, AI is significantly altering "consumer attitudes, marketing tactics, and brand preferences." Additionally, these approaching shifts in the global virtual economy (i.e., cantered on temporary or flexible jobs, which usually include interacting with customers or clients online) will have a big influence on marketing initiatives (Wang et al., 2020[19]; Chen et al., 2012)[20].

AI has slowly taken over the world along with machine learning, the pharmaceutical industry is not lagging towards being significantly influenced by Artificial Intelligence and machine learning. A branch of computer science called artificial intelligence evaluates vast volumes of data in the medical industry. Branding in the field of marketing has been significantly impacted by AI. According to research, brand equity, brand choice, brand intimacy, and brand sustainability may all be improved by AI (Varsha, et al. 2021)[5]. Interactive agents may also increase brand loyalty, user preference, and brand experience (Natiq, et al. 2022)[4]. Personalized product and service offers based on client preferences are made possible by AI, which improves brand perception and customer happiness (Michael, 2022)[3]. AI also helps understand consumer preferences, segments, and target audiences and recommend purchases. AI integration can enhance business performance, financial success, and competitive advantage (Mahbub, 2023)[2].

"Text mining, machine learning, artificial neural networks, robotic process automation, and other algorithm-based tools" are examples of artificial intelligence (AI). These tools are designed or programmed to independently learn from data to generate predictions and produce amazing outcomes (Huang & Rust, 2018)[22]. Furthermore, artificial intelligence (AI) collaborates with businesses and marketers ingeniously to generate, arrange, and use data for marketing objectives, therefore promoting brands globally (Davenport & Ronanki, 2018)[21]. The strategic planning, legal, and administrative aspects of management, including branding, pricing, sales, and advertising, have all benefited from the application of artificial intelligence (AI) in marketing (Gentsch, 2019)[24]. Recently, there has been a noticeable increase in interest in the effects of AI on branding (West et al., 2018)[26]. Using AI to drive organizational success, brands are created by associating ordinary things with positive emotions and social connotations (Galloway, 2016)[23]. Voice search and keyword search for brands have completely transformed as a result of recent advances in AI (Yoga Narasimhan, 2014)[27]. To locate the proper brand, a virtual assistant helps to enhance search performance by making it more accurate and efficient. Furthermore, analysts contended that AI would spur product innovation (Domingos, 2015)[25] and allow consumers to recognize the appropriate brand of goods through product line expansions (West et al., 2018)[26].

According to Swaminathan et al. (2020), brands in the digital sphere are linked to artificial intelligence (AI) suggestions on items, which have been studied before (Lee & Hosanagar, 2018)[28]. Notwithstanding this, crucial attempts to compile the body of knowledge about the influence of AI on branding seem haphazard and unclear (Stone et al., 2020)[20]. According to Columbus (2019)[29], artificial intelligence (AI) may be used for brand segmentation, personalization, pricing, and sales forecasts.

Comprehending how artificial intelligence (AI) affects pharmaceutical brand management methods is crucial for restructuring tactics, streamlining processes, and boosting competitiveness in the market. With AI integration, new strategies are introduced that completely transform market positioning, customer interaction, and brand exposure. Pharmaceutical firms may efficiently cater to customer demands by employing accurate data analysis and tailoring marketing tactics with AI-driven insights. The findings from this research will add to the knowledge of the usage of AI in Brand Management Practices of Pharmaceutical Products. This information enables more efficient operations, reduced costs, and better product placement in addition to increasing consumer engagement through tailored interactions. Additionally, researching the impact of AI helps with regulatory compliance, ethical issues, and future trend prediction, allowing businesses to proactively innovate and adapt in this ever-changing environment.

4. AI's advantages in the pharmaceutical Industry:

AI has the potential to enhance consumer interaction and maximize marketing tactics. AI can analyze consumer data to produce relevant content and tailor advertising based on factors like preferences, Quality control, branding, buying patterns, and demographics. AI is also capable of automating customer support duties like tracking client interactions and answering questions from customers. Because AI can analyse customer data and utilize it to develop targeted ads and relevant content, it can also be used to optimize digital branding for quality standardization to implement through marketing campaigns[37]. AI can also result in time and cost savings for pharmaceutical companies. Processes like tracking customer contacts and answering customer inquiries can be automated by AI, which can eliminate the need for manual labour. Artificial Intelligence (AI) has the potential to enhance pharmaceutical businesses' marketing strategies by analyzing client data and leveraging it to generate relevant content and tailored campaigns[36].

