Usability and Performance Analysis of E-Commerce Websites

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Abstract - Online business or trade has become the buzz word in today's Internet dominant era. The concept of using e-commerce sites for shopping the daily items and other goods have become also popular in the developing countries like India. The experience of users and study of their behaviour on e-commerce websites helps in determining the usability of these websites, which is acknowledged as a key factor for assessing the quality of any website. These quality measures along with performance measures are collected and compared for 28 e-commerce websites using two different approaches. The relative priority and preferences of the features and ease are investigated through a survey in this paper. Further, using GTmetrix-an online tool, speed tests and other parameters are garnered to analyze their performance. This research work is carried out with the objective to compare and analyze the performance of popular e-commerce websites and also to study its relationship with user preferences and behavior on these websites which can further guide the website developers and entrepreneurs in improving the performance and satisfying the customers.

Keywords: e-commerce, GTmetrix, performance, performance evaluation and usability.

I. INTRODUCTION

In today's digital world, where customers are always in hurry and they have abundance of options available; they want to get things in an instant. Modern websites are providing many lucrative features than ever before to such customers. Many of the e-commerce websites struggle to get the high performance on variety of devices under different network conditions. But users are becoming impatient and less tolerant to wait. Slow websites are major turn off for many customers and causes frustration among them [1]. Performance is all about user's experience on the website which varies from user to user and it plays a major role in the success of any e-commerce website. Even a small delay is enough to annoy the customers. While the parameters Page Loading and downloading time, which contribute to the performance are also suggested by researchers to include in the usability components [2]. Usability is about the presentation of the content on the website. It includes easy content exploration, fundability, task efficiency, user satisfaction, and automation [3].This work is an attempt to study the ease of interaction the e-commerce websites provide to their customers and also to analyze the performance and speed of these ecommerce websites. Many automated online tools assist in assessing the various important components of a website. Further,

their dependability on each other is also explored. The performance of different ecommerce websites is analyzed using automated Usability Testing tool GTMetrix. Furthermore, comparison of the performance results and user behaviors responses garnered through a survey is represented to investigate the relation between them.

The paper is organized in five sections, where section II gives a brief of the related work done in literature, section III describes the research methodology used for carrying out the work in short. Further section IV explains and discusses the results obtained from the tool and survey. Lastly, section V concludes the paper.

II. LITERATURE REVIEW

Purchasing products online through e-commerce websites give customers opportunities to research about the product, seller and other related information. Lots of research has been conducted in this area from different aspects in the last two decades. Auger 2005 in [4]; Welling and White 2006 in [5] have identified and concentrated on the importance of website performance measurements in the websites. They have also presented the impact of the design and interactivity on the performance of the e-commerce websites. Further, in 2006 Venkateshet.al proposed an approach in electronic channels to convert visitors in customers [6]. Fangyu Lia and YefeiLiba, researchers from China in 2011 evaluated usability of business to customer (B2C) websites in China. Two questionnaires were used to collect the evaluation scale depending upon the performance of the operations on these websites and their importance [7].

Abdul Majid and Rogayah in 2014 conducted a study based on the model proposed by researchers in [6] in order to evaluate the usability of the website "thepoplook.com". Their work also helped to identify the problems that customers faced while using that website and in the model. Further, they have identified five major attributes named ease of use, made-to-medium, emotion, content and security of the usability to evaluate the e-commerce websites [8] Bhat, Dr. Shahidet.al in 2016 have explained in [9] the e-commerce trends and its present status. The work done by him explained key factors that affect the increase in the usage of these web sites. Further, to identify the challenges and benefits in e-commerce, Abdul Gaffar Khanin 2016 conducted a study based on the secondary data garnered from journals, research papers, books and magazines [10].

In 2019, Retail Systems Research report represented the results of the study conducted by RSR [11]. These results are based on the evaluation of 80 major retail websites based on page speed performance and shopper experience.

Further, this report also depicts the survey results from 1300 consumers, where 90% of them gave slow loading time as a reason to leave a website. The literature review clearly states that usability and performance are always key factors of e-commerce website to attract and maintain their customers.

