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RESEARCH PAPER

SWOT Analysis of Artificial Intelligence: Empirical Evidence from the Pharmaceutical Industry of Pakistan

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ABSTRACT

Article intelligence is the fastest-growing technology globally across all industries. According to the researcher, by the end of 2030, almost 50% of the industry will operate based on artificial intelligence models. This study aims to examine the SWOT analysis of the article Intelligence. A quantitative-based approach was used by SmartPLS to examine this impact. Data was gathered from 300 managerial-level employees of the pharmaceutical industry across Pakistan. This study's results show several strengths, weaknesses, opportunities, and threats to artificial intelligence in the pharmaceutical industry. However, strengths are the highest factors that create a good platform for artificial intelligence to further expand in the pharma industry. While the threats were the least affecting factors for artificial intelligence in the pharma industry of Pakistan.

KEYWORDS Artificial Intelligence, Opportunities, Strength, Threats, Weakness

Introduction

AI stands for artificial intelligence. This word is a combination of two words, artificial and intelligence. Artificial means anything produced or made by human beings rather than occurring naturally (Kamada et al., 2023). In contrast, the word intelligence means the ability of a body or machine to acquire knowledge and skills and be capable of applying that knowledge and skills. In other words, it is also called manmade intelligence. Artificial intelligence is one of the top-growing technologies of today's world (Ulucan-Karnak et al., 2023). Artificial Intelligence (AI) has emerged as a transformative force in the industrial landscape, revolutionizing how businesses operate, make decisions, and drive innovation (Irshad et al., 2021). Its importance in the industry cannot be overstated, as AI technologies continue to reshape processes, enhance efficiency, and unlock unprecedented productivity levels (Munoko et al., 2020). AI is crucial in determining the future of numerous global businesses, including manufacturing, shipping, healthcare, and finance (Pires, 2023). The ability of AI to optimize operations and streamline procedures is one of the most important contributions it has made to the sector. AI algorithms can analyze massive datasets to find patterns, trends, and anomalies that would be difficult for humans to notice (Himeur et al., 2021). This enables businesses to make data-driven decisions, which leads to better resource allocation, less downtime, and more productivity (Rane & Narvel, 2022). Artificial intelligence-powered predictive maintenance systems may foresee equipment problems and plan repairs before they happen in the manufacturing industry, minimizing production delays and saving significant money (Lee et al., 2019).

Additionally, AI has a significant impact on product creation and innovation. Industries are using AI to improve research and development procedures, enabling prototyping, testing, and iteration that is quicker and more precise (Muhammad et al., 2021). Machine learning algorithms can quickly uncover possible innovations by sifting through voluminous scientific literature and data. This is especially clear in pharmaceutical industries, where AI is used to find novel medication molecules and predict their potential efficacy with astounding accuracy, possibly transforming the drug discovery process (S. F. Ahmad et al., 2021). Through the enhancement of human capacities and the creation of new productivity levels, AI-driven automation is also essential in revolutionizing industries. Assigning repetitive and labor-intensive tasks to AI systems is now possible, freeing human workers to concentrate on more complex jobs that call for creativity and critical thinking. AI's impact on improving customer experiences and engagement is further evidence of the importance of technology in the sector (Mudassir et al., 2022). Virtual assistants and AI-driven chatbots are revolutionizing customer service by offering tailored interactions and real-time assistance around the clock (Muhammad et al., 2022). By examining client data and preferences, AI may customize recommendations, offers, and marketing methods, increasing customer happiness and loyalty (Jauhar et al., 2023). AI in retail increases revenue and market competitiveness by enabling more precise demand forecasts, inventory control, and tailored shopping experiences (Haleem et al., 2022). However, the industry's ability to evolve thanks to AI is not without difficulties. Adopting AI necessitates large expenditures in data management, technology infrastructure, and labor upskilling (Pireh et al., 2022).

Additionally, ethical issues surrounding AI, such as algorithmic bias and job displacement, must be adequately considered to ensure that AI's advantages are dispersed fairly across societies (Kim & Heo, 2022). In conclusion, artificial intelligence has an unmistakable impact on the sector, changing established procedures, spurring innovation, and launching companies into uncharted territories of productivity and expansion (Ahmed & Muhammad, 2011). Industries that embrace AI's potential are positioned to gain a competitive edge, open up new opportunities, and pave the way for the Fourth Industrial Revolution as it develops and matures (Kitsios & Kamariotou, 2021). Industries can manage the difficulties of a quickly shifting global market and pave the path for a more affluent and technologically advanced future by leveraging the potential of AI to improve operations, accelerate innovation, and enhance customer experiences (M. A. Khan et al., 2022).

Literature Review

Artificial intelligence (AI) is proof of the fantastic potential of technological development and human inventiveness (Zdravkova, 2022). Thanks to its ability to process enormous amounts of data with unmatched speed and accuracy, it is a robust tool in various industries (Oussous et al., 2018). The healthcare, financial, manufacturing, and entertainment industries have all undergone radical change due to AI's ability to analyze complicated patterns, find hidden relationships, and generate insights (Sayed et al., 2020). AI systems may continuously enhance their performance by learning from experience using machine learning and deep neural networks, ensuring that their power only increases over time. The ability of AI to improve decision-making processes is perhaps its most impressive strength (Mustapha et al., 2021). AI can deliver data-driven recommendations that help professionals make informed decisions by quickly filtering through terabytes of data (Y. Khan et al., 2022). In healthcare, AI assists doctors in diagnosing diseases with greater accuracy, improving patient outcomes. AI-driven algorithms forecast market trends in finance, enabling investors to invest strategically (Fayaz et al., 2017).

The power of AI also extends to scientific research, where it speeds up data analysis and contributes to advances in genetics, particle physics, and climate modeling. The power of AI is also demonstrated by automation and optimization (Richter et al., 2022). Robots and software with AI capabilities may quickly complete repetitive activities that formerly required much human effort, lowering errors and boosting productivity (Haleem et al., 2021). AI-powered robots streamline manufacturing lines, resulting in better products and lower costs. AI-driven self-driving systems improve road safety and efficiency, which helps transportation (Ibrahim et al., 2012).

The development of chatbots and virtual assistants that enhance customer service and accessibility has also been facilitated by AI's aptitude for natural language processing, resulting in more seamless interactions between people and technology (Buhalis & Cheng, 2020). Although AI has many advantages, moral considerations, and appropriate application come first. To avoid biases, uphold privacy, and assure openness, the incredible power of AI must be used wisely (Tlili et al., 2023). The long-term influence of AI on civilization will be determined by finding a balance between technological development and moral stewardship (Yigitcanlar et al., 2021). In conclusion, artificial intelligence's strength resides in its exceptional data processing skills, contribution to informed decision-making, and disruptive effects across numerous industries. AI is still evolving; therefore, wisely utilizing its potential will ensure it becomes a significant force for good (Wang et al., 2023).

Although artificial intelligence (AI) is a tremendous technological advancement, it contains flaws that should be carefully considered (Hwang et al., 2020). Its vulnerability to prejudice and discrimination is a significant drawback. AI systems learn from enormous datasets, which may unintentionally reinforce biases already in the data (Irshad et al., 2022). This may result in unfair hiring, lending, and law enforcement decisions, which will exacerbate rather than lessen societal inequities. A serious flaw is AI's lack of comprehension and common sense thinking (Ozmen Garibay et al., 2023). Although AI can process and analyze data at breakneck speeds, it frequently has trouble understanding context, sarcasm, or subtle human communication (S. F. Ahmad et al., 2022). This constraint limits its capacity to execute challenging tasks that call for contextual understanding, which impairs its effectiveness in realistic situations (Grimmelikhuijsen, 2023). The problem of accountability and transparency emphasizes AI's shortcomings even more. For instance, deep learning models frequently function as "black boxes," challenging to understand the reasoning behind their choices (Abedin, 2022). Users may find it difficult to believe and validate the results produced by AI when using them in critical applications like autonomous automobiles or healthcare diagnosis (Siyal et al., 2021).

