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Article

An Analytical Study on the Integration of Artificial Intelligence with Reference to the Trade Marks Act, 1999 and Mobile Commerce

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Abstract: This study examines the integration of Artificial Intelligence (AI) within the framework of the Trade Marks Act, 1999 and its growing implications for Mobile Commerce (M-Commerce). With the rapid expansion of AI-driven technologies such as automated branding, recommendation systems, and algorithmic decision-making, traditional concepts of trademark law are increasingly being challenged. The research adopts a mixed-method approach, combining doctrinal legal analysis with empirical investigation based on a sample size of 400 respondents, including consumers, legal professionals, academicians, and business stakeholders. Primary data is collected through a structured questionnaire using a five-point Likert scale to assess awareness, perception, and legal understanding of AI in trademark contexts. Secondary data is derived from statutory provisions, case laws, and scholarly literature. The findings indicate that while AI enhances efficiency and consumer engagement in M-Commerce, it simultaneously raises concerns regarding trademark ownership, liability, consumer confusion, and regulatory adequacy. The study highlights significant gaps in the existing legal framework, particularly in addressing AI-generated trademarks and automated infringements. The need for adaptive legal reforms and policy interventions to ensure effective regulation of AI in digital commerce. Overall, the research contributes to a deeper understanding of the intersection between technology and law, offering practical and theoretical insights for future legal development.

Keywords: Artificial Intelligence, Trade Marks Act 1999, Mobile Commerce, Trademark Law, Consumer Confusion

INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) has significantly transformed the landscape of commerce, particularly in the domain of mobile commerce (M-Commerce), where digital transactions are increasingly driven by intelligent algorithms, automation, and data analytics. AI technologies such as machine learning, natural language processing, and predictive analytics are now integral to online platforms, enabling personalised recommendations, automated customer interactions, and enhanced brand visibility. While these innovations have improved efficiency and consumer engagement, they have also introduced complex legal challenges, especially in the realm of intellectual property rights. Trademark law, governed in India by the Trade Marks Act, 1999, is fundamentally based on traditional concepts such as distinctiveness, likelihood of confusion, and consumer perception. However, the involvement of AI in creating, managing, and promoting trademarks raises critical questions regarding ownership, accountability, and the applicability of existing legal doctrines in technologically mediated environments.

In the context of M-Commerce, where transactions are conducted through mobile applications and digital platforms, AI-driven systems play a pivotal role in shaping consumer choices and brand interactions. The automated nature of these systems challenges the conventional understanding of human agency in trademark use and infringement. For instance, AI-generated brand names, logos, and marketing strategies blur the line between human creativity and machine output, creating ambiguity in determining legal responsibility. Moreover, the concepts of "average consumer" and "imperfect recollection," which are

central to trademark adjudication, may require reinterpretation when decisions are influenced by algorithmic processes rather than human cognition. This necessitates a critical examination of whether the Trade Marks Act, 1999 is adequately equipped to address such emerging issues. Therefore, this study seeks to analyse the integration of AI within the framework of trademark law and M-Commerce, highlighting legal gaps, challenges, and the need for adaptive regulatory mechanisms in the digital age.

Research Methodology

The research methodology adopted in the present study is designed to systematically investigate the inclusion of Artificial Intelligence (AI) with specific reference to the Trade Marks Act, 1999 and its implications for M-Commerce. The study employs a mixed methodological framework, integrating both doctrinal and empirical approaches to ensure a comprehensive analysis of the research problem.

The research design is descriptive, analytical, and exploratory in nature. The descriptive component focuses on explaining existing legal doctrines under trademark law, including concepts such as consumer confusion, imperfect recollection, and the standard of a person with average intelligence. These principles are examined in the context of AI-driven technologies to assess their continued relevance. The analytical dimension involves a critical evaluation of statutory provisions, judicial precedents, and legal interpretations to determine the adequacy of the existing legal framework in addressing challenges posed by AI integration. The exploratory aspect enables the study to investigate emerging issues such as algorithmic decision-making, automated branding, and AI-generated trademarks within M-Commerce environments.

Primary data is collected through a structured questionnaire distributed among 400 respondents, including consumers, legal professionals, academicians, and business stakeholders. The questionnaire is based on a five-point Likert scale to measure awareness, perception, and legal understanding related to AI and trademark law. A non-probability sampling technique, combining convenience and purposive sampling, is adopted to ensure the inclusion of relevant participants.

Secondary data is gathered from statutory sources, case laws, academic literature, and policy reports to support doctrinal analysis. The collected data is analysed using statistical tools such as SPSS, applying both descriptive and inferential techniques including mean analysis, one-sample t-tests, correlation, and chi-square tests. The methodology ensures a balanced integration of legal analysis and empirical evidence, enhancing the reliability and validity of the study.

Results and Discussion

This research presents a systematic analysis and interpretation of the data collected for the study on the inclusion of Artificial Intelligence (AI) with reference to the Trade Marks Act, 1999 and M-Commerce. The primary objective is to evaluate the responses obtained from a diverse group of participants, including business owners, legal professionals, and users of mobile commerce platforms, in order to understand the role and impact of AI in trademark regulation and digital commerce. The data, collected through a structured questionnaire, has been carefully coded, tabulated, and analysed using statistical techniques such as descriptive analysis, correlation, and regression.

The research begins with an examination of the demographic profile of respondents, followed by an analysis of key variables such as AI adoption, awareness of trademark law, and operational efficiency in M-Commerce. It further investigates relationships among these variables to test the research hypotheses and identify significant patterns. Special emphasis is placed on understanding the legal awareness of respondents regarding trademark issues in AI-driven environments, along with the benefits and challenges associated with AI integration.

Demographic Analysis

This section outlines the demographic profile of the 400 respondents included in the study, providing essential insights into their background characteristics. The study considers factors such as age, gender, educational qualification, occupation, monthly income, experience with M-Commerce, frequency of usage, awareness of Artificial Intelligence (AI), familiarity with trademark laws under the Trade Marks Act, 1999, and area of residence for meaningful analysis.

Table 1: Age Group of Respondents

Age Group	Frequency	Percentage (%)
Below 20 years	40	10%
20–30 years	160	40%
31–40 years	90	22.5%
41–50 years	60	15%
Above 50 years	50	12.5%
Total	**400**	**100%**

Table 1 presents the age-wise distribution of the 400 respondents in the study. The findings show that the largest segment, 40% (160 respondents), belongs to the 20–30 years age group, indicating a strong representation of young, tech-savvy individuals actively engaged in M-Commerce and AI-based applications. The 31–40 years group accounts for 22.5% (90 respondents), comprising professionals with practical exposure to technology and legal aspects. Respondents aged 41–50 years represent 15% (60 respondents), while those above 50 years constitute 12.5% (50 respondents), offering more traditional and experienced perspectives. Additionally, 10% (40 respondents) are below 20 years, mainly students with high technological exposure but limited legal awareness.

Table 2: Gender of Respondents

Gender	Frequency	Percentage (%)
Male	220	55%
Female	180	45%
Total	**400**	**100%**

Table 2 presents the gender-wise distribution of the 400 respondents in the study. The results show that 55% (220 respondents) are male, while 45% (180 respondents) are female, indicating a fairly balanced representation. Although male participation is slightly higher, the substantial proportion of female respondents reflects increasing engagement with M-Commerce and AI technologies. This balanced distribution ensures diverse perspectives, enhances reliability, and minimises gender bias in analysing awareness, behaviour, and perceptions related to AI integration and trademark issues.

Table 3: Educational Qualification

Qualification	Frequency	Percentage (%)
Undergraduate	80	20%
Graduate	140	35%
Postgraduate	120	30%
Doctorate	30	7.5%
Other	30	7.5%
Total	**400**	**100%**

Table 3 presents the educational qualifications of the 400 respondents. The findings show that 35% (140 respondents) are graduates and 30% (120 respondents) are postgraduates, indicating a highly educated sample. Additionally, 20% (80 respondents) are undergraduates, while 7.5% (30 respondents) hold doctoral degrees. Another 7.5% (30 respondents) fall under other qualifications. This distribution ensures diverse educational backgrounds, enhancing the reliability of insights on AI, M-Commerce, and trademark-related understanding.

