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Analytical Hierarchy Process for Ranking E-Commerce Portals - A Case Study of Fashion Industry in India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Abstract

In recent years, the rise of online shopping has become a crucial aspect of the overall consumer purchasing experience. Shoppers now possess the ability to acquire a diverse range of products via the internet, significantly transforming their buying habits. As a result, it is essential for retailers to improve the customer shopping experience by facilitating seamless transactions and creating visually appealing websites. The prosperity of an online retail enterprise largely depends on the quality of its platforms, which must effectively attract potential buyers. Assessing the quality of e-commerce platforms poses a complex decision-making challenge, as it involves both qualitative and quantitative factors. This study proposes the use of the Analytic Hierarchy Process (AHP) technique to prioritize various e-commerce platforms. This approach will be applied to several leading Indian e-commerce sites to assess their influence on customer experience.

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Keywords: E-commerce platforms; Analytical Hierarchy Process(AHP); E-commerce ranking; fashion retail.

1 Introduction

The functioning of a physical retail store is influenced by several factors, including its hours of operation, utility expenses such as water and electricity, and costs related to the range of inventory it carries. These constraints pose significant challenges for brick-and-mortar businesses in their pursuit of profitability. E-commerce, on the other hand, refers to the online platform for purchasing and selling goods and services. This shopping method is unrestricted by time or geographical location, resulting in a growing preference among consumers for virtual stores over traditional physical outlets. Over the last decade, e-commerce has profoundly altered the business environment and is anticipated to continue playing a vital role in the future.

The effectiveness of a model online retail enterprise relies significantly on the existence of high-quality websites that draw in prospective customers. This research presents a set of criteria and factors considered essential for assessing e-commerce platforms. A ranking algorithm based on the Analytic Hierarchy Process (AHP) technique is suggested to evaluate the performance of these platforms. The methodology is implemented on various prominent Indian e-commerce platforms to analyse their influence on customer experience. In this investigation, e-commerce platforms refer to both e-commerce websites and mobile applications.

2 Objective of the Study

The objective of this study is to evaluate how the quality of rapid E-Commerce platforms influences customer experience, to analyse prominent e-commerce platforms based on defined criteria, and to establish a ranking of customer preferences for the chosen websites and applications based on their feedback. The assessment of e-commerce platforms will include the identification of several critical attributes considered vital for their evaluation. These essential attributes will then form the basis for utilizing the Analytic Hierarchy Process (AHP) to ascertain the ultimate priority ranking of the e-commerce sites.

3 Literature Review

The Internet has evolved from a simple communication tool into a vast and interactive marketplace for products and services, engaging more than 5.52 billion users globally 1. https://www.statista.com/statistics/617136/digital-population-worldwide/ and India's e-commerce market 2. https://www.ibef.org/industry/ecommerce-presentation/ is set to reach US$ 325 billion by 2030, fuelled by 500 million shoppers and increased internet access, especially in rural areas. By 2026, over 1.18 billion people are expected to have smartphones, enhancing digital transactions. Rural areas will drive over 60% of demand, particularly from tier 2-4 towns. Indian e-commerce is expected to grow at a compound annual growth rate (CAGR) of 27% to reach US$ 163 billion by 2026. Particularly, The India Fashion Ecommerce market size was valued at **US$ 14 billion in 2023** and is expected to reach **US$ 63 billion by 2030,** grow at a compound annual growth rate **(CAGR) of 24% from 2023 to 2030.** Ecommerce platforms enable customers to purchase fashion products like apparel, footwear, accessories, jewelry and more through online channels. The growth is driven by increasing internet and smartphone penetration, rising disposable incomes and a young demographic profile https://www.coherentmi.com/industry-reports/india-fashion-ecommerce-market/

So, The Internet possesses the potential to facilitate direct sales of products and services to consumers, serve as an electronic medium for communication, and manage business transactions, including orders and payments. It has become increasingly common for businesses to engage in direct sales to customers via the Internet. In fact, numerous companies operate exclusively through online platforms. E-commerce has transitioned from being merely an alternative to an essential component for businesses seeking enhanced performance.