5. AI's challenges in the pharmaceutical Industry:

AI in pharma digital branding with marketing offers many benefits, but it also has drawbacks. Because AI requires specialized hardware and software, its implementation and upkeep can be costly. AI can also be challenging to handle because it needs close oversight and monitoring. Lastly, because AI is fallible and imperfect, it can be challenging to trust. AI also presents moral dilemmas. The analysis of consumer data by AI, including branding, standardizing, labelling, demographics, shopping patterns, and preferences, may give rise to privacy issues. Furthermore, AI can be used to automate tasks like tracking and interactions with various user manufacturer's and seller's feedback. This might lead to ethical issues with autonomy and control.

6. BRAND & Artificial Intelligence (AI)[40]:

6.1. AI possesses great potential to:

a. Boost brand objectives and justify activities that increase brand participation.
b. Preventing notable fluctuations in the market's perception Contribute to personalizing and greatly improving the brand's experience.

6.2. The Instruments or Tool: entropy combining and signal evaluation Enhances earnings, competitive edge, experience, and customer loyalty.

6.3. Utilise product catalogues intelligently: By Offering advanced deep learning arrangements that optimize the pricing, content, and validity of the offers; Technologically modifying the catalogue offerings based on consumer behavior and expertise.

6.4. Improving or enhancing social networks: Create content routing depending on user activity, traffic volume, and other variables by using data optimization.

6.5. Market participation: Several variables can contextualize and enhance the uniqueness of real-time interactions.

6.6. Customer service: anticipating needs and providing "just-in-time" participation with technology and information.

6.7. Cycle of choice: Emphasising customer involvement in brand management. Customer happiness increases brand loyalty, which raises the brand's visibility.

6.8. AI enhances consumer interactions: They are.

i. Creating personalized evaluations.
ii. Voice recognition and emotional intelligence approaches.
iii. Developing a relationship with clients to raise awareness.
iv. Application programming interfaces (APIs) with AI capabilities.

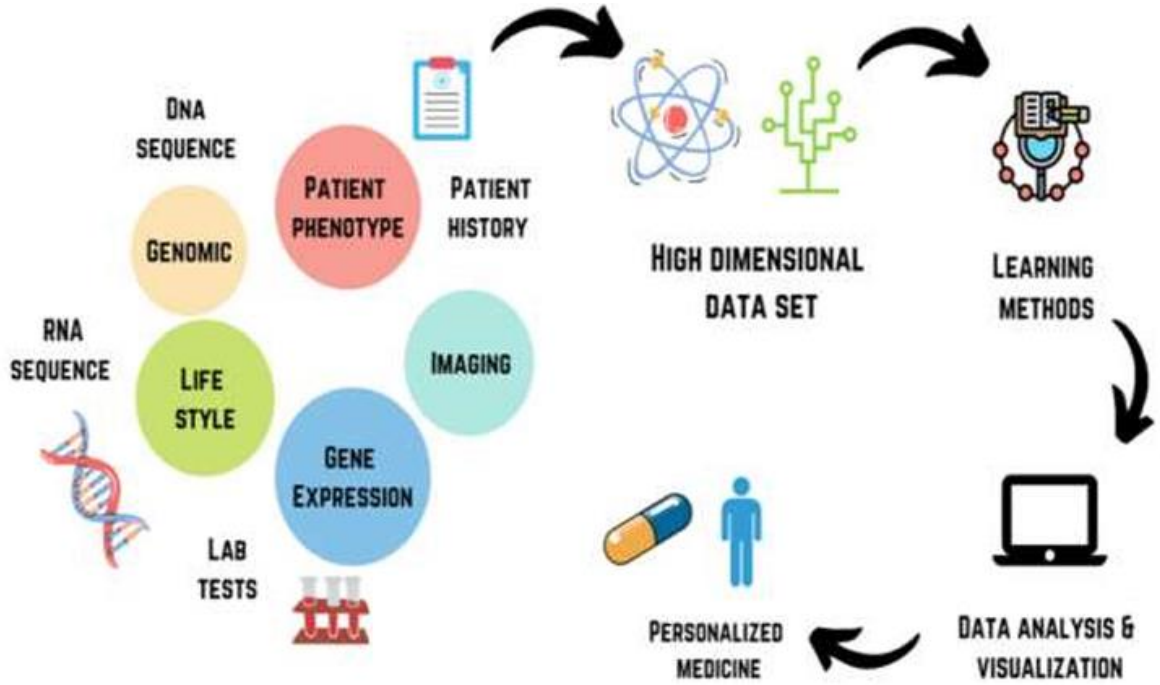
6.9. Using Digital Media to Promote Brands:

a. Knowledge travelled quickly.
b. The influence of social media and oral communication Customer opinions have an impact on reputation.
c. AI is used by brands to better control the experience and buzz.

d. Software for automation makes labor-intensive tasks easier.

7. AI & PATIENTS:

AI has the potential to be a true ally in the patient experience as it advances in the healthcare setting to support patients.



Sources from IJARIIE[40]

8. AI IN HEALTHCARE:

According to venture capital company Rock Health, 206 transactions totaling $2.7 billion for 121 health AI and machine learning companies were completed between 2011 and 2017. A valuation of ten promising AI applications might result in yearly healthcare savings of up to $150 billion in the United States by 2026. Lowering operating costs, safeguarding patient data against fraud, and processing images are all ways to reduce healthcare costs. Workflow assistants powered by AI allow doctors to free up time on their calendars, saving them both money and effort. Pathologists use artificial intelligence (AI) to help them analyze tissue samples so they can make more accurate diagnoses. There are ten possible uses of AI that, in the opinion of Accenture and the Harvard Business Review, might revolutionize the healthcare industry[41].

S.No.	Health Application	Reasons for Adopting
1	Robotic surgery Assisted	Due to developments in technology, robotic surgery options are now more versatile
2	Visual nursing assistants	The medical field is under increasing strain due to a shortage of personnel.
3	Initial Diagnosis	Better precision through interoperability and data architecture
4	Cyber Security	More security breaches and a greater need to safeguard health information
5	Autonomous/Self-governing image diagnosis	More storage space and greater confidence in AI technologies
6	Automated devices	The growth of equipment or devices that are connected
7	Reduced dosage error	Frequently occurring mistakes in healthcare that have actual repercussions
Sources from HBR[41]		

9. AI IN THE PHARMA INDUSTRY:

The anticipated cost of creating a drug over ten years is US$ 2.6 billion. Nine times out of ten proposed medications fail between phase I trials and regulatory approval despite this investment[42]. In the pharmaceutical industry, artificial intelligence is defined as using automated algorithms to perform jobs that would typically require human intelligence, according to a paper written by Codrin Arsene, CEO of Digital Authority Partners. In the last five years, artificial intelligence has completely changed how scientists in the biotech and pharmaceutical industries cure illnesses, develop new drugs, and much more[43]. Machine learning and other technologies are expected to make the hunt for novel pharmaceuticals easier, faster, and more affordable. A HIMSS Analytics 2017 Essentials Brief report states that less than 5% of healthcare organizations now use or invest in AI technologies[44]. Prominent pharmaceutical companies are getting closer to leveraging AI for targeted, strategic uses. Artificial Intelligence (AI) has the potential to help pharmaceutical businesses reduce their operational costs and boost the success of their new drug research[45]. McKinsey estimates that the output of pharmaceuticals and medical products might increase by up to $100 billion annually because of the use of big data, artificial intelligence, and machine learning in clinical trials, decision-making, and innovation[46].