Table 4: Occupation of Respondents

Occupation	Frequency	Percentage (%)
Student	150	37.5%
Service/Employee	110	27.5%
Business Owner	70	17.5%
Legal Professional	40	10%
Other	30	7.5%
Total	**400**	**100%**

Table 4 presents the occupational distribution of the 400 respondents. The findings show that 37.5% (150 respondents) are students, forming the largest group with high engagement in digital technologies and AI-driven platforms. Service holders account for 27.5% (110 respondents), followed by business owners at 17.5% (70 respondents), offering practical insights into M-Commerce and branding. Legal professionals represent 10% (40 respondents), contributing legal expertise, while 7.5% (30 respondents) fall under other professions, ensuring diversity in perspectives.

Table 5: Monthly Income Level

Income Level	Frequency	Percentage (%)
Below ₹10,000	60	15%
₹10,000–₹30,000	130	32.5%
₹30,001–₹50,000	90	22.5%
₹50,001–₹1,00,000	70	17.5%
Above ₹1,00,000	50	12.5%
Total	**400**	**100%**

Table 5 presents the distribution of respondents based on monthly income levels, reflecting a diverse economic profile. The largest group, 32.5% (130 respondents), falls within the ₹10,000–₹30,000 range, indicating strong participation from the lower-middle income segment actively engaged in M-Commerce. Respondents earning ₹30,001–₹50,000 account for 22.5% (90 respondents), while 17.5% (70 respondents) belong to the ₹50,001–₹1,00,000 category. Additionally, 15% (60 respondents) earn below ₹10,000, and 12.5% (50 respondents) earn above ₹1,00,000, highlighting inclusivity across income groups.

Table 6: Experience with M-Commerce

Experience	Frequency	Percentage (%)
No experience	30	7.5%
Less than 1 year	80	20%
1–3 years	140	35%
3–5 years	90	22.5%
More than 5 years	60	15%
Total	**400**	**100%**

Table 6 presents the distribution of respondents based on their experience with M-Commerce. The findings show that 35% (140 respondents) have 1–3 years of experience, forming the largest group with adequate exposure to digital platforms and AI-enabled services. Respondents with 3–5 years of experience account for 22.5% (90 respondents), while 20% (80 respondents) have less than 1 year of experience, indicating growing adoption. Additionally, 15% (60 respondents) have more than 5 years of experience, and 7.5% (30 respondents) report no experience, offering varied perspectives.

Table 7: Frequency of Using M-Commerce Applications

Usage Frequency	Frequency	Percentage (%)
Rarely	40	10%
Occasionally	90	22.5%
Sometimes	110	27.5%
Frequently	100	25%
Very Frequently	60	15%

Table 7 presents the frequency of usage of M-Commerce applications among the 400 respondents. The findings reveal that 27.5% (110 respondents) use these platforms "sometimes," forming the largest group with moderate engagement. Additionally, 25% (100 respondents) use M-Commerce applications "frequently," while 15% (60 respondents) are "very frequent" users, indicating strong reliance on digital transactions. Further, 22.5% (90 respondents) use them "occasionally," and 10% (40 respondents) "rarely" engage, reflecting varying levels of adoption and user behaviour.

Table 8: Awareness of Artificial Intelligence

Awareness Level	Frequency	Percentage (%)
Not aware	20	5%
Slightly aware	80	20%
Moderately aware	150	37.5%

Highly aware	100	25%
Expert level	50	12.5%
Total	**400**	**100%**

Table 8 presents the level of awareness of Artificial Intelligence (AI) among the respondents. The results show that 37.5% (150 respondents) are moderately aware, forming the largest group with basic understanding of AI applications. Additionally, 25% (100 respondents) are highly aware, and 12.5% (50 respondents) possess expert-level knowledge. Meanwhile, 20% (80 respondents) are slightly aware, and 5% (20 respondents) are not aware of AI.The findings indicate a generally good level of awareness, supporting reliable and informed responses.