Additionally, AI struggles with flexibility and unforeseen circumstances. Since AI models are frequently trained on historical data, they are not well-suited to deal with novel or rapidly changing situations (T. Ahmad et al., 2021). AI's performance can deteriorate when the data deviates from the training set, sometimes resulting in mistakes or incorrect interpretations . The rising automation enabled by AI raises worries about job loss and socioeconomic repercussions (Ni et al., 2023). While AI-driven automation might increase efficiency, it challenges specific job markets, raising the possibility of wider economic inequalities and calling for workforce retraining to stay relevant in an AI-driven society (Nissim & Simon, 2021). The ethical and security issues related to AI adoption are also significant drawbacks (Gul Hasan et al., 2023). AI systems may be vulnerable to attacks from malicious actors, potentially resulting in security and privacy lapses. Robust frameworks and governance procedures are needed to ensure AI is used ethically and responsibly while protecting against abuse (Irshad et al., 2023). In conclusion, the weaknesses of artificial intelligence encompass biases, lack of understanding, transparency

issues, adaptability challenges, socioeconomic impacts, and security concerns. Acknowledging and addressing these weaknesses is essential for harnessing the full potential of AI while minimizing its negative repercussions on society (Zulfiqar & Ahmed, 2022).

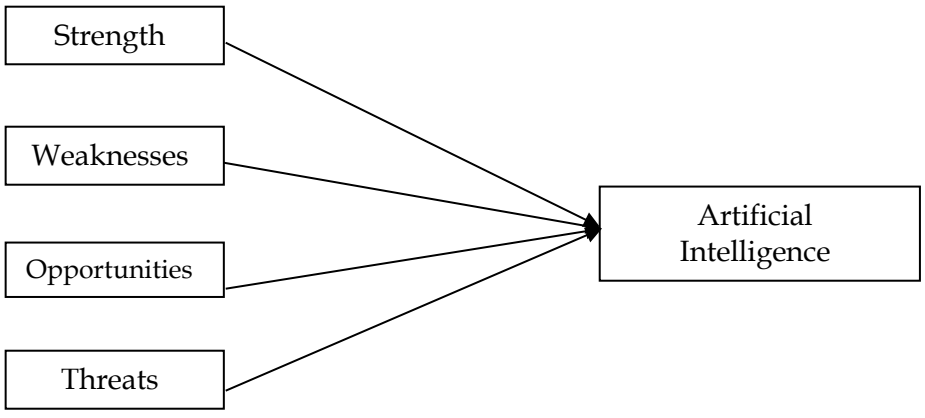
Artificial intelligence (AI) is becoming widely incorporated into several businesses, posing various hazards that need careful consideration. The displacement of human work is one significant danger (S. F. Ahmad, Han, et al., 2023). There is a growing worry that specific employment rolls will become extinct as AI-driven automation gets more sophisticated, which would result in labor displacement and economic turmoil. Manufacturing and customer service are two sectors that rely significantly on regular work and are particularly vulnerable to this danger, which could worsen unemployment and income inequality (Ibrahim et al., 2014). Data security and privacy are a significant concern as well. Many sensitive data are gathered, analyzed, and used extensively with AI. Data breaches, illegal access, and the misuse of personal information are made possible. To defend against these dangers and uphold customer trust, businesses must traverse the complicated world of data protection legislation (S. F. Ahmad, Alam, et al., 2023). Overreliance and complacency may result from the rapid growth of AI. There is a risk of ignoring human oversight and critical thinking as industries depend increasingly on AI for operational operations and decision-making (Bankins, 2021). Blindly implementing AI-generated recommendations could have unforeseen repercussions and missed opportunities without comprehending the underlying reasoning or implications. The ethical issues are also quite important (Liu et al., 2022). AI algorithms incorporating biases from training data may continue discriminating and reinforcing socioeconomic imbalances. Biased AI systems may make unjust decisions in fields like financing and hiring, which could result in structural inequality (Obaid et al., 2022). It is crucial to strike a balance between technological advancement and moral duty to prevent to avoid amplifying existing disparities. Based on the above literature following hypothesis and the conceptual framework have been driven (Awan & Muhammad, 2011).

H_1: The strength of the Pharmaceutical Industry significantly impacts Artificial Intelligence.

H_2: The weaknesses of the Pharmaceutical Industry significantly impact Artificial Intelligence.

H_3: The opportunities of the Pharmaceutical Industry significantly impact Artificial Intelligence.

H_4: The threats of the Pharmaceutical Industry significantly impact Artificial Intelligence.