E-commerce can be described as ''any form of business transaction in which the parties interact electronically rather than by physical exchanges or direct physical contact" (Ecom, 1998). It refers to business activities involving consumers, manufacturers, service providers, and intermediaries using computer networks such as the Internet.

The rise of online shopping has become so pronounced that it is now a fundamental aspect of our daily lives. Numerous websites offer a vast array of goods and services across various categories. E-commerce platforms provide products ranging from clothing and accessories for men, women, and children to beauty and health items, books, magazines, automotive accessories, software, consumer electronics, electrical goods, household appliances, jewellery, audio and video equipment, entertainment products, gift items, real estate, and various services. Previous studies have indicated that e-commerce is undergoing significant changes, making the management of online businesses increasingly complex. As online shopping gains traction globally, web sales are expected to impact overall business growth. To achieve success, it is crucial that prices in online stores are competitive with those found in traditional retail outlets. In recent years, e-commerce has transformed consumer buying and selling behaviours, leading customers to become more discerning due to their access to information and a multitude of shopping options. Therefore, understanding customer needs is vital for developing a successful and profitable online store.

AHP is a method for organizing and analysing complex decisions based on math and psychology (Duan et al., 2022). Previous literature (Vaidya and Kumar, 2006) shows that many researchers have adopted AHP and fuzzy AHP methodology in various fields such as supplier selection (Jain et al., 2018) safety management system (Chan et al., 2004), project selection (Parvaneh and El-Sayegh, 2016) e-government (Gupta et al., 2017), risk assessment (Lyu et al., 2020), and service quality (Bakir and Atalik, 2021). This method has been chosen for its versatility and high efficiency in solving different types of decision-making problems (Gupta et al., 2022) AHP has also been successfully used in various fields of human resource management (Peregrin and Jablonsky, 2021) such as selecting employees (Duan et al, 2022) human capital management (Tavakoli et al., 2016) green HRM (Goel et al., 2022) and employee performance (Gao et al**.,** 2023) university ranking (Rad et al., 2011) proposal of public contract (Bertolini et al., 2006).

The Analytical Hierarchy Process (AHP) is widely used in e-commerce for decision-making processes (Boyaci and Baynal, 2016) especially in contexts that involve multiple criteria, complex choices, and the need to weigh different factors. AHP is a structured technique that uses pairwise comparisons and rankings to help decision-makers determine priorities and allocate resources efficiently. The Analytical Hierarchy Process enables e-commerce companies to make data-driven, consistent decisions across complex multi-criteria problems. By providing a structured approach to decision-making, AHP helps optimize various aspects of the e-commerce value chain, from product selection and inventory management to marketing and logistics. This ultimately contributes to better customer experiences, improved operational efficiency, and increased profitability.

Many researchers have applied AHP to evaluate e-commerce website like effect of website quality on customers, security, parameters selection, comparison of different e-commerce portals, etc., For instance quality of websites with AHP-TOPSIS (Sutami et al., 2017, Aydin and Kahraman, 2022) comparison of website for online advertising (Mazandarani, 2010) Expert decision on ecommerce platforms (Hsein hsu et al., 2010) AHP with TOPSIS to rank B2C e-commerce website in e-alliance (Yu et al., 2011) success factors of e-commerce (Kong and Liu, 2005) comparison of different e-commerce portals (Gomathi, 2015), comparative study on Indian e-commerce websites (Arora and Kaur, 2015) the effect of website quality on customers quality (Lee and Kozar, 2004), e-commerce security using AHP (Zhang et al, 2012) evaluation of e-commerce websites by fuzzy-AHP-TOPSIS (Kaya, 2010).