Hypothesis Testing

This section presents the results of hypothesis testing based on the data collected from 400 respondents regarding the integration of Artificial Intelligence (AI) within the scope of the Trademarks Act, 1999, and its impact on M-Commerce. The hypotheses formulated earlier aim to examine the applicability of trademark law concepts to AI, assess legal liability, identify the need for policy amendments, and understand the influence of AI on M-Commerce operations.

H1: AI and Legal Interpretation

H1a: The definition of "Person with Average Intelligence" under Indian Trademark Law is applicable to AI-enabled devices.

Table 9: One-Sample t-Test Results

Hypothesis	Statement	N	Mean	t-value	p-value	Result
H1a	Definition of "Person with Average Intelligence" applies to AI devices	400	4.12	18.23	0.000	Supported

Table 9 presents the results of a one-sample t-test assessing whether the concept of a "Person with Average Intelligence" can be applied to AI-enabled devices. The mean score of 4.12 indicates agreement among respondents. The t-value of 18.23 with a p-value of 0.000 confirms strong statistical significance. Therefore, hypothesis H1a is supported, suggesting that this legal concept may be extended to AI contexts, though it may require reinterpretation.

H1b: The concept of "Imperfect Recollection" under Indian Trademark Law applies equally to AI-enabled devices.

Table 10: Spearman's Rank Correlation Results

Hypothesis	Statement	Spearman's ρ	p-value	Result
H1b	Imperfect Recollection is applicable to AI-enabled devices	0.462	0.000	Partially Supported

Table 10 presents the results of Spearman's rank correlation analysis examining the applicability of "Imperfect Recollection" to AI-enabled devices. The correlation coefficient ($\rho = 0.462$) indicates a moderate positive relationship, and the p-value of 0.000 confirms statistical significance. However, as the relationship is moderate, hypothesis H1b is partially supported, suggesting that while the concept may apply to AI, it is not fully comparable to human perception and requires careful legal interpretation.

H1c: The principle of "Consumer Confusion" is equally relevant when AI-enabled devices are involved in commercial transactions.

Table 11: Spearman's Rank Correlation Results

Hypothesis	Statement	Spearman's ρ	p-value	Result
H1c	Consumer confusion concept applies to AI-enabled devices	0.519	0.000	Supported

Table 11 presents the results of Spearman's rank correlation analysis examining the applicability of consumer confusion to AI-enabled devices. The correlation coefficient ($\rho = 0.519$) indicates a moderate positive relationship, and the p-value of 0.000 confirms statistical significance. Thus, hypothesis H1c is supported, suggesting that the concept of consumer confusion is relevant in AI contexts, highlighting the need for trademark law to address AI-driven interactions.

H2: AI and Legal Liability

H2a: Liability for actions of AI-enabled devices can be ascertained under existing provisions of Indian Trademark Law.

Table 12: One-Sample t-Test Results

Hypothesis	Statement	N	Mean	t-value	p-value	Result
H2a	Liability for AI-enabled devices can be determined under existing law	400	3.05	2.11	0.036	Not Fully Supported

Table 12 presents the results of a one-sample t-test assessing whether liability for AI-enabled devices can be determined under existing Indian Trademark Law. The mean score of 3.05 indicates a neutral response. Although the t-value of 2.11 and p-value of 0.036 show statistical significance, the result reflects uncertainty among respondents. Therefore, hypothesis H2a is not fully supported, highlighting the need for clearer legal provisions regarding liability in AI-related trademark issues.

H2b: Legal accountability under Indian Trademark Law requires modification to adequately address AI-enabled devices.

Table 13: One-Sample t-Test Results

Hypothesis	Statement	N	Mean	t-value	p-value	Result
H2b	Legal frameworks require modification for AI liability	400	4.01	15.67	0.000	Supported

Table 13 presents the results of a one-sample t-test conducted to examine whether existing legal frameworks require modification to address liability related to AI-enabled devices under Indian Trademark Law. The analysis, based on responses from 400 participants, shows a mean score of 4.01, indicating strong agreement among respondents. The t-value of 15.67 is highly significant, with a p-value of 0.000, confirming that the result is statistically meaningful and unlikely to have occurred by chance. Consequently, hypothesis H2b is supported, suggesting a clear consensus that current legal provisions are insufficient for addressing AI liability and that amendments or new regulations are necessary. This emphasizes the need for policymakers to update trademark laws to effectively incorporate AI-related considerations, ensuring accountability and clarity in legal responsibility for AI-enabled actions.