10. AI'S ADAPTATION IN THE PHARMA INDUSTRY:

Despite the high quality of treatment that is now provided, drug development is becoming more challenging. Because of this, overall revenues are typically dropping, and to address this, many businesses are looking for innovative management techniques. Better predictive analytics tools, data-driven decisions, and more automated and efficient processes are needed to boost R&D productivity and create new drugs. Here, the application of AI is covered. However, considering that many medical and pharmaceutical experts lack AI competency, fully embracing AI may prove difficult.

Techniques: A multitude of techniques can be employed to facilitate adoption, such as:

a. Many pharmaceutical companies engage with specialized businesses and startups that concentrate on AI-powered drug discovery, either by working with them or by purchasing them out. It's now feasible to use their knowledge and resources to create promising therapeutic candidates based on existing ideas and experience. Notable collaborations with Bergand firms include those with the pharmaceutical giants AstraZeneca, Roche, and Sanofi Pasteur, to name just a few. Furthermore, Pfizer made headlines when they recently partnered with IBM Watson Health, as did Novartis and Johnson & Johnson. Pfizer also joined IBM's Watson Centre for Drug Discovery.
b. Partnerships between industry and academia are expected to continue growing as pharma starts implementing AI.
c. Establishing in-house knowledge and equipping staff with the required resources
d. Issues with R&D and open scientific initiatives with less financial risk than previous approaches, this is a helpful method of applying AI to medication development.

11. Review of Literature:

11.1. Krishnagiri, et al. (2023)[31]: The objective of this paper was to examine how medication development and patient delivery are being revolutionized by Artificial Intelligence (AI) in the pharmaceutical sector. It demonstrated how AI may expedite medication development, save expenses, and improve patient outcomes by making labor-intensive processes like big data analysis, filtering, and forecasting simpler. The results highlighted AI's potential to expedite drug development procedures, which might result in the production of novel, affordable treatments, and a strong pipeline of future pharmaceuticals. It highlighted AI's potential to reduce costs and, more crucially, save lives by utilizing existing technology to produce medications more quickly and affordably.

11.2. B. Mahabub, Basha, Shaik. (2023)[33]: The study examined how Artificial Intelligence (AI) is affecting marketing by combining qualitative analysis from interviews with fifteen marketing experts from Indian organizations with insights from a literature review. It sought to shed light on pre- and post-AI marketing strategies, ethical issues, and the wider industrial use of artificial intelligence (AI), as well as the effects, advantages, and difficulties of AI integration in marketing. The main conclusions emphasized the variables that affect the integration of AI in marketing, the benefits and challenges that come with it, and the tactical changes in marketing tactics that occur before and after AI adoption. The study emphasized how integrating AI may improve business performance, resulting in increased profitability and a competitive edge.

11.3. Prasad, Patil., et al. (2023)[9]: The study's goal was to investigate artificial intelligence's (AI) potential in the pharmaceutical sector. In addition to outlining difficulties, it sought to investigate how AI may affect medication development, clinical trials, personalized medicine, and drug discovery. The results demonstrated AI's enormous potential

to transform the pharmaceutical industry, especially in terms of advancing medication safety protocols, personalizing therapies, optimizing clinical trial designs, and improving drug discovery. But the study also identified barriers that prevent its broad use, including unclear regulations, worries about data privacy, problems with accessibility, and ethical dilemmas.

11.4. Devendra, Singh, Lodhi, et al. (2022)[8]: The study's objective was to investigate the incorporation of artificial intelligence (AI) in the pharmaceutical industry and evaluate its possible uses in quality control, continuous production, dosage form design, and drug development. According to the study, AI showed a lot of potential, particularly when combined with robotics and genetic algorithms (ANNs). Artificial Intelligence has made drug development processes more efficient, production more streamlined, dosage forms more well-designed, and quality control procedures better. Its application in the medical field, especially in promoting social contact among older patients, has demonstrated advantages over conventional medicinal uses. Even with these developments, the analysis found project implementation barriers that needed to be removed to integrate AI widely into the pharmaceutical sector.