4 Methodology

The Analytical Hierarchy Process (AHP) is a decision-support methodology established by (Saaty.TL, 1977, Saaty, 1980, Saaty, 1985, Saaty, 1980, Saaty, 1991). Its primary objective is to quantify the relative priorities among a specific set of alternatives using a ratio scale, which is grounded in the judgment of the decision-maker. This method emphasizes the significance of intuitive judgments made by the decision-maker and the consistency in comparing alternatives throughout the decision-making process. Given that decision-makers rely on their knowledge and experience to form judgments and subsequently make decisions, the AHP framework aligns effectively with their behavioural patterns. A notable advantage of this approach is its ability to systematically organize both tangible and intangible factors, offering a structured yet relatively straightforward solution to decision-making challenges. Furthermore, by deconstructing a problem logically from a broader perspective to increasingly finer details, one can establish connections between the smaller elements and the larger context through simple paired comparison judgments (Saaty.TL, 1977, Saaty, 1980, Saaty, 1985, Saaty, 1980, Saaty, 1991). developed the following steps for applying the AHP:

1. Define the problem and determine its goal.
2. Structure the hierarchy from the top (the objectives from a decision-maker's viewpoint) through the intermediate levels (criteria on which sub- sequent levels depend) to the lowest level which usually contains the list of alternatives.
3. Construct a set of pair-wise comparison matrices (size n×n) for each of the lower levels with one matrix for each element in the level immediately above by using the relative scale measurement shown in Table 1. The pair-wise comparisons are done in terms of which element dominates the other.
4. There are n(n-1)/ 2 judgments required to develop the set of matrices in step 3. Reciprocals are automatically assigned in each pair-wise comparison.
5. Hierarchical synthesis is now used to weight the eigenvectors by the weights of the criteria and the sum is taken over all weighted eigenvector entries corresponding to those in the next lower level of the hierarchy.
6. Having made all the pair-wise comparisons, the consistency is determined by using the eigenvalue, λ_{max}, to calculate the consistency index, CI as follows: CI=(λ_{max}-n)/(n-1), where n is the matrix size. Judgment consistency can be checked by taking the consistency ratio (CR) of CI with the appropriate value in Table 2. The CR is acceptable, if it does not exceed 0.10. If it is more, the judgment matrix is inconsistent. To obtain a consistent matrix, judgments should be reviewed and improved.
7. Steps 3-6 are performed for all levels in the hierarchy.

Table 1. Verbal judgments of preferences rating

Numerical rating	Verbal judgments of preferences
9	Extremely preferred
8	Very strongly to extremely
7	Very strongly preferred
6	Strongly to very strongly
5	Strongly preferred
4	Moderately to strongly
3	Moderately preferred
2	Equally to moderately
1	Equally preferred

Results are obtained by Professional commercial software **Expert Choice**, developed by Expert Choice, Inc. 38. https://www.expertchoice.com/2020, is available in the market which simplifies the implementation of the AHP's steps and automates many of its computations

Table 2. Average random consistency (RI)

Size of matrix	1	2	3	4	5	6	7	8	9	10
Random consistency	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

In this research, primary data were collected through questionnaires distributed to online consumers. A well-structured questionnaire was utilized to streamline the data collection process. The design of the questionnaires was meticulously developed to guarantee the utmost accuracy of the information gathered and to improve the understanding of the respondents. Following this, the Analytic Hierarchy Process (AHP) was employed to analyse the collected data in order to achieve the goals of the present study. To compare the websites, five essential criteria used by vineeta et.al., 2017 were initially identified for evaluation, deemed necessary for the assessment. The selected criteria are given below

1.Product: The customers mainly consider the quality, variety and availability of products at the time of purchasing which will affect the purchasing decision of the customers.

2.Pricing: Here pricing means we considered Discount price, offers, coupons, promotion pricing, EMI option on payment, payment methods, cancellation charges and Delivery charges etc.

3.Security: During online shopping, customers provide their sensitive information and anticipate that retailers will ensure its safety and security.

4.Support service: we considered support service as Phone support, SMS service, IVR service, WhatsApp service, chat support, 24*7 services; customer's feedback and complaints window.

5.Logistic: Flexibility in shipping, online tracking, possibility of change in address, Speedy delivery, and fast delivery options, customized delivery option, Easy Return and money back guarantee.

Subsequently, five leading Indian e-commerce websites are assessed and compared based on the chosen criteria by organizing the decision-making process into a three-tier hierarchy consisting of Goal, Criteria, and Alternatives. In this study we considered five Indian clothing/apparel e-commerce portals Myntra ,Ajio, Meesho ,Nykaa and Tatacliq. Overview of this process is shown in the following Fig. 1 and after structuring the goal in hierarchy AHP process is applied to find the priority ranking of E-Commerce portals.

The AHP calculations are given in Table 3 to 9.

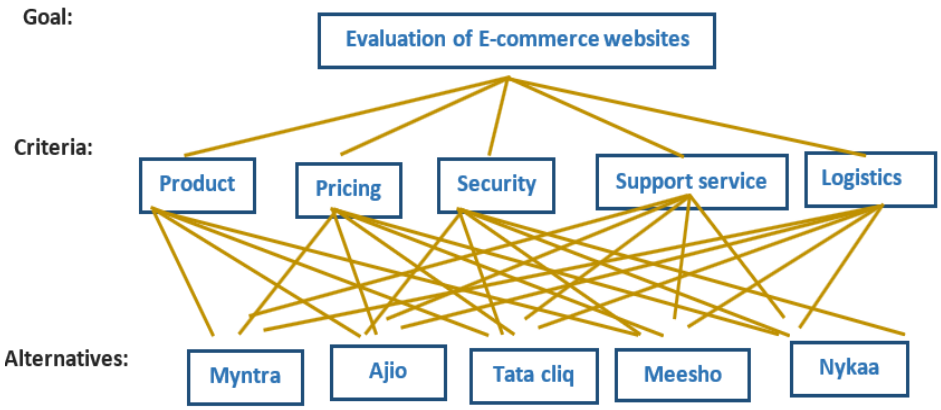

Fig. 1. The hierarchy of the model

Table 3. Pair-wise comparison matrix for all criteria

	Product	Pricing	Security	Support	Logistics	Priority vector
Product	1	1/5	1/3	3	3	0.144
Pricing	5	1	5	6	6	0.537
security	3	1/5	1	2	2	0.173
Support	1/3	1/6	½	1	2	0.084
logistic	1/3	1/6	1/2	1/2	1	0.062
						Total 0.999

$\lambda_{max} = 5.40$, $CI = 0.10$, $RI = 1.120$, $CR = 0.089 < 0.1$

Table 4. Pairwise comparison matrix for "*product* "

Pairwise comparison matrix for "*product* "						
product.	**Myntra**	**Ajio**	**Tatacliq**	**Meesho**	**Nykaa**	**Priority vector**
Myntra	1	2	2	4	3	0.375
Ajio	1/2	1	2	3	2	0.251
Tatacliq	1/2	1/2	1	2	2	0.172
Meesho	1/4	1/3	12	1	2	0.108
Nykaa	1/3	1/2	1/2	1/2	1	0.094
						Total 1.00

$\lambda_{max} = 5.165$, $CI = 0.041$, $RI = 1.120$, $CR = 0.037 < 0.1$

Table 5. Pairwise comparison for "Pricing"

Pairwise comparison for "Pricing"						
Pricing	**Myntra**	**Ajio**	**Tatacliq**	**Meesho**	**Nykaa**	**Priority vector**
Myntra	1	1	1	1	1	0.2
Ajio	1	1	1	1	1	0.2
Tatacliq	1	1	1	1	1	0.2
Meesho	1	1	1	1	1	0.2
Nykaa	1	1	1	1	1	0.2
	CI	**0**		**CR**	**0**	**Total 1.00**

λ_{max} = 5, CI=0, RI=1.12, CR=0<0.1

Table 6. Pair-wise comparison matrix for "*security*"

Pair-wise comparison matrix for "*security*"						
Security	**Myntra**	**Ajio**	**Tatacliq**	**Meesho**	**Nykaa**	**Priority vector**
Myntra	1	2	4	3	1	0.326
Ajio	1/2	1	3	2	1/2	0.190
Tatacliq	14	1/3	1	1/2	1/3	0.074
Meesho	1/3	1/2	2	1	1/2	0.122
Nykaa	1	2	3	2	1	0.288
						Total 1.00