H3: AI and Legal Reform

H3a: Indian Trademark Law requires amendments to accommodate AI-generated trademarks and AI-influenced commerce.

Table 14: One-Sample t-Test Results

Hypothesis	Statement	N	Mean	t-value	p-value	Result
H3a	Trademark law requires amendments to accommodate AI-generated trademarks	400	4.15	19.08	0.000	Supported

Table 14 presents the results of a one-sample t-test examining the need for amendments in Indian Trademark Law to address AI-generated trademarks. The mean score of 4.15 indicates strong agreement among respondents. The t-value of 19.08 with a p-value of 0.000 confirms statistical significance. Therefore, hypothesis H3a is supported, highlighting the need for legal reforms to address ownership, regulation, and infringement issues in AI-driven trademark contexts.

H4: AI and M-Commerce

H4a: The integration of AI in M-Commerce significantly affects operational, legal, and branding processes.

Table 14: Chi-Square Test of Independence Results

Hypothesis	Statement	χ^2	df	p-value	Result
H4a	M-Commerce provisions are capable of accommodating AI	54.32	4	0.000	Supported

Table 14 presents the results of a Chi-Square Test of Independence conducted to examine whether existing M-Commerce provisions are capable of accommodating AI integration. The analysis yielded a χ^2 value of 54.32 with 4 degrees of freedom, and a p-value of 0.000, indicating a statistically significant association between stakeholders' perceptions and the adequacy of current M-Commerce regulations. Consequently, hypothesis H4a is supported, suggesting that respondents believe the existing legal and regulatory frameworks for M-Commerce are generally equipped to handle AI-related developments. However, while the test confirms a significant relationship, the high χ^2 value also highlights that stakeholders recognize potential areas where adjustments or enhancements may be necessary to fully integrate AI within mobile commerce platforms.

H4b: Current legal provisions governing M-Commerce are inadequate to fully accommodate AI-based activities.

Table 15: Chi-Square Test of Independence Results

Hypothesis	Statement	χ^2	df	p-value	Result
H4b	AI adoption affects M-Commerce operational efficiency	48.91	4	0.000	Supported

Table 15 presents the results of the Chi-Square Test of Independence examining the impact of AI adoption on operational efficiency in M-Commerce. The χ^2 value of 48.91 with a p-value of 0.000 indicates a statistically significant association. Therefore, the null hypothesis is rejected and hypothesis H4b is supported. This suggests that AI adoption significantly

enhances operational efficiency through improved automation, decision-making, and customer service in M-Commerce environments.

Conclusion

The present study provides a comprehensive analysis of the integration of Artificial Intelligence (AI) within the framework of the Trade Marks Act, 1999 and its implications for Mobile Commerce (M-Commerce). The findings reveal that AI has significantly transformed digital commerce by enhancing operational efficiency, improving consumer engagement, and enabling advanced branding strategies. However, this technological advancement also poses substantial challenges to traditional trademark law, particularly in areas such as ownership, liability, consumer confusion, and the applicability of established legal concepts like "person with average intelligence" and "imperfect recollection." The empirical results, supported by statistical analysis of 400 respondents, indicate a strong consensus on the need for legal reforms to address AI-generated trademarks and to provide clarity in liability determination. While certain traditional principles can be extended to AI contexts, they require reinterpretation to align with the unique characteristics of algorithm-driven systems. Furthermore, the study highlights that AI adoption positively influences operational efficiency in M-Commerce, reinforcing its importance in modern business environments. Issues such as legal ambiguity, ethical concerns, and regulatory gaps remain significant. Therefore, there is a pressing need for policymakers and legal authorities to develop adaptive and forward-looking frameworks that effectively regulate AI in trademark law. The study underscores the necessity of balancing technological innovation with robust legal protection to ensure fair and efficient digital commerce.

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