11.5. Konstantin, et al. (2022)[11]: The goal of the study was to thoroughly examine how artificial intelligence (AI) is used throughout the lifetime of pharmaceutical products. It was found that Clinical trials and pre-clinical testing accounted for 34% of the 177 initiatives that were analysed, with innovative small molecule design systems coming in second (33%). Target identification for novel medications was another important aspect, with more than 25% of the systems covering it. Notably, none of the systems offered comprehensive coverage of all lifecycle functions, and many of them (57%) exclusively specialized in one area. The meta-analysis uncovered several AI applications throughout the lifecycles of pharmaceutical products; however, the solutions that were already in place did not fully address every facet, suggesting room for more advancement and integration in this field.

11.6. Sharma, R. et al. (2022)[7]: The authors conducted this research to uncover the ongoing trends, research gaps, and opportunities of AIs in the supply chain management of Pharma companies. It was found that five basic research factors that AI is influencing, designing an effective supply chain helping pick the correct suppliers, managing inventory, predicting the products that will be needed, and making the supply chain more environmentally friendly.

11.7. P. Varsha, et al. (2021)[5]: This study aimed to explore the bibliometric analysis towards understanding the increase in usage of Artificial intelligence and its effect on branding. The study found several factors that were interlinked with AI and branding, namely, social media analytics, neural networks, chatbots, user-generated content, Facebook, Twitter, and Instagram. These findings illustrate the relationship and areas of research focus within the field of AL and branding, it offers valuable insights into the evolving landscape of AI and branding.

***11.8.* Pranav, Desai. (2021)[35]:** The objective of this paper was to examine how growing market competitiveness may have a substantial impact on the creation of effective branding strategies with artificial intelligence (AI) and machine learning (ML). The paper emphasized how these technologies may be used to analyze enormous volumes of data for accurate personalization, boost client happiness, and promote loyalty. It highlighted how AI and ML may be used to give clients more customized experiences that go beyond straightforward product or service purchases. Through behavior analysis and recording, these technologies allow for customized experiences that align with individual preferences. Ultimately, the paper explored how AI and ML may be used to create more successful branding strategies, recognizing that these technologies have the power to transform consumer experiences and promote brand distinctiveness in a crowded market.

11.9. Yishu, Liu., Weixiong, Chen. (2021)[32]: The goal of the study was to evaluate the situation of brand marketing for intelligent technology goods now, considering the difficulties presented by changing market dynamics and artificial intelligence. It aimed to provide methods for maximizing these items' brand marketing to increase their marketability. The results showed a fall in the smart technology brand turnover year-over-year growth rate, indicating a notable slowdown in growth when compared to prior years. This fall shows that there are common problems with the intelligent technology businesses' existing marketing tactics and that these problems require immediate attention to optimise branding strategies for marketing and boost market performance.

11.10. Carolina,et al. (2020)[34]: The paper aimed to explore how Artificial Intelligence (AI) might improve Brand Management, while also analysing the possible hazards involved. The findings identified seven major AI applications: “propensity modelling, automated customer service, intelligent advertisements, recommendation systems, customer segmentation systems, conversion rate optimization systems, and dynamic pricing.” Within the field of brand management, these apps were seen as useful resources for enhancing communication, understanding consumer behaviour, and providing better customer service. The research did note several possible hazards, though, such as the risk of brand identity and image dilution from the use of AI and the moral dilemmas raised by the gathering of customer data. In summary, the study found that AI can significantly change brand management provided it is implemented with a focus on customer benefit and ethical issues.

11.11. B. Peter, V., Henstock. (2019)[6]: The author aimed to evaluate whether it’s time for internal investment in Artificial intelligence in pharma companies. The study states that AIs in pharma companies can change the outlook of medicines as well as enhance the decision-making skills of the pharma companies towards new medicines. AI has reached a level where it works equivalent to human capabilities and is only improving with each passing year. The researcher believes that investing in pharma companies can help tackle major critical problems and challenges in the industry.

11.12. Lalit, Singh., et al. (2019)[10]: The study aimed to investigate how pharmaceutical production and formulation processes may be streamlined with Artificial Intelligence (AI) to achieve optimal product qualities. Artificial intelligence (AI) provides efficiency by optimizing variables and comprehending their influence on desired outcomes, whereas traditional formulation techniques demand substantial resources. The results emphasized AI's function in using Design of Experiment (DoE) and Quality by Design (QbD) approaches to guarantee product quality, reduce variable interactions, and use modeling and simulation tools for production. Combining QbD with AI not only makes it easier to understand goods and procedures but also makes it easier to produce pharmaceuticals that are both affordable and of excellent quality.

12. Objectives of the Study:

a. To analyse the impact of AI on the branding of pharmaceutical products
b. To Give appropriate suggestions to enhance the Use of AI in pharmaceutical products.

13. Research methodology:

13.1. Pilot Study: Pilot study have been done within the campus for adopting these research studies.

13.2. Data collection: *Both* Primary and secondary data.

13.3. Sample size: 200 Top-level managers of Pharma companies.

13.4. Sampling Technique: Non-probability purposive sampling (Top level managers having at least 2 years of experience will be selected)

13.5.. Statistical tool: SPSS 26 have been used in this research analysis.

13. 6. Statistical Technique: Non-parametric One Sample Wilcoxon sign rank Test. The Non-parametric One Sample Wilcoxon Sign Rank Test is a statistical method employed to assess if a sample's median significantly differs from a hypothesized population median.

14. Data Analysis and Interpretation:

14.1. The Demographics Profile Summary: The demographic distribution of the 200 top-level managers in the pharmaceutical business showed the following results. The respondents' ages were as follows: 33 managers (16.5%) were between the ages of 25 and 34; 67 (33.5%) were between the ages of 35 and 44; 77 (38.5%) were between the ages of 45 and 54; and 23 managers (11.5%) were beyond the age of 55. There were 57 female managers (28.5%) and 143 male managers (71.5%) in terms of gender representation. 23 managers (11.5%) had less than five years' experience in the pharmaceutical industry, 45 22.5%) had five to ten years' experience, 53 managers (26.5%) had eleven to fifteen years' experience, 49 (24.5%) had sixteen to twenty years' experience, and 30 (15%) had more than twenty years' experience. Different managers had different educational backgrounds: 14 managers (7%) had other educational credentials, 79 (39.5%) had a bachelor's degree, 88 (44%) had a master's degree, and 19 managers (9.5%) had a PhD or doctorate.

S.No.	Variables	Category	Frequency	Percentage
1	Gender	Male	143	71.5
		Female	57	28.5
2	Age	25 – 34 years	33	16.5
		35 – 44 years	67	33.5
		45 – 54 years	77	38.5
		55 years and above	23	11.5
3	Years of Experience in the Pharmaceutical Industry	Less than 5 years	23	11.5
		5 – 10 years	45	22.5
		11 – 15 years	53	26.5
		16- 20 years	49	24.5
		More than 20 years	30	15.0

4	Educational Background	BSc	79	39.5
		MSc	88	44.0
		PhD/Doctorate	19	19.0
		Other	14	7.00

Table 1. Demographic Profile

14.2. Wilcoxon One-Signed Rank Test: Non - parametric one-sample Wilcoxon signed ranked test is applied to evaluate the Impact of artificial intelligence on the branding of pharmaceutical products. It is seen that p-value < 0.05, Brand image, Brand Engagement, Brand Consistency, Brand Positioning, Brand loyalty, Brand Reputation, Brand perception, Brand Recognition, Brand Trust, and Brand advocacy have high impact of artificial intelligence on the branding of pharmaceutical products.

S.No.	Impact of artificial intelligence on the branding of pharmaceutical products	Null hypothesis	Observed Median	P value	Results
1	Brand image	The median of brand image equals 3	4	0.000	Rejected (High impact)
2	Brand Engagement	The median brand engagement equals 3	4	0.000	Rejected (High impact)
3	Brand Consistency	The median of brand consistency equals 3	4	0.000	Rejected (High impact)
4	Brand Positioning	The median of brand positioning equals 3	4	0.000	Rejected (High impact)
5	Brand loyalty	The median of Brand loyalty equals 3	4	0.000	Rejected (High impact)
6	Brand Reputation	The median of brand reputation equals 3	4	0.000	Rejected (High impact)
7	Brand perception	The median of Brand perception equals 3	4	0.000	Rejected (High impact)
8	Brand Recognition	The median of brand recognition equals 3	4	0.000	Rejected (High impact)
9	Brand Trust	The median of brand trust equals 3	4	0.000	Rejected (High impact)
10	Brand advocacy	The median of Brand advocacy equals 3	4	0.000	Rejected (high impact)

Table 2. Wilcoxon One-Signed Rank Test

14.3. Verification of the Alternative Hypothesis: According to the alternative hypothesis, there is a link (one variable influencing the other) between the two variables under study[50]. An experimental hypothesis forecasts the change(s) that, upon manipulation of the independent variable, will transpire in the dependent variable[49]. The alternative hypothesis H1, also referred to as HA, postulates the existence of a non-random source influencing sample findings. The alternative hypothesis's formulation is crucial since it specifies the kind of test to be conducted[47].

Null Hypothesis: *Hypothesis 1:* The dosage offered under this brand is, on average, 50 mg (population mean dosage = 50 mg). *Hypothesis 2:* The dosage offered under this brand is not typically 50 mg on average (population mean dosage ≠ 50 mg)[51].

S.No.	Alternative Hypothesis	Results
1	The median of brand image does not equal 3	Supported
2	The median brand engagement does not equal 3	Supported
3	The median of brand consistency does not equal 3	Supported
4	The median of brand positioning does not equal 3	Supported
5	The median of Brand loyalty does not equal 3	Supported

6	The median of brand reputation does not equal 3	Supported
7	The median of Brand perception does not equal 3	Supported
8	The median of brand recognition does not equal 3	Supported
9	The median of brand trust does not equal 3	Supported
10	The median of Brand advocacy does not equal 3	Supported

Table 3. Verification of Alternative Hypothesis

15. Recommendations and Suggestions:

1. Analyse vast volumes of data using AI algorithms to gain a comprehensive understanding of consumer behavior, preferences, and market trends. Use this information to your advantage when developing your branding tactics.
2. AI-powered chatbots, dynamic websites, and personalized suggestions are a few tactics for increasing client engagement. More brand loyalty and closer ties result from this.
3. Employ AI-powered analytics to make sure that customer expectations are met, and brand messaging and experiences are consistent across all touchpoints.
4. Improve brand positioning strategies by utilizing AI's predictive power. Determine the holes in the market and seize the chance to effectively break into them.
5. To increase brand trust, use AI to communicate in an honest and ethical manner. Encourage and support advocacy through customer-focused programs supported by AI.
6. Stay up of AI advancements and incorporate them frequently into your branding strategies. Recognise AI's expanding potential to maintain creativity and competitiveness.

Conclusion:

The results of a comprehensive analysis show that there has been a notable change in the pharmaceutical industry regarding the impact of artificial intelligence (AI) on various element of brand management. AI could dramatically enhance several crucial aspects of brand management, such as advocacy, engagement, consistency, positioning, loyalty, reputation, perception, and trust. There appears to be a relationship between pharmaceutical brand strategy management and AI-powered insights. In this setting, AI is crucial in transforming people's perspectives, interactions, and market positioning. The findings underscore the significant and profound influence of AI, demonstrating its potential to augment and potentially revolutionise traditional approaches to brand management. Brands are now able to develop extremely effective, targeted campaigns that shift consumers' impressions of them from static to dynamic, thanks to AI-driven analytics that analyse customer sentiment. Artificial intelligence (AI) powered personalised interactions push the boundaries of brand engagement and build enduring bonds and brand loyalty. Using AI technology is both a strategic advantage and a must for navigating the complex and ever-changing pharmaceutical market. Companies are encouraged to take the lead and use AI as a vital component of creativity, adaptability, and long-term growth into their branding strategy. The ability of pharmaceutical businesses to leverage artificial intelligence (AI) and present a story that seamlessly combines technology and human-cantered values will determine their success in the future. This will assist them in building brands that, in an increasingly competitive market, will endure and forge a deep emotional bond with consumers.

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