λ_{max} = 5.072 CI = 0.018, RI = 1.120, CR = 0.016 < 0.1

Table 7. Pair-wise comparison matrix for "*support service*"

Pair-wise comparison matrix for "*support service*"						
Support service	**Myntra**	**Ajio**	**Tatacliq**	**Meesho**	**Nykaa**	**Priority vector**
Myntra	1	1/2	1/2	1/3	2	0.126
Ajio	2	1	2	1/2	2	0.238
Tatacliq	2	1/2	1	1/2	2	0.179
Meesho	3	2	2	1	3	0.362
Nykaa	1/2	1/2	1/2	1/3	1	0.095
						Total 1.00

λ_{max} = 5.131, CI = 0.033, RI = 1.120, CR = 0.029 < 0.1

Table 8. Pair-wise comparison matrix for "*logistic*"

Pair-wise comparison matrix for "*logistic*"						
logistic	**Myntra**	**Ajio**	**Tatacliq**	**Meesho**	**Nykaa**	**Priority vector**
Myntra	1	2	3	2	1	0.024
Ajio	1/2	1	3	2	1/2	0.197
Tatacliq	1/3	13	1	1/2	1/3	0.081
Meesho	1/2	1/2	2	1	1/2	0.135
Nykaa	1	2	3	2	1	0.294
						Total 1.00

λ_{max} = 5.088, CI = 0.022, RI = 1.120, CR = 0.020 < 0.1

Table 9. Final priority table

	Product	**Price**	**Security**	**Support service**	**Logistic**	**Final priority vector**	**Rank**
	0.144	**0.537**	**0.173**	**0.084**	**0.024**		
Myntra	0.375	0.20	0.326	0.126	0.197	0.2331	1
Ajio	0.251	0.20	0.190	0.238	0.081	0.1984	2
Tatacliq	0.172	0.20	0.074	0.179	0.135	0.1632	5
Meesho	0.108	0.20	0.122	0.362	0.294	0.1815	3
Nykaa	0.094	0.20	0.288	0.095	0.038	0.1797	4

5 Results

This study examines the comparative evaluation of five Indian e-commerce platforms, taking into account various criteria such as product range, pricing strategies, security measures, customer service, and logistics efficiency. The results reveal that Myntra (0.23) achieves the highest ranking in overall suitability among the assessed apparel e-commerce sites. As a result, Myntra is recognized as the most effective fashion e-portal, reflecting consumer preferences for product quality and a greater level of trust in this platform. Following Myntra, Ajio ranks as the second most favoured e-commerce fashion portal, with Meesho in third place, Nykaa in fourth, and Tatacliq in the last position. The findings underscore that Myntra and Ajio are the two most preferred online apparel platforms among Indian consumers.

6 Conclusion

Online shopping has become an integral part of daily life. A considerable number of educated individuals utilize online shopping platforms for their routine purchases. Additionally, the fast-paced lifestyle in urban environments has made online shopping a more convenient option for consumers. In contemporary society, individuals often navigate two distinct realms: their physical world and their digital identity. Activities such as online shopping, communication through WhatsApp, and engagement on social media platforms like Facebook are vital components of this digital life. There is a plethora of online shopping websites available, and customer attitudes and preferences regarding product purchases are influenced by a variety of factors. Research indicates that Myntra is the favoured choice among current users.

The results show that two of the selected websites enjoy increased popularity among users, possessing features that align with user needs. The leading websites exhibit robust capabilities and usability characteristics, including user-friendly navigation, security, and flexibility, which likely enhance their appeal, particularly to younger consumers. These factors may have strengthened customer trust and confidence, as users report satisfaction stemming from their positive experiences with these platforms. This approach can also be applied to other e-commerce sites under different criteria and sub-criteria, allowing for comparisons with results obtained through alternative methods.

Disclaimer (Artificial Intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

Competing Interests

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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