Web Page Design Based on Generation Differences Using Hesitant Fuzzy Sets Preprint Version Information

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Abstract.

Online shopping has a vital place in shopping behavior. Various factors have an impact on individuals' motivations for online shopping. In this study, the online shopping motivation of individuals who have experienced that earlier has been evaluated with regards to the Technology Acceptance Model, Diffusion of Innovation Theory, and Extended Unified Theory of Acceptance and Use of Technology. An integrated model is developed by using the innovativeness and relative advantage factors from the Diffusion of Innovation Theory; perceived usefulness, perceived ease of use, attitude towards use and usage intention factors from Technology Acceptance Model and finally habit, hedonic motivation and social influence from Extended Unified Theory of Acceptance and Use of Technology.

All those factors and relationships between factors were tested using PLS-SEM. The model is employed to test the online shopping behavior of Generation X, Y, and Z and revealed the differences among those 3 groups. After found out differences and significant relationships among generations, hesitant fuzzy set method is used to explain how to webpage design should be for each generation members. The study explains which factors are given priority when building a webpage for target generation based on factors of proposed model.

Keywords: Generation Cohort, Hesitant Fuzzy Sets, Web-Page Design, PLS-SEM

1 Introduction

Shopping via internet or online shopping has crucial impact on our lives. Shoppers want to glance at more alternatives and reduce shopping time. In 2019, E-commerce retailing market size in Turkey is approximately $31.5 billion dollars and it grew nearly 42% compared to 2018 [1]. A good or service is sold by company to consumer directly through internet, this system called B2C e-commerce or retailing e-commerce [2]. In the light of growth B2C e-commerce in Turkey this paper is about online shopper behavior and web-page design suggestion by taking into consider behavior of online shoppers. Behavior of online shoppers has tested with an integrated model

which is proposed by using factors of diffusion of innovation theory [3], technology acceptance model [4] and extended unified theory of acceptance and use of technology [5]. In order to running model data are collected and online shoppers are classified based on their generations. Generations are determined as Generation X (Gen X), Generation Y (Gen Y) and Generation Z (Gen Z) based on generation cohort theory.

The structure of the paper as is follows. Section 2 presents diffusion of innovation theory (DOI), technology acceptance model (TAM) and unified theory of acceptance and use of technology (UTAUT2) and factors which are used in the proposed model. And there is also that Gen X, Y and Z is explained in this section. Section 3 explains the fundamental concept of research model and sample data and partial least squares structural equation modelling (PLS-SEM) and hesitant fuzzy cognitive mapping (HFCM). Scenarios are generated and suggestions are given regards to scenarios towards web-page design and results obtained from PLS-SEM are shown in Section 4. in Section 4. Concluding remarks are presented in Section 5 some future suggestions are given about web-page design and online shoppers behavior.

2 Literature Review

2.1 General Structure of Theorems

DOI explains spreading of new idea or new technology on social system via which channels [6]. Rogers claims that innovation itself, communication, time and social system affect the diffusion of innovation. An innovation goes through information, conviction, decision, implementation and verification phases. [7] In this study two factors are used which are defined in DOI.

TAM is model which explains adoption of new technologies [4]. TAM is derived from Theory of Reasoned Action [9]. Main skeleton of the model which is proposed in this study is TAM. All factors of TAM are used.

Unified theory of acceptance and use of technology (UTAUT) is adapted from TAM and (UTAUT2) is broad version of UTAUT. UTAUT2 tries to measure adoption of new technologies or ideas. In this study, hedonic motivation, habit and social influence factors are used from UTAUT2.

2.2 Factors

In this section, general concept of factors which are used in this study are explained briefly. Attitude towards use (ATU) is the degree to which shoppers like online shopping idea [10]. Behavioral Intention (BI) is intent or determination towards online shopping [11]. In this study BI is defined as to continue online shopping. Hedone is a word which comes from ancient Greek era and means pleasure [14] and hedonic motivation (HM) is take pleasure in doing something [5]. From online shopping perspective HM is the degree of pleasure that customers take from online shopping. Habit (HBT) is an act that a person performs automatically after many learnings [5]. In this paper HBT is adapted to want shopping in online because of past experiences. Adopting a new idea before any other person in a social system [6] or making a decision

without affected from others [8] is called innovativeness (IN). Perceived ease of use (PEoU) defined as "the degree to which a person believes that a particular system would be free of effort." [4]. From viewpoint of online shopping, PEoU is perception of customer how easy shopping in online [10]. Perceived usefulness (PU) defined as "the degree to which a person believes that using a particular system would enhance his or her job performance." [4]. From viewpoint of online shopping, PU is a sense of fulfilment or benefit when shopping in online [12 -13]. Relative advantage (RA) is defined as "the degree to which an innovation is perceived as being better than the idea it supersedes." [6]. In this study, RA adopted as to degree online shopping idea better than any other shopping methods. Social Influence (SI) is an effect upon individual that comes from other people [5].

2.3 Generations

According to Karl Mannheim, generations can be classified that individuals are born with same era who are affected from same historical and social phenomenon. Individuals within same group have similar acts, opinion and attitude. In this study cover three generations: Gen X, Gen Y and Gen Z.

Members of Gen X are born between 1964-1979. In comparison with western part of world, members of Gen X in Turkey don't meet with technology on their early age. Gen X are defined as individualistic and pragmatist [16-17].

Members of Gen Y are born between 1980-1996. Most of the members Gen Y who are born in Turkey grow with same technology level as peers that live in western world. [15-16-17]

Members of Gen Z are born in 1996 and later. Gen Z has born in high level technology and digital era. Gen Z is very good at using technology and see the technology as their limb. [16-18]

3 Research Model and Methodology

This study builds on the question that "what is the motivation of online shoppers to continue online shopping?" and "what is differences between generations?" After determining the factors impact on online shopping study aims to make suggestion upon web-page design using these factors.

3.1 Research Model and Sample Data

In order to testing consumer behavior for online shopping the model is introduced. Proposed model consists of 9 factors which are taken by DOI, TAM and UTAUT2. All nine factors are adapted to context of this study. Figure 1 shows that relationships between factors. Arrows show that relationships and pointy head of arrow shows relationship direction. For instance, when SI increases HM increases too. This structure is valid for every relationship. All relationships are constituted as a result of the literature review and a new model has been revealed.
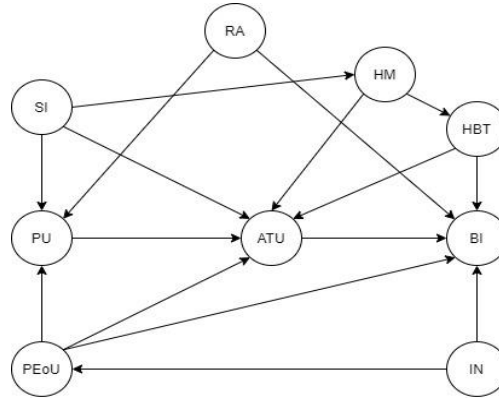
Fig. 1. Research Model

After model construction has been done data collection procedure starts. A questionnaire is prepared based on the measurement question of the literature. The questionnaire consists of 38 questions and 7 points Likert scale is used. 1 point indicates full disagreement and 7 point indicate full agreement. 822 responses are obtained and 111 of it 711 valid responses. 86 responses belong Gen X, 426 responses belong Gen Y and 199 responses belong Gen Z.

3.2 Methodology

PLS-SEM

With the purpose of analyzing hypotheses which are represented by arrows in Figure 1 and validity of proposed integrated model, PLS-SEM method is used. The method consists of two steps. In first step reliability and validity are examined. If all reliability and validity values higher than minimum expected value hypotheses can be examined in second step [19]. Model data should ensure internal consistency reliability, convergent validity and discriminant validity. SmartPLS (v. 3,2,8) is used to obtain results of the hypotheses. Model run for all generations separately.

Hesitant Fuzzy Cognitive Maps

HFCM is an approach that enables to make interpretation about uncertain conditions. There are 4 steps which are development of the model, collecting suggestion from experts, development of fuzzy envelope for hesitant fuzzy linguistic sets and operation of HFCM [21].

In this study network model development and casual relationships between factors are determined by using literature. Figure 1 in section 3 represents the network model and casual relationships. To compare relationships among factors f^2 values are used instead of expert suggestion. f^2 values, which can be seen at Table 1 in section 4, have been transformed to linguistic terms and these linguistic terms have been used to generate trapezoidal membership function through fuzzy envelope operation.

4   Results

Table 1. Significance of hypotheses and f^2 values.

Generation X			Generation Y			Generation Z		
Hypothesis	f^2	Significancy	Hypothesis	f^2	Significancy	Hypothesis	f^2	Significancy
PU → ATU	0,183	Significant	PU → ATU	0,118	Significant	PU → ATU	0,154	Significant
PEoU → ATