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Predictive Analytics in Digital Marketing

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Abstract: The rapid growth of digital marketing is possible only through frictionless payment system like digital transaction, QR etc., Both primary and secondary data was collected for this study, the primary data was collected by using structured questionnaire to understand the digital marketing strategies, sales, challenges and opportunities of the digital marketing. In Predictive analytics customer perception was predicted by mobile usage, trust, email response and digital interaction. Digital marketing clearly shows the customer empowerment. Statical tools like Neural Network (NN) and Tree analysis was used to evaluate the collected date. Via these statistical tools two factors are contribute highly they are "often usage of smartphone to look for products or services" and "aware of promotional emails from brands". It emphasis that Google Analytics, CRM, etc these predictive analytic tools should have a clear idea about the mobile usage pattern and the promotional strategy in a frequent interval to enhance the purchasing decision.

Key Word: CRM, Promotional strategy, Digital marketing, Purchasing decision.

1. Introduction:

New emerge trend in marketing is digital marketing through this customer feels that the whole world is in the packet if the customer. Jio, Digital India and Starlink these are the three pillars which leads to popularize the digital marketing in India. Jio create an effective platform in digital marketing at 2016 itself by giving free internet facility. In 2015 Digital India concept was forced by the government towards Aadhar, DigiLocker and UPI usage. Jio and Airtel place a vital role in implementing the Digital India concept. Later in 2026, with the help of Starlink the high-speed internet was possible in India.

Marketing means buying and selling, both this business activity was supported by digital marketing through numerous social medias (like YouTube, Instagram, Facebook etc.,) and the various payment gateways (like Phone Pe, Paytm etc.,), and Payment App (like QR Codes, Google pay, etc.,). Digital marketing exemplified the view of Mahatma Ganthigi "The Customer is King". Customer will get high rage of choices while selecting the product. It is possible to the customer to compare the product based on price, quality, and the supplier while taking a purchase decision. It is possible only in digital marketing. So that customer can get any product form any where even from outside of India.

There are lot of digital marketing tools to reach the customer, in that mobile and email marketing was popular in our India. In India 72% of the population is using the mobile phones. So, the impact of the digital marketing was high because of mobiles. Mobiles are supportive in the mode of notification, recommendation, promotional emails, latest offers etc., Which will induce the customer to buy the product. Factors like Past experience, trust, content relevance also considers while taking buying decision. Digital marketing is attempted to forecast the customer behaviour by their search engine (to know their interested area), product they add in the wise list, product they already bought etc., Via that the predict analysis mobile marketing was conducted and the mobile will notify the customer and encourage to buy the product.

2. Review of Literature:

Kaur (2024) highlighted that digital marketing significantly influences consumer decision-making, brand loyalty, trust, and purchase intentions. The study synthesised literature showing how various digital channels affect modern consumer behaviour patterns, especially in online contexts.

Kalra et al. (2023) examined how internet and social media marketing affect consumer purchase behaviour. The review showed that younger demographics (e.g., Millennials, Gen Z) are more influenced by digital marketing strategies than older consumers.

Mukhtar et al. (2023) reviewed literature on consumer behaviour and loyalty within digital marketing strategies. The authors emphasised how digital platforms such as social media, email marketing, and search engines play a key role in enhancing consumer satisfaction and repeat engagement.

Basimakopoulou et al. (2022) provided a comprehensive review of digital marketing evolution and conceptual frameworks, discussing how digital transformation redefines value creation for businesses and outlining future research directions, including mobile and data-driven marketing strategies.

Ziakis and Vlachopoulou (2023) reviewed how artificial intelligence (AI) influences digital marketing practices — from segmentation to personalisation and automated targeting — highlighting how AI reshapes strategy and efficiency in digital campaigns.

3. Research Methodology:

Descriptive research was adopted in this study, which helps to understand the demographic information and Consumer preference in digital marketing. Also to understand the huge development of digital marketing and the positive response of the customer. This study aims to determine the factor which influence a lot in predictive analytics in digital marketing.

Descriptive and analytical research design is used in this study, moreover this design was helpful to understand the relationship between mobile and email marketing and how it influences the probability of purchase.

Structure questioner was used to collect the primary date. Convenience sampling was used and 100 sample was collected for this study. Secondary date also used for this research. Tree structured analysis and Neural Network (NN) tool was used in this study.

4. Objective:

- To find out how predictive analytics can boost the efficiency of digital marketing strategies.
- To know how predictive analytics contributes to better sales outcomes and higher customer conversion rates.
- To pinpoint major challenges and opportunities in applying predictive analytics for data-driven marketing choices.

5. Analytical Tools and Interpretation:

TREE STRUCTURED ANALYSIS FOR PREDICTIVE ANALYTICS IN DIGITAL MARKETING

Tree analysis model summary, gain node summary and Risk of the model are presented in the below table. Tree Diagram for Predictive Analytics in Digital Marketing is shown in the below figure 1

Table – 1

Model summary of Predictive Analytics in Digital Marketing

Model Summary		
Specifications	Growing Method	CHAID
	Dependent Variable	Overall, how probable is it that you will buy something as a result of interactions with mobile and email marketing
	Independent Variables	Often usage of smartphone to look for products or services, Frequency of explore items through mobile applications or websites, Go through the marketing emails that align with my interests, Aware of promotional emails from brands., Checking the links included in marketing emails., Mobile notifications affect my interest in products or special offers, Consider the products after encountering them in emails or mobile advertisements, Believe in marketing messages that are relevant to needs, Customized offers enhance and chance of making a purchase decision, Trust the suggestions provided via mobile or email marketing, Previous experience shape the offers which is available in the website, Favourably to marketing messages delivered at the right time, Mobile and email marketing help me save time when choosing products, Digital interactions influence ultimate buying choices, Engagement through mobile and email assists brands in grasping the preferences.
	Validation	None
	Maximum Tree Depth	3
	Minimum Cases in Parent Node	100
	Minimum Cases in Child Node	50
Results	Independent Variables Included	Often usage of smartphone to look for products or services.
	Number of Nodes	3
	Number of Terminal Nodes	2
	Depth	1

Source: Output generated from SPSS 20

Table – 2

Risk of the model for Predictive Analytics in Digital Marketing

Risk	
Estimate	**Std. Error**
.600	**.049**
Growing Method: CHAID **Dependent Variable: Overall, how probable is it that you will buy something as a result of interactions with mobile and email marketing**	

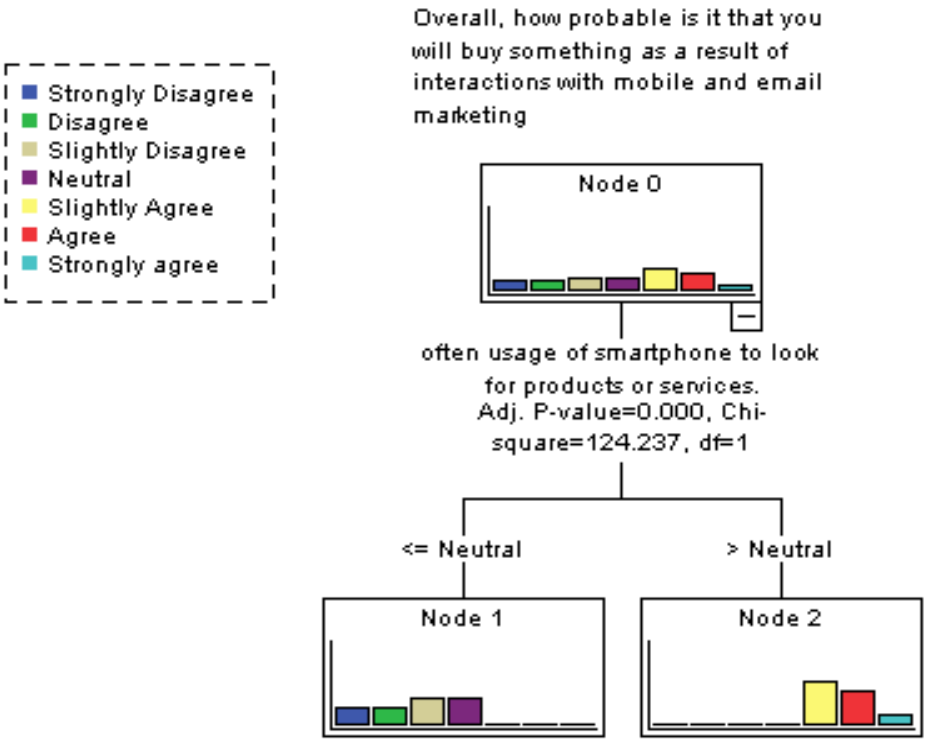
Source: Output generated from SPSS 20

Table – 3
Gain summary for nodes Predictive Analytics in Digital Marketing

Gains for Nodes												
	Node-by-Node						Cumulative					
	Node		Gain				Node		Gain			
Node	N	Percent	N	Percent	Response	Index	N	Percent	N	Percent	Response	Index
2	50	50.0%	5	100.0%	10.0%	200.0%	50	50.0%	5	100.0%	10.0%	200.0%
1	50	50.0%	0	0.0%	0.0%	0.0%	100	100.0 %	5	100.0%	5.0%	100.0%
Growing Method: CHAID Dependent Variable: Overall, how probable is it that you will buy something as a result of interactions with mobile and email marketing												

Source: Output generated from SPSS 20

Figure – 1
Tree Diagram for Predictive Analytics in Digital Marketing

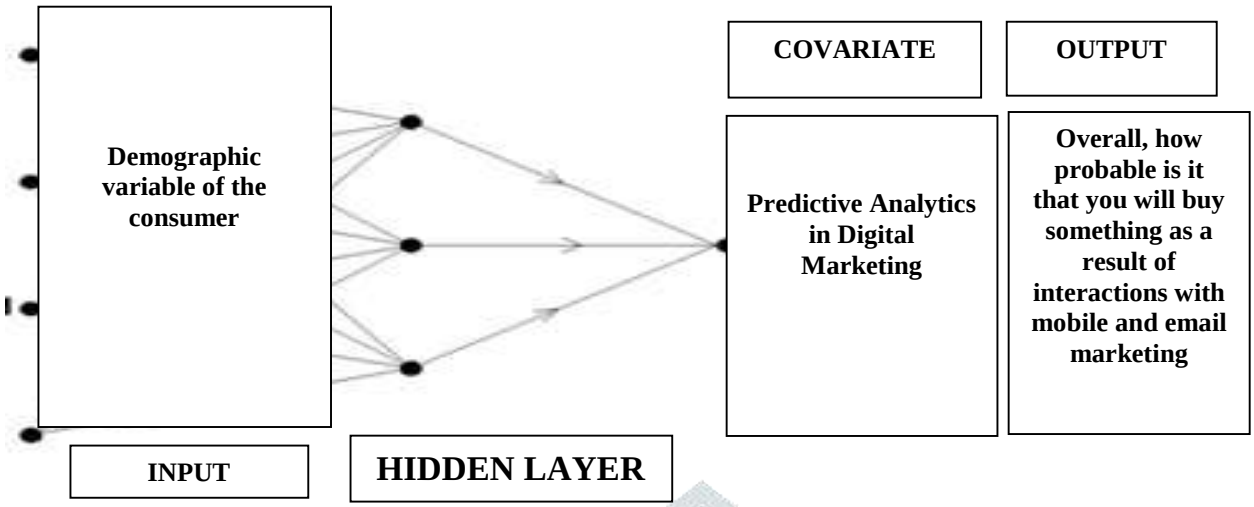


From tree analysis model summary, it is clear that the "Often usage of smartphone to look for products or services" is the important independent variable. This variable is contributing more towards predictive analytics in digital marketing. So, the marketer should increase the visibility, user friendly software and offer location-based information has to be given to enhance the customer satisfaction.

ANALYSIS OF OVERALL SATISFACTION TOWARDS PREDICTIVE ANALYTICS IN DIGITAL MARKETING BY USING THE NEURAL NETWORK (NN) METHOD

The Neural Network architecture, used in this study, is a multilayer feed forward network using SPSS 20. The architecture, which provides the best fit for the data is the network with three hidden layers and an output layer. The learning and momentum parameters are 0.6 and 0.9 respectively and error convergence falls below 0.01 Percent. Tan sigmoid is the activation function chosen for the hidden layers, and the pure linear function is used to get the output layer, which is the real time value. The architecture, which provides the best fit for the data is the network with six input layers, fifteen covariate variables and one hidden layers and one output layer, as shown in figure 2

Figure – 2
Basic Neuron Model for overall satisfaction of the customers towards Predictive Analytics in Digital Marketing



The neural network model stems from the studies on the working of human brain systems, and serves as an associative memory between the input and output patterns. These models contain many densely interconnected elements called Neurons or Nodes. The neuron has a set of "n" inputs "x"j, where the subscript "j" takes a value from 1 to "n" and indicates the source of the input signal. Each input "x"j is weighted before reaching the main body of the processing elements, by the connection strength or weight factor "wj". (Multiplied by"wj"). In addition, it has a bias term "w"0, a threshold value that has to be reached or exceeded for the neuron to produce a signal, a non-linearity function F that acts on the produced signal (or activation) R, and an output O. The non-linearity function used in this network is the sigmoid. The sigmoid is very popular because it is monotonic, is bounded, and has a derivative: f"'(s) = kf (s) [1-f(s)]. The model used in this work is the Feed Forward Multilayer perception, using the Back Propagation Algorithm. Where (4-3-1)

6-Input layers

15-Covariates layers

1-Hidden layers

1-Output layer

All inputs are analyzed in the experimental validation part, with appropriate output results by the illustration of graphs so that the influences of the parameters of tensile strength are taken into consideration. The network information is presented in the table. The validation of the estimated NN and Experimental value illustrations is shown in Figure.

Table - 5
Model Summary for Neural Network Model Predictive Analytics in Digital Marketing

Model Summary		
Training	Cross Entropy Error	8.363
	Percent Incorrect Predictions	4.1%
	Stopping Rule Used	1 consecutive step(s) with no decrease in error[a]
	Training Time	0:00:00.03
Testing	Cross Entropy Error	6.527
	Percent Incorrect Predictions	11.1%
Dependent Variable: Overall, how probable is it that you will buy something as a result of interactions with mobile and email marketing		
a. Error computations are based on the testing sample.		

Source: Output generated from SPSS 20

Table – 6
Neural Network Model for overall satisfaction of the customers towards Predictive Analytics in Digital Marketing

Network Information			
Input Layer	Factors	1	Age
		2	Gender
		3	Education Level
		4	Occupation
		5	Frequency of Online purchasing
		6	Familiarity in digital tools
	Covariates	1	Often usage of smartphone to look for products or services.
		2	Frequency of explore items through mobile applications or websites.
		3	Go through the marketing emails that align with my interests.
		4	Aware of promotional emails from brands.
		5	Checking the links included in marketing emails.
		6	Mobile notifications affect my interest in products or special offers.
		7	Consider the products after encountering them in emails or mobile advertisements.
		8	Believe in marketing messages that are relevant to needs.
		9	Customized offers enhance and chance of making a purchase decision.
		10	Trust the suggestions provided via mobile or email marketing.
		11	Previous experience shape the offers which is available in the website.
		12	Favourably to marketing messages delivered at the right time.
		13	Mobile and email marketing help me save time when choosing products.
		14	Digital interactions influence ultimate buying choices.
		15	Engagement through mobile and email assists brands in grasping the preferences.
	Number of Units[a]		37
	Rescaling Method for Covariates		Standardized
Hidden Layer(s)	Number of Hidden Layers		1
	Number of Units in Hidden Layer 1[a]		6
	Activation Function		Hyperbolic tangent
Output Layer	Dependent Variables	1	Overall, how probable is it that you will buy something as a result of interactions with mobile and email marketing
	Number of Units		7
	Activation Function		Softmax
	Error Function		Cross-entropy

a. Excluding the bias unit

Source: Output generated form SPSS 20.

The factors of predictive analytics in digital marketing model parameters are modeled by using the Neural Network Method. The parameters are optimized so as to determine the set of parameters, which will influence the increase in the overall satisfaction towards predictive analytics in digital marketing, Neural Networks Architecture and network information.

Table – 7
Independent Variable importance for Neural Network Model for the overall satisfaction of the customers towards Predictive Analytics in Digital Marketing

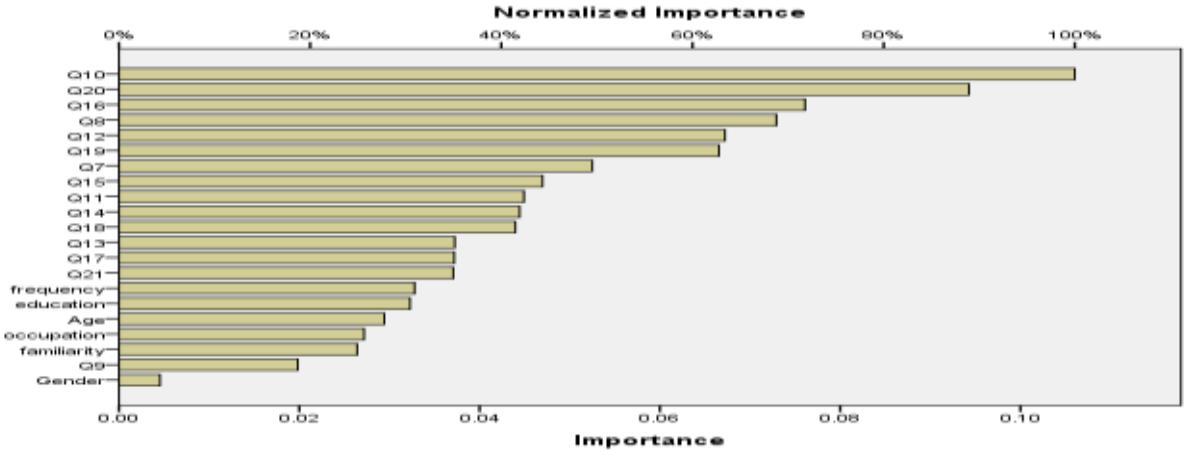
Independent Variable Importance	Importance	Normalized Importance
Age	.029	27.8%
Gender	.005	4.3%
Education Level	.032	30.4%
Occupation	.027	25.6%
Frequency of Online purchasing	.033	30.9%
Familiarity in digital tools	.026	24.9%
often usage of smartphone to look for products or services.	.052	49.5%
Frequency of explore items through mobile applications or websites.	.073	68.8%
Go through the marketing emails that align with my interests.	.020	18.7%
Aware of promotional emails from brands.	.106	100.0%
Checking the links included in marketing emails.	.045	42.4%
Mobile notifications affect my interest in products or special offers.	.067	63.4%
Consider the products after encountering them in emails or mobile advertisements.	.037	35.1%

Believe in marketing messages that are relevant to needs.	.044	41.9%
Customized offers enhance and chance of making a purchase decision.	.047	44.3%
Trust the suggestions provided via mobile or email marketing.	.076	71.8%
Previous experience shape the offers which is available in the website.	.037	35.1%
Favourably to marketing messages delivered at the right time.	.044	41.5%
Mobile and email marketing help me save time when choosing products.	.067	62.8%
Digital interactions influence ultimate buying choices.	.094	88.9%
Engagement through mobile and email assists brands in grasping the preferences.	.037	35.0%

Source: Output generated from SPSS 20

Figure – 3

Normalized importance for overall satisfaction of the customers towards Predictive Analytics in Digital Marketing



The table and diagram show the predictive analytics in digital marketing. The particular media viz., "Aware of promotional emails from brands" contributes more towards the output of overall satisfaction of the customers towards predictive analytics in digital marketing. Therefore, the marketer should aware the timing and values of the customer while sending the message. Ensure the friendly type of E-mails and should avoid excessive messages which will improve the predictive analytics effectiveness of digital marketing.

6. Findings:

- Education level and frequency of online purchase is the highly contributed factor in demographic factor.
- "Often usage of smartphone to look for products or services" is the highly contributed factor according to Tree analysis.
- Among all the factor "Aware of promotional emails from brands" is highly influence factor according to NN Analysis.
- Additional key factors that influenced this included digital engagement, confidence in mobile or email recommendations, mobile alerts, and the time-saving advantages of digital marketing.

7. Suggestion:

- Predicting analysis deals with the customers personal data and information; therefore, predictor must have a social responsibility while using such dates.
- The marketing information must have reliability, accuracy and transparency.
- Customer should not feel annoyed it may lead to negative impact.
- Predicting analysis should have an accuracy which is result in customer preference and buying behaviour.
- Trust was built up by the positive customer experience, digital marking has the responsibility in creating the trust among the customer.

8. Conclusion:

The study indicates that predict analytics in digital marketing helps to understand the customer behaviour and purchasing pattern. Predictive analytics enables marketers to send timely, relevant, and personalized communications, leading to increased customer satisfaction and higher conversion rates. Nonetheless, marketers should prioritize the ethical usage of customer data, maintain transparency, and refrain from overwhelming customers with excessive messages to uphold trust. In summary, predictive analytics boosts the strategic efficiency of digital marketing and facilitates data-driven decision-making in a fast-changing digital landscape.

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