III. RESEARCH METHODOLOGY

To carry out this work, two approaches have been used which include traditional survey method and result froman automated online tool-GTmetrix. The survey is organized to collect the customers' preferences on the user interface, their habits, preferences and shopping experience on e-commerce websites. Further, an automated tool is used which performs the speed test and other performance tests in order to collect the real time data from each of the 28websites. The results are then illustrated and compared in the following section.

IV. RESULTS AND DISCUSSION

TABLE I GT METRIX RESULT

WEBSITES	Average of Page Speed Grade (%)	Average of HTML SIZE(KB)	Average of Onload (ms)	Average of Total Requests	Average of Connection duration (ms)	Average of Fully loaded (ms)
AJIO	4.1875	0.377838135	363.25	8.15625	4.53125	61.375
AMAZON	52.75159236	89.46842655	2523.681529	357.8789809	74.21019108	8189.853503
ANDAMEN	11	161.6132813	2385.25	314.75	19.5	5769.25
BIGBASKET	53	1.079589844	6899	203.5	1.5	8824.5
BRINDO	26	3.876953125	3353.5	19	257.5	3789
CANDERE	67	76.81021484	15434	148	630.66	20451.33
CLUB FACTORY	8.666666667	1.292317708	3105.66	6.333333333	23	6318.3
EBAY	0.000408054	0.000692073	1117.833333	0.002768333	85.83333333	1263
FIRSTCRY	68.5	53.15966797	0.019521655	196.5	0.000574045	0.063351693
FLIPKART	1.883985441	3.195300948	4741.5	12.78139217	38.5	8493.5
GLOBALDESI	22	22.28222656	1177	629.5	49.5	7231
HOMESHOP18	0.069777239	0.11834448	90.13148317	0.473384895	2.650363967	292.494768
JABONG	8.375	0.75567627	4770.5	16.3125	58	11538.5
KOOVS	33.5	3.022705078	3.33820308	65.25	0.098161628	10.83313955
LIMEROAD	74	42.93310547	726.5	145	9.0625	122.75
LOCAL BANAYA	0.007753027	0.013149387	2906	0.052598322	36.25	491
MYNTRA	0.412698413	0.061538938	3578	0.301587302	19.5	7651.5
NYKAA	2.888888889	0.430772569	0.370911453	2.111111111	0.010906848	1.203682173
REDIFF	5.5	80.80664063	53.23015873	157.375	4.087301587	60.14285714
SHOPCLUES	62.5	55.21606445	372.6111111	225.75	28.61111111	421
SNAPDEAL	0.082539683	0.012307788	2370.75	0.06031746	19.25	4246.75
TATACLIQ	16.75	1.511352539	1192.625	32.625	9.75	2884.625
VAJOR	67	6.045410156	2266.5	130.5	48.5	10025.5
VILLIFASHION	79.5	41.44628906	10.64603175	107	0.817460317	12.02857143
VOONIK	63	16.13896484	1453	168	18.125	245.5
YEHME	29	2.8359375	5812	84.5	72.5	982
ZIVAMA	76.5	44.11328125	6415	145	774.5	23077
ZOPNOW	51	10.21191406	6474	225	313.5	15008

As two approaches are used in this paper to conduct the work, here the results obtained from each approach are presented in different sections.

A. GT Metrix Results

A total 28websites are selected to run on the GTmetrix. It assesses each website on number of parameters. These parameters include total requests, HTML size, and connection duration, on load time in average. The results collected for each website are presented in table1.The table shows the average of the six different parameters that is page speed grade percentage, HTML size, connection duration, on load time, fully on load time and total requests

These results are collected and represented based on the average of the performance of each e-commerce website in the month of February 2020.