Materials and Methods

This study holds its philosophical roots in positivism, a pure scientific paradigm that believes in absolute measurable reality. A quantitative approach based on the survey method was adopted to conduct this study. Primary data was gathered from the 300 managerial-level respondents of the pharmaceutical industry across Pakistan by purposive sampling technique. Data was collected via a closed-ended questionnaire composed of two sections. The first section was based on demographic questions, and the second portion was based on the questions on study measures. Five measures were used for the study: strengths, opportunities, weaknesses, threats, and artificial intelligence. All five measures were adopted from different prior reliable studies considering the reliability of the study. The gathered data was analyzed via SmartPLS.

Results and Discussion

Demography of the respondents

The below table of the respondent demography shows 300 respondents, among which the research data was collected. The table shows three sections; the first section shows the gender-wise distribution of the respondents. This section shows that among the 300 respondents, 65% were male, and 35% were female. The second section shows the age-wise distribution of the respondents. This section shows that among the total respondents, 41% of respondents belong to the age group of 20 to 30 years, 43% belong to the age group of 31 to 40 years, 12% belong to 41 to 50 years, while the rest of the 5% belong to the age group of above 50 years. The third and the last section of the table represents the experience-wise distribution of the respondents. This section shows that among the total respondents, 37% belong to those who have experience in the industry of less than one year, 26% belong to those who have experience of 1 to 5 years, 15% belong to those who have experience of 5 to 10 years, while the rest of 15% holds an experience of above ten years.

Table 1
Respondent Demography

Gender	**Frequency**	**Percentage**
Male	195	65.0%
Female	105	35.0%
Total	300	100.0%
Age Group	**Frequency**	**Percentage**
20 to 30 Years	122	41%
31 to 40 Years	128	43%
41 to 50 Years	35	12%
51 and Above Years	15	5%
Total	300	100%
Industry Experience	**Frequency**	**Percentage**
Less than 1 Year	112	37%
1 Year to 5 Years	78	26%
5 to 10 Years	65	22%
More than 10 Years	45	15%
Total	300	100%

Reliability of the Scales

The below table of the reliability shows the reliability statistics of the scales. When using a variance-based approach, there are two types of reliability: item reliability and construct reliability. The measure used for the item's reliability is named outer loadings, and the measure used for the construct reliability is named composite reliability. The threshold value for both measures is 0.7. The below table of reliability shows that all items and construct of the research model have outer loading and composite reliability values greater than the threshold value, indicating that all the items and the construct are reliable to be further analyzed.

Table 2
Reliability of the Scales

Construct	Items	Outer Loadings	Composite Reliability
Strength	ST1	0.768	0.878
	ST2	0.845	
	ST3	0.723	
	ST4	0.776	
Threats	TR1	0.745	0.893
	TR2	0.732	
	TR3	0.845	
	TR4	0.923	
	TR5	0.721	
Weaknesses	WK1	0.771	0.880
	WK2	0.833	
	WK3	0.792	
	WK4	0.775	
	WK5	0.777	
	WK6	0.732	
Opportunities	OP1	0.766	0.889
	OP2	0.743	
	OP3	0.753	
	OP4	0.893	
Artificial Intelligence	AI1	0.733	0.857
	AI2	0.751	
	AI3	0.701	
	AI4	0.799	
	AI5	0.811	
	AI6	0.747	

Convergent validity of the scales

Convergent validity measures how much the items of a construct are related to each other. The measure used for the convergent validity is the Average Variance Extracted (AVE). The threshold value for the AVE is 0.5 or above. The table below shows that all the constructs have AVE values greater than the threshold value, which indicates that all the model constructs are convergently valid.

