Association between shopping habit and demographics of m-commerce user's in India using two way ANOVA

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Association Between Shopping Habit and Demographics of M-Commerce user's in India using Two way ANOVA

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***Abstract*—India has the second highest mobile phone users after China. In India using touch screen mobile device is fashion. All age group people now used touch screen handheld device to do shopping for daily need. Mobile commerce provides personalization and location based services to users. For those demographics of users plays an important role. In this paper authors try to find association between shopping habit and demographics of Indian mobile commerce users. For that authors conduct a online survey and collect data of 335 users. To conduct this experiment authors chose two demographics factors of Mobile commerce user's 1.Gender 2.yearly income. Through two way analysis of variance (ANOVA) we identified that 1) Gender and yearly income of customer are significant at 95% and 9999% confidence level respectively on shopping habit. 2) There is interaction between gender and yearly income towards shopping habit.**

Keywords—Survey, Mobile-shopping, Mobile commerce, Two way ANOVA, Interaction diagram, Shopping Habit

I. INTRODUCTION

In India the number of mobile users grows with rapid rate due to low cost mobile phones with better configuration and fast data access with low cost. Due to availability, personalization and location based services mobile commerce is used in India by every age people. In India younger age people (below 35) is 75% which plays important role in the growth of online shopping users. There are various key factors which plays important role in success of Mobile commerce. These are accessibility, entertainment, reliability, mobility, externality and reciprocity [12]. By the end of year 2017 it will be expected that 3 billion Smartphone's and 1 billion tablet users worldwide [16]. This implies that Mobile commerce is hot topic for future research.

The workflow diagram of mobile commerce shown in Fig 1 explains the five major players of it. First player is online buyer who uses their Smartphone for mobile shopping. Second player is buyer's information, which are used to provide personalized and location based services to customer. Third player is online store which send formatted order of buyer to payment gateway. Fourth player is payment gateway which helps to provide validation of payment options opted by buyer. The fifth and last player is bank. Bank transfer the amount of order to the merchant bank account to complete the order from buyer side.

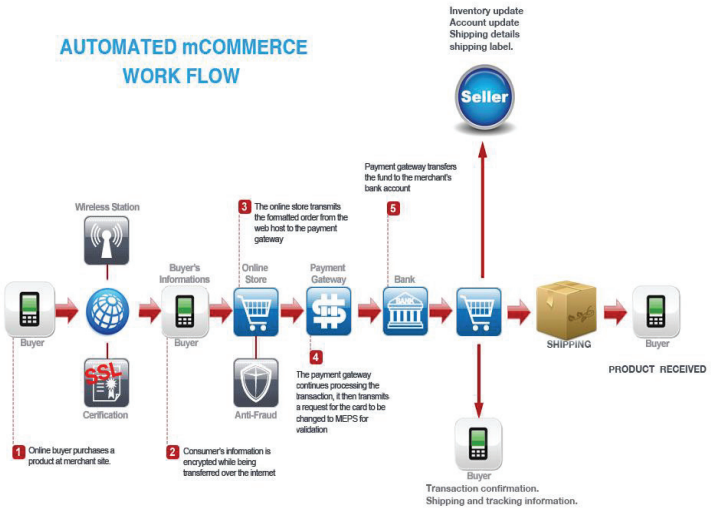

Fig 1: Work flow Diagram of Mobile commerce

Traditional shopping model are applicable only for personal computer users. For mobile shopping different models are used such as Technology acceptance model (TAM) [20]. In mobile shopping users get better offers on product as compared to traditional shopping with effect number of users who uses online shopping are now more than traditional shopping users. The shopping habit is defined as the frequency of doing online shopping by consumer. In this paper authors defined shopping habit as occasionally, Daily, Weekly and Monthly. The shopping habit is depend on the demographics of users such as Gender, Income, Number of members in family, age group etc. so there is need to identify which demographics effect more on shopping habit.

There are various data mining techniques like clustering, factor analysis, correlation, regression, test of independence and ANOVA, which are used to find association between defined variables of study [21]. In this paper authors used two-way analysis of variance (ANOVA) to find association between two

categorical demographic variables (Gender and yearly income) on one continuous variable (Shopping Habit). Two-way ANOVA is also called as analysis of covariance (ANCOVA). The two independent variables used in the study are also called factors.

For this study we collect primary data of 335 Indian Mobile commerce users. To collect responses authors prepare questionnaire using Google Forms (https://docs.google.com/forms/d/1KtWvGfsLN1ms0fHeHbFdyTPubIz5r6u4hmRThDOd_2g/viewform)[22]. From this survey authors used only two demographics variables: Gender and Yearly income as independent variable and shopping habit (frequency of online shopping) as dependent variable.