Page speed is the amount of time that takes for a webpage to load. This speed is computed by the considering factors like page file size, image compression and so on [12]. The average page speed is highest at villi fashion with 79.5%, zivama with 76.5%, candere and vajor at 67% respectively. The websites with lowest average page speed include AJIO, rediff and snap deal. The average page speed grade percentage of different e-commerce websites are presented in figure 1. It has been observed that only 39% of the e-commerce websites are having page speed grade more than 50%.
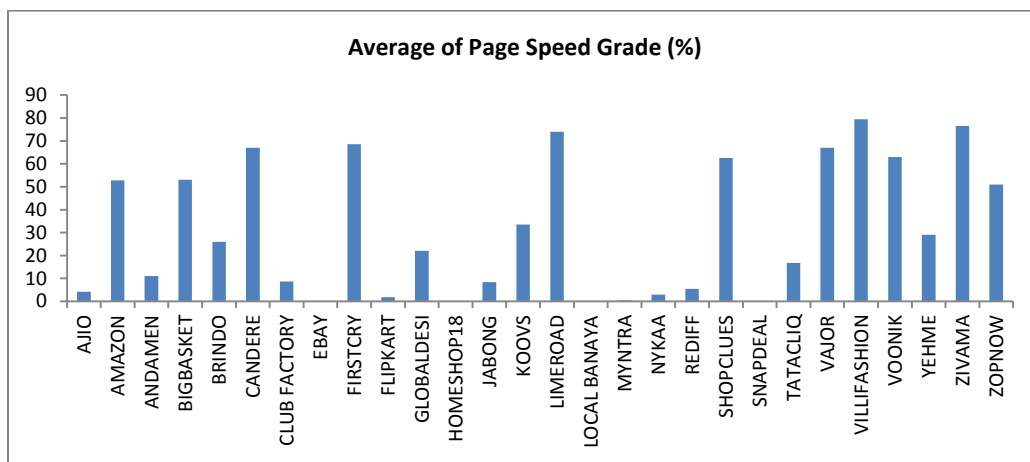

Fig.1 Page speed grade

Another parameter is HTML size which is the size of the coding file of a website. It is represented in Kilo Bytes (KB) in the third column in table 1. The website www.andamen.comhas largest size with 161.613 KB, amazon with 89.468 KB, red iff with 80.8066 and candere with 76.8102 KB. The popular websites like snapdeal.com, firstcry.com, lime road and zivama have the almost average page size among these websites.

While on the other hand, ebay, jabong and myntra have very less HTML size. The average percentage of page speed grade and HTML size of websites are plotted in figure 2, which shows the correlation between these parameters. Most of the times, page speed is directly proportional to the HTML size of the website with few exceptions at the websites like www.andamen.com and www.bigbasket.com.

Next parameter on load time, which is measured as the total processing time taken when all the resources of the page have finished downloading. The websites which have resulted by taking the most time are candere, big basket and zop now. While among the quickest responses in terms of the downloading time are AJIO, flipkart, homeshop18, nykaa and snap deal.

The time that an e-commerce website takes to fully download and on load time (which is time taken to download only front-end components) are depicted in fig.3. Because of the database connections in every e-commerce site, and time taken to load components from database, it takes more time to fully load the website.

A very few of them are taking same almost time to fully load. Such e-commerce websites are identified here- ajio.com, ebay.com, limeroad.com, nykaa.com, voonik.com and yehme.com.
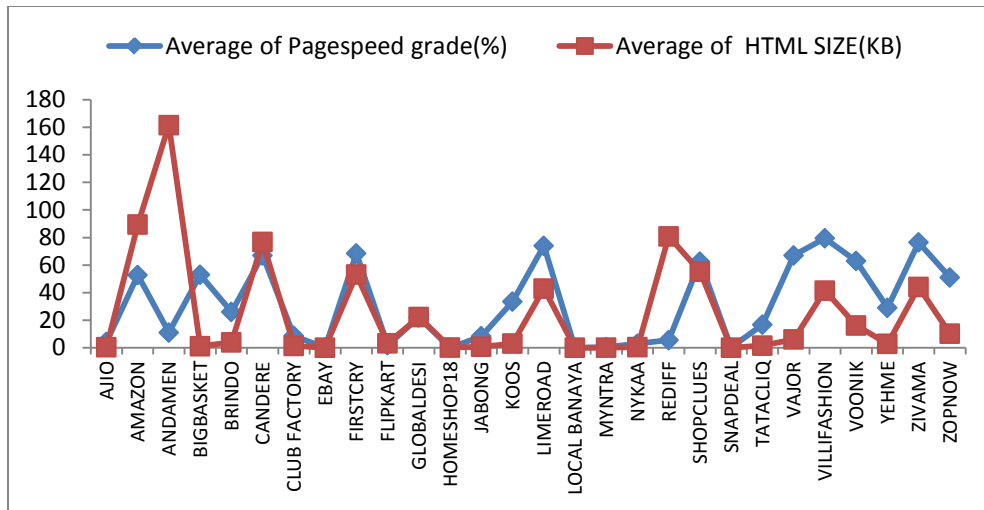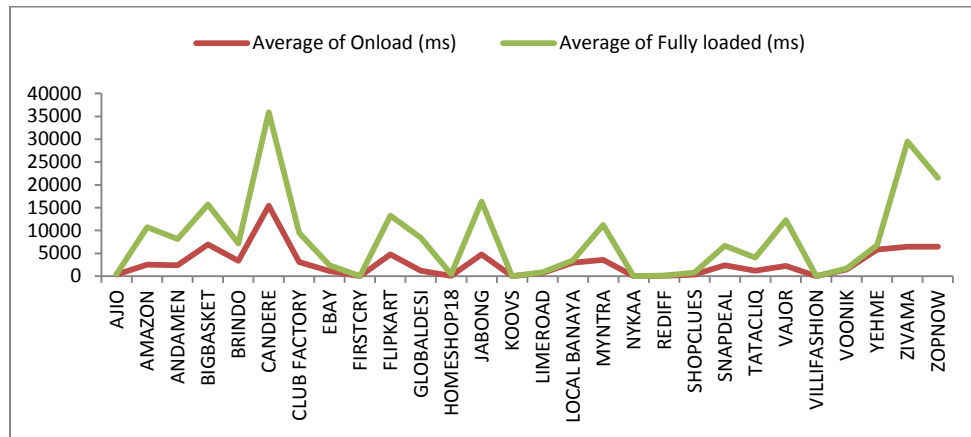
Fig.2 Page speed grade and html size

Fig.3 Average fully load and on load time

Also, it has been observed that websites with more gap in on load and fully load time have higher connection duration. But when the averages of total requests of customers on each website were examined, it has been found that they have a very close relation with the percentage of page speed grade which is represented with the help of graph in fig.4.
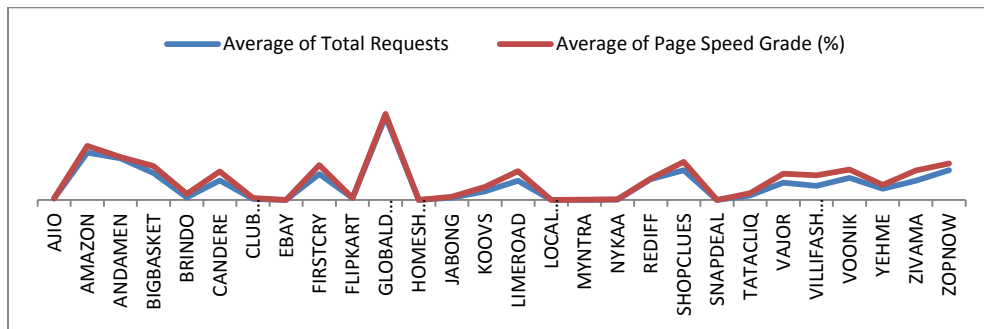

Fig.4 Average total requests and page speed grade

It would not be wrong, if we say that page speed grade plays a major role in increasing the number of requests on page. This grade can further be enhanced if the front end and backend components get quickly loaded.

B. Survey Results

To understand the user's behavior and their preferences on e-commerce websites, a survey was conducted, and 81 users responded to it. Among the respondents, 67% are females and 33% are males. Further, respondents are from different age categories, which are mainly divided into four groups

G1 through G4. Group G1 includes persons having age less than or equal to 18, G2 has the persons from age 19 to 25, G3 includes age 26 to 40 and G4 has the persons above 40. The group wise distribution of the respondents is presented in figure 4, which shows that maximum participants are from Group G2.
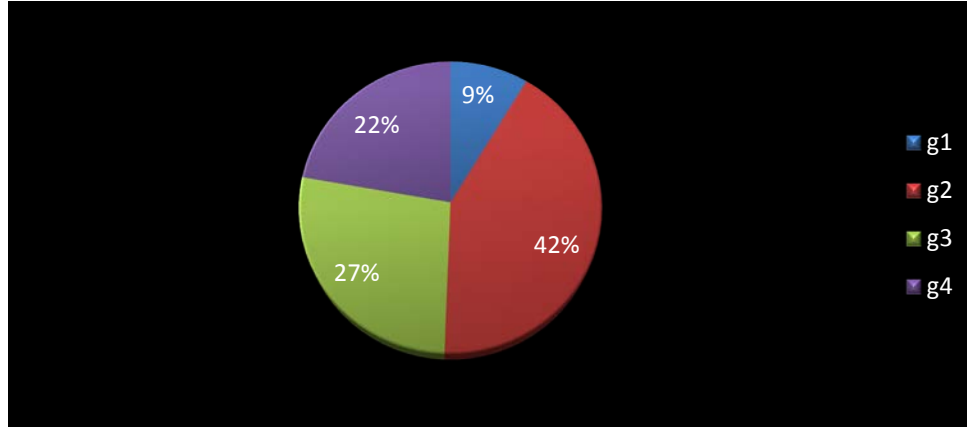

Fig.5 Respondents age groups

When the participants were asked to rank the popular 15 shopping websites on the scale of 1 to 5, it has been seen that amazon. In is the first preference of maximum of the respondents. These 15 websites included snapdeal.com, amazon.com, clubfactory.com, nykaa.com, myntra.com, flipkart.com, candere.com, localbanya.com, shopclues.com, firstcry.com, jabong.com, fabindia.com, onshopdeal.com,

villifashion.com and rediff.com. The top rankings by the users are represented in table 2. This data is represented in percentage, which shows that 33.33 % of the participants have ranked amazon at Rank 1, while 22.22 % participant ranked it at number 2. Only amazon. In and flipkart.com are at rank 1 according to the response of the customers.

TABLE II RANKING OF THE E-COMMERCE WEBSITES

WEBSITES	R1	R2	R3	R4	R5
AMAZON	33.33	22.22	0	12.34	13.58
FLIPKART	19.75	0	14.81	0	0
NYKAA	0	22.22	0	0	0
SNAPDEAL	0	0	14.81	0	0

Further, when the users were asked about the reasons of their preferences for shopping on these websites then low cost, delivery on time and quality of the product are them top choices, respectively. Also, it has been analyzed that both males and females prefer to do online shopping of the products which are available at low cost.

However, it has been seen that females are more concerned about quality than men. The availability of any product at lesser price is one of the lucrative reasons among customers, as it attracts 63% of them for shopping. The percentage of distribution of preferences among the various age groups is shown with the help of a bar graph in fig.6.

Moreover, most of the times, their preferred time of shopping online depends on the need of the product. While females choose to shop online during the offers or sales period and men prefer when they are in rush. The results are plotted in figure 6with respect to their age groups.

Furthermore, when it comes to comparing the prices of a product at different websites, maximum of customers does that. This practice is more common in males than females. Among the male participants, 88% nodded for comparing before placing an order. On the other hand, 74% of the female participants always look for the same product at different websites to check its price.
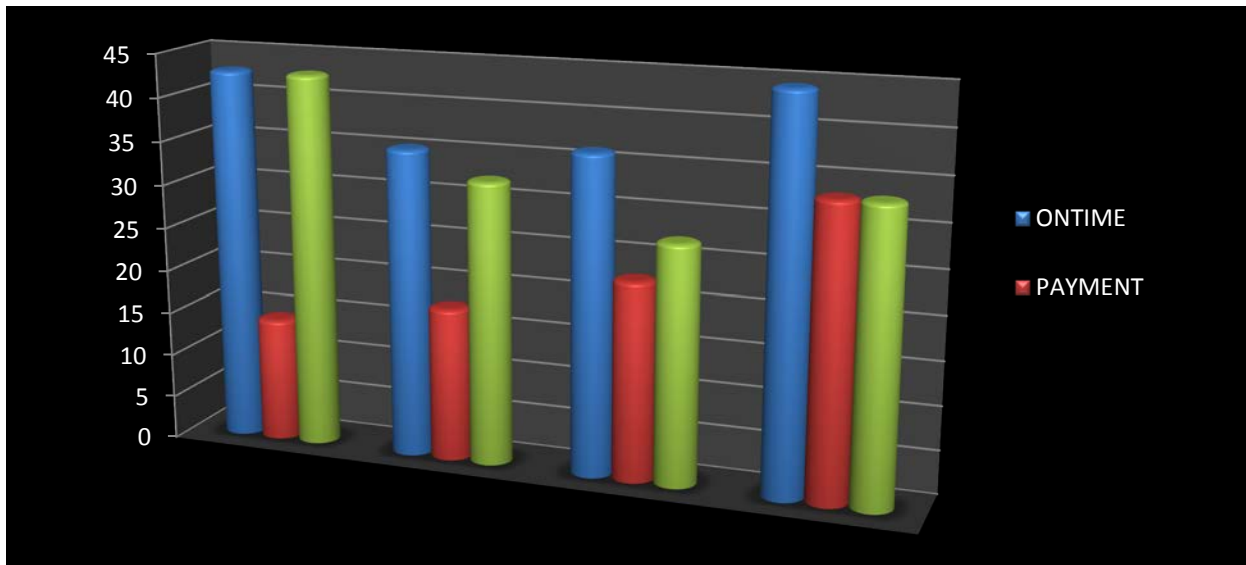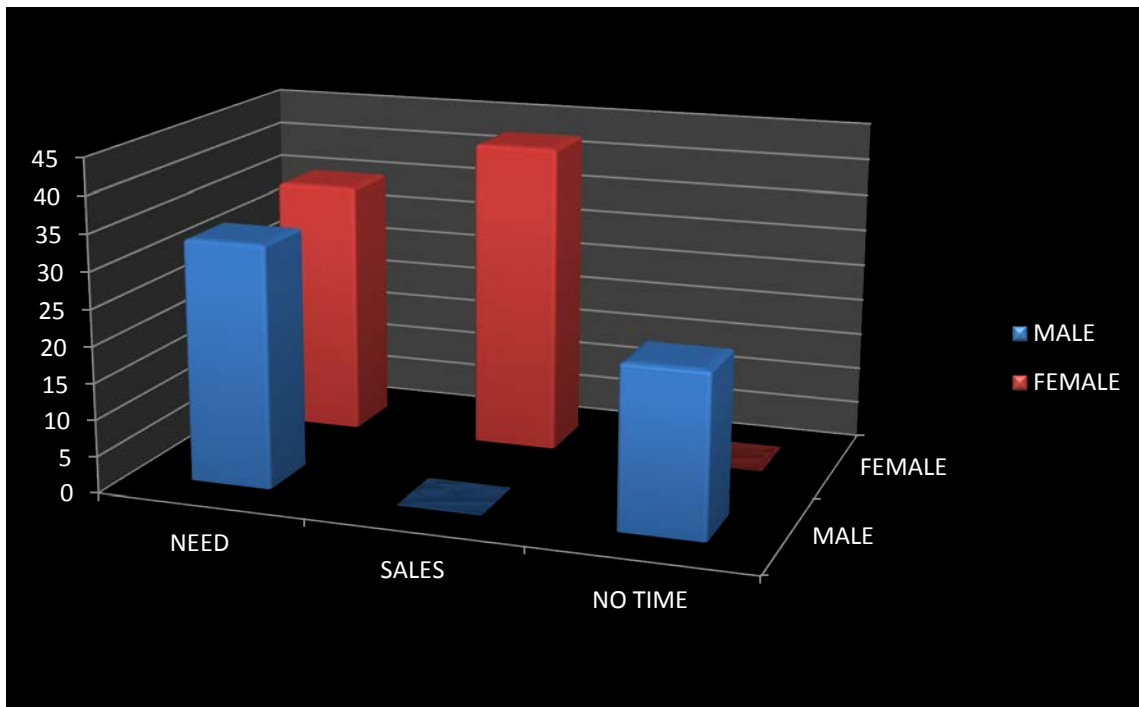
Fig.6 Age group wise preferences

Fig.7 Online shopping preferences

Further, it has been observed that this behavior is observed at peaks in persons whose age is between 26 to 40 years old. Another important behavior was noticed among females who prefer to shop online during sales, on the other hand males' shop only when there is need of something or when they have no time to go to shop. Next, to test the usability of the website, users were asked to rank the websites according to their look and design. The popular websites myntra.com, clubfactory.com, Nykaa.com and flipkart.com got almost similar scores from the respondents, while Amazon is at top place among its users for its design.
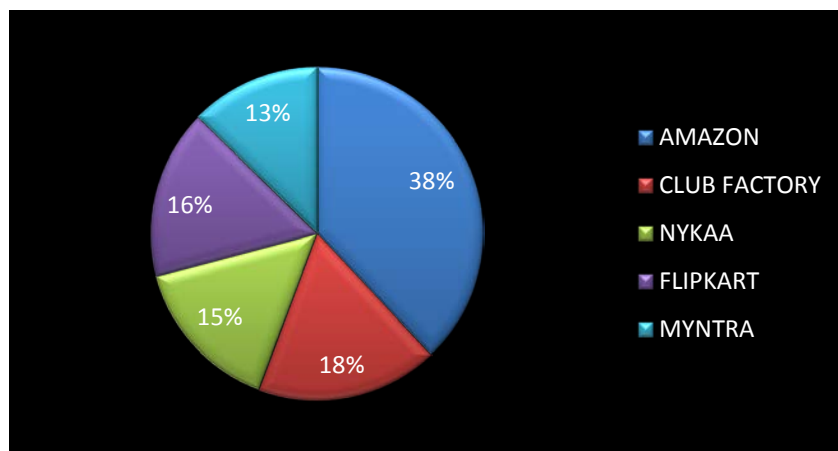
Fig.8 Users votes to design

Besides the usability, when the users were asked about their choice of using app or direct URL for placing the order, it has been observed that more females prefer to place order using an app. Further, it has been found that most of the people have installed flipkart, amazon and/or club factory apps in their phones. Amazon is the most downloaded app and is more popular among males, whereas flipkart holds the second position. Also, most of the respondents agree that the product and its quality is above any other features of the website for them to buy a product through it while design, looks and easy navigation of the website comes later. It is interesting that users choose quality of the product while shopping but when it comes to price, they prefer low cost. Another important behaviour of the users was revealed when they answered about their reaction if the product received is not up to the mark. Only half of them return the product back in such situation, while others do nothing, and this obviously take a toll on their online shopping habit and selection of the website.

V. CONCLUSION

The performance of various e-commerce websites has been analyzed in this paper using various parameters like page speed grade percentage, HTML size, connection duration, on load time, fully on load time and total requests. The results garnered using GTmetrix also presented a clear relation between page speed grade percentage and HTML size. Moreover, e-commerce websites having high page speed grade have more page requests. This is just one factor for using that website. Customers also want products having good quality at low cost. They are smart who choose to compare the price before placing the order, so online market must compete both in its service and design. This work can be used as guidance for the e-commerce developers and the online organizations to improve themselves.

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