Table 3
Convergent Validity

Construct	AVE
Strength	0.655

Threats	0.642
Weaknesses	0.589
Opportunities	0.589
Artificial Intelligence	0.565

Discriminant validity of the scales

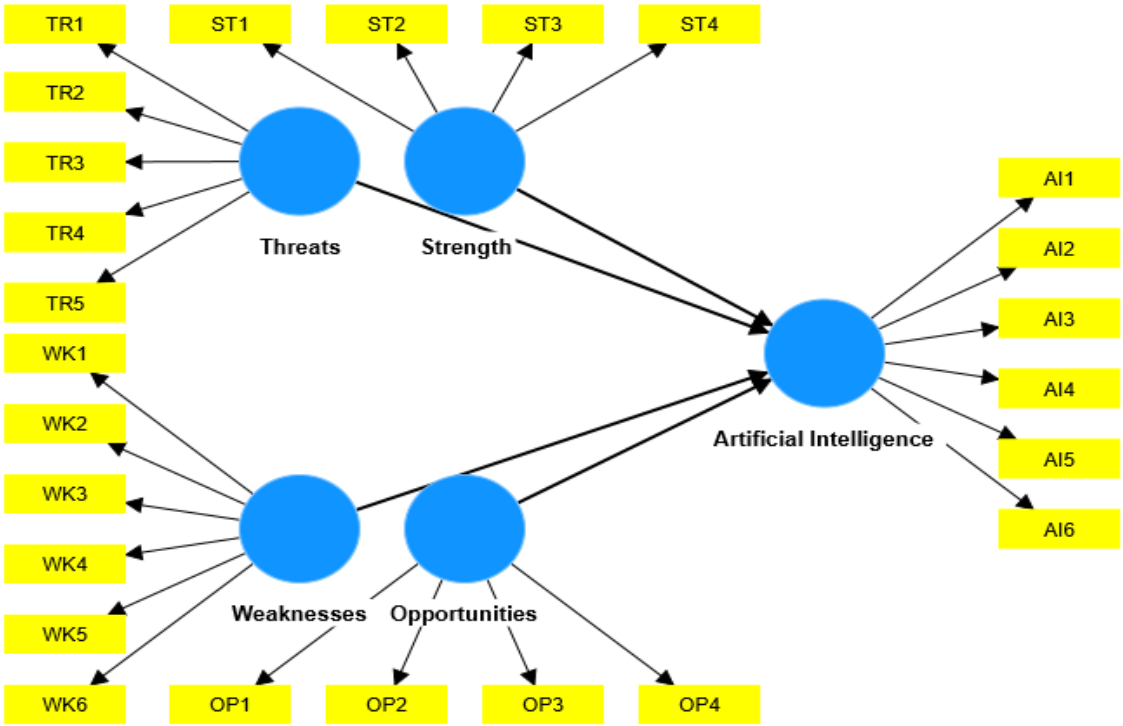
Discriminant validity is the measure that defines how much one construct of a research model theoretically differs from the other construct. The measure used for the discriminant validity is the HTMT values. The threshold value for the HTMT is 0.85 or below. The below table of the HTMT shows that all the variables have HTMT values smaller than the threshold value, indicating that all the constructs are discriminately valid.

Table 4
HTMT Values

	Artificial Intelligence	Opportunities	Strength	Threats
Opportunities	0.406			
Strength	0.21	0.151		
Threats	0.263	0.425	0.231	
Weaknesses	0.494	0.743	0.415	0.476

Structural Model

The figure below shows the research's structural model, explaining the study variables' relationships.



Hypothesis testing and regression analysis

Regression is an old technique used to diagnose one variable's cause-and-effect impact on the other. Two main measures are used for the statistical significance of the

regression-based relationship. The first measure is the t-value, and the second is the p-value. The threshold value for the p-value is 0.05 or less, and the threshold value for the t-value is 1.96 or above. The below table shows that all the hypotheses have the p and t value in significance range as per their threshold, which indicates that the results of this study support all four hypotheses. While the beta value of the table for each relationship explains the strength of that relationship.

Table 5
Hypothesis Testing

Hypothesis	Beta	T statistics	P values	Results
H1: Opportunities -> Artificial Intelligence	0.221	2.448	0.014	Supported
H2: Strength -> Artificial Intelligence	0.243	7.135	0.000	Supported
H3: Threats -> Artificial Intelligence	0.093	6.667	0.000	Supported
H4: Weaknesses -> Artificial Intelligence	0.191	14.755	0.000	Supported

Conclusion

This study examines the strength, weaknesses, opportunities, and threats of artificial intelligence for the pharmaceutical industry. The results of this study also confirm that all four variables are essential for artificial intelligence in the pharmaceutical industry of Pakistan. Upon the basis of the deep analysis, it is concluded that strength is variable with the highest coefficient value of 0.243 while threats have the lowest coefficient value of 0.093. This indicates that artificial intelligence has several strengths for the pharmaceutical industry; however, its threats are minor to be neglected. It is also suggested that the pharmaceutical industry implement the article intelligence system as soon as possible to strengthen the pharma industry.

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