This paper is organized as Introduction is provided in part I, Objective of study is defined in part II, Literature review in part III, part IV elaborate hypothesis design, part V presents research methodology, part VI discuss the data analysis technique, part VII discuss results and discussion of experiment, and conclusion of study is provided in fragment VIII.

II. Objective of Study

Numbers of Smartphone users are directly proportional to the online shopping users in India. As the demographics of user's plays an important role in consumer behavior and shopping habit, in this paper authors try to find:

- Association between demographics factor Gender and yearly income on shopping habit.
- Check interaction between independent variables gender and yearly income.

III. Literature Review

A. Online Shopping

Today's online shopping is most popular way of doing shopping because of low cost of electronic gadgets and internet. In online shopping consumer can choose products according to their need from a large variety of products in one place [26] [28]. In traditional shopping customer can touch and feel product so there is not an issue of quality of product. But in online shopping there is no touch and feel so there is an issue of quality. There are various factors that affect customer satisfaction in online shopping. These are product uncertainty, retailer visibility, price, logistic service, service and reviews [15] [31]. Demographics of user's also play an important role in online shopping. With the help of personal details of users, purchase sequence is generated. Purchase sequence gives the description of the changes in online shopping over a period of time [30]. Now social media is also linked with online shopping. In social media user can share their emotional experiences and images [29]. According to these social media datasets we make segment of users and provide them personalized services [25]. Customer can get various advertisements about products in different application platform but the real shopping experience happen in product page. In product page the layout and categorization of product is important to provide customer satisfaction [27]. There are various authors who use users demographics to find out the factors which influence online shopping and helps to provide customer satisfaction [24] [23]

B. Mobile commerce

Mobile commerce is a platform where user can purchase product with the use of mobile device connected through wireless data connection [12]. The difference between online shopping and mobile shopping is that in mobile shopping customer use handheld (mobile) devices while in online shopping they can use both mobile and fixed devices like pc [24]. Wireless Application protocol (WAP) is the technology used in mobile commerce to provide internet anytime anywhere [13]. In the new era of Smartphone's the mobile commerce is very easy due to its efficiency and effectiveness [14]. In Smartphone's we see that technology is upgraded day by day with minimum cost. With effect that mobile commerce market is now in boom and major companies are investing in that [17]. In India now reliance Jio comes as mobile operators with lowest data connection rate with 4G facility. This helps users to do fast data access in mobile phones and increases the mobile commerce market. In mobile commerce user can get personalized and location based services which helps to achieve customer satisfaction [18]. To provide location and personalized services user's personal database is used which is a privacy issue [19].

C. Two way ANOVA

Analysis of variance (ANOVA) is a statistical test used to compare two or more variables of study. There are two types of ANOVA: one way and two-way. Two-way ANOVA is also called as analysis of covariance (ANCOVA). In two-way ANOVA there are two independent categorical factors. The sample table of two-way ANOVA is explained below:

TABLE I. Sample two-way ANOVA table

Source of variation	Sum of squares	Degree of freedom (DOF)	Mean squares	Variance ratio
Between columns	SSC	C-1	MSC=SSC/(C-1)	F1=MSC/MSE
Within samples	SSR	R-1	MSR=SSR/(R-1)	F2=MSR/MSE
Residual	SSE	(C-1).(R-1)	MSE=SSE/(C-1).(R-1)	
Total	SST	RC-1		

In the above table
SSC= sum of squares between columns
SSR= sum of squares between rows
SSE= sum of squares for the residual/error
SST= total sum of squares
MSC= mean sum of squares between columns
MSR= mean sum of squares between rows
MSE= mean sum of squares for residual/error
R=no of rows used in study
C= no of columns used in study

On the basis of F1 and F2 value conclusion is drawn. In this paper demographic factor gender is used in column and yearly income used in rows. Gender has two values Male and female so dof is (2-1) =1. For yearly income 5 values are here. These are 1) less than one lakh 2) 1 lakh to 3 lakh 3) 3 lakh to 5 lakh 4) 5 lakh to 7 lakh 5) more than 7 lakh. So for yearly income dof = (5-1) =4.

Two-way ANOVA is used in different research area shown in table below

TABLE II. USAGE OF TWO-WAY ANOVA IN DIFFERENT FIELDS [1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11]

SR. NO.	PAPER TITLE	RESEARCH AREA
1	The Enhancement of Student's Mathematical Connection Ability and Self-Regulation Learning with Metacognitive Learning- Approach in Junior High School [1]	Education
2	The Differences in Coordination between Children with ADHD and Healthy Children Based on Two-way ANOVA ANALYSIS [2]	Medical
3	learning ANOVA concepts using simulation [3]	Education
4	Correlation between Three Facial Vibration Measurement Methods [4]	Music
5	Dimensional Reduction Analysis for Physical Layer Device Fingerprints with Application to ZigBee and Z-Wave Devices [5]	Computer science
6	Extraction of Mono-aural Vocal and Non-Vocal Components Exploiting 'ANOVA' Computational METHOD IN REPET [6]	Electronics and communication
7	WORK SMARTER, NOT HARDER: A TUTORIAL ON DESIGNING AND CONDUCTING SIMULATION EXPERIMENTS [7]	operation research
8	A MODEL-DRIVEN ENGINEERING APPROACH TO SIMULATION EXPERIMENT DESIGN AND EXECUTION [8]	Computer science and software
9	Assessment of WiFi RSS using Design of Experiment for Mobile Robot Wireless Positioning System [9]	Mechanical engineering
10	Animation technology content of the gender factor differences [10]	Computer science and software
11	Evaluation of Data Mining Tools for Telecommunication Monitoring Data Using Design of Experiment [11]	Electrical and computer engineering

In the above table it is clearly shows that computer science is the field where two-way ANOVA is used by many researchers. In this paper authors also used this technique as a data mining tool.

IV. HYPOTHESIS DESIGN

Based on the objectives of study two independent categorical variables are gender and yearly income. There are three sets of null hypothesis for the given set of data for study:

H1: There is no significant difference between population means of gender.

H2: There is no significant difference between population means of yearly income.

H3: There is no interaction between gender and yearly income.

V. RESEARCH METHODOLOGY

There are four steps in methodology.

1) Data selection:
Data collected from respondent who use mobile shopping. All age group people from India is participated in this survey. The maximum frequency age group is 18-25 years means young age people.

2) Data collection method:
Online survey through Google forms is used to collect data from major parts of India. The collected data was summarized with the help of spreadsheets.

3) Data selection:
There are 335 samples collected for two predefined questions about product type and payment method.

4) Tool used for study:
In this study authors used 'R' open source tool for analysis. 'R' is a most powerful language used for statistical computing and graphics.

VI. DATA ANALYSIS TECHNIQUE

Qualitative and quantitative data both are used for study. Qualitative data provide support to quantitative data to provide solution of research problem/hypothesis. Quantitative data is analyzed by statistical test Two-way ANOVA.

VII. RESULTS AND DISCUSSION

Authors used Two-way ANOVA for the collected data to find association between shopping habit and demographics (Gender, yearly income) for mobile commerce user's in India.

1) Summary of collected data

TABLE III. SUMMARY OF DATA COLLECTED FOR STUDY

Shopping habit	Gender	Yearly income
Min:1	Female: 131	<I lakh: 44
Mean: 2.275	Male: 204	>7 lakh: 70
Median : 2		1 lakh – 3 lakh : 83
Q1: 1		3 lakh – 5 lakh : 78
Q3: 4		5 lakh to 7 lakh :60
Max: 4		

It can be seen on table III that frequency of male participants is more than female which means that Male users are more intended to mobile shopping than female users in India. It can be also seen that all income group people participated in the survey where the highest frequency yearly income group is 1 lakh to 3 lakh. Shopping habit is in the form of qualitative form in questionnaire which is here coded as quantities to perform test. Coding table for shopping habit is shown in table IV.

TABLE IV. TRANSFORM SHOPPING HABIT IN QUANTIATIVE FORM

Shopping habit type	coded value
Occasionally	1
Daily	2
Weekly	3
Monthly	4

2) Two-way ANOVA Table

To validate H1: There is no significant difference between means of gender and H2: There is no significant difference between means of yearly income two-way ANOVA table shown in table V.

TABLE V. TWO-WAY ANOVA TABLE TO VALIDATE H1 AND H2

SSOURCE	SUM OF SQUARES	DF	MEAN SQUARES	F	SIG	H_0
Gender	8.46	1	8.4585	6.0690	0.01427	Accepted H1
yearly income	84.44	4	21.10890	15.1458	2.294e-11	Accepted H2
gender * yearly income	2.88	4	0.7209	0.5173	0.72310	Rejected H3
residual	452.96	325	1.3937			

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

It can be seen from table 5 that significance value for gender is 0.01427 which is significant at 95% confidence. Similarly for yearly income value of P is $2.294e^{-11}$ which indicate that population mean of yearly income is significant at 9999% confidence. There two results shows acceptance of H1 and H2.

3) Interaction between Gender and Yearly income towards shopping habit

Test results to check interaction between independent demographic variables gender and yearly income towards shopping habit presents in table 6. It can be seen from table 6 that there is no influence of gender and yearly income towards shopping habit. From table 6 it can also be seen that there is a interaction between gender and yearly income. The difference of gender is only caused by difference of yearly income which is used.

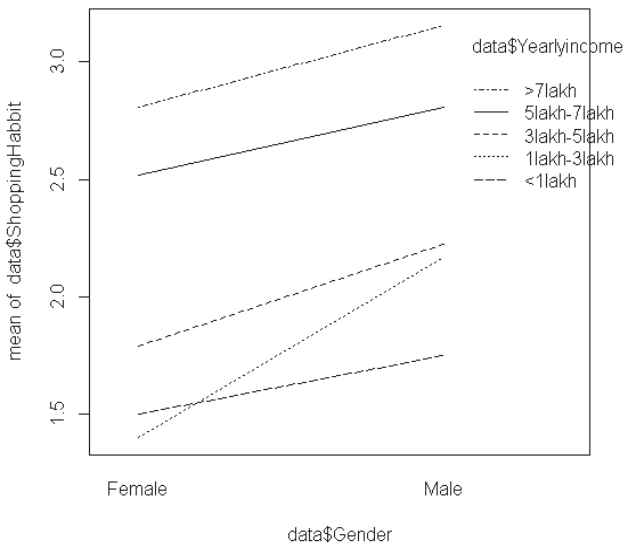

Fig 2: Interaction between Gender and yearly income towards shopping habit

Fig 2 clarifies the interaction between gender and yearly income towards shopping habit. In the above figure 2 it is seen that there is no interaction between yearly income group > lakh, 5 lakh to 7 lakh and 3 lakh to 5 lakh. These are shown by three parallel lines in fig 2. But there is a interaction between yearly income group 1 lakh to 3 lakh and less than 1 lakh which is seen by two crossed lines in fig

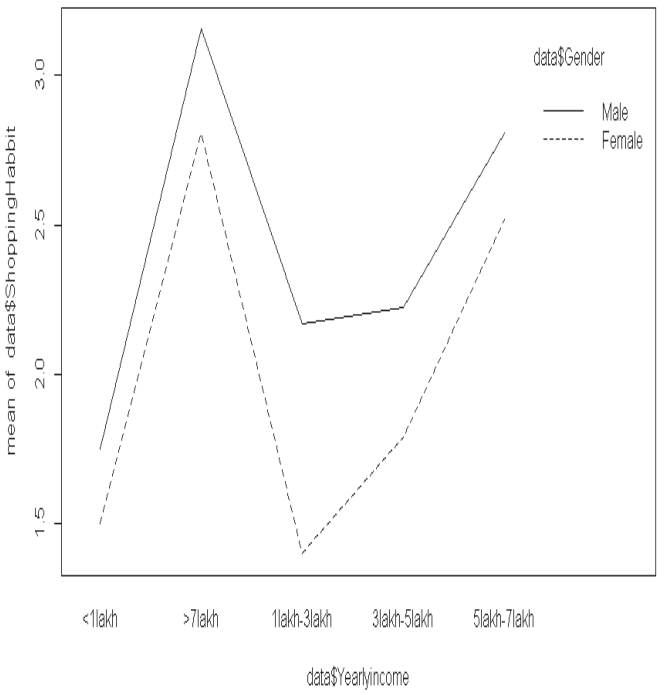

Fig 3: Interaction between Yearly income and Gender towards shopping habit

Figure 3 clarifies the no interaction between yearly income and gender towards shopping habit. In fig 3 we interchange the independent variable gender to yearly income. In the above fig 3 it is clearly seen that major lines are parallel which shows no interaction. It can also be seen that the major difference where income group of male and female varies are 1 lakh to 3 lakh and 3 lakh to 5 lakh. Because of these differences in income group in fig 2 we see interaction between gender and yearly income towards shopping habit.

VIII. CONCLUSION

On the basis of analysis, results and discussion the following conclusions are drawn:

1) There is no significant difference between population means of gender means acceptance of H1. In table 3 we see that male users are 204 while female users are 131 who participated in study. Results of table 5 shows that there is no gender difference in shopping habit means male and female both are equally paticipated in mobile shopping.

2) There is no significant difference between population means of yearly income means acceptance of H2. In table 3 we see that frequency of different yearly income group varies in number. But the results in table 5 clearly show that there is no difference between means of different yearly income group.

3) There is an interaction between gender and yearly income towards shopping habit.

These results drawn from study are helpful to personalize the shopping experience of mobile commerce users. In the future work we try to add more demographics of user's to get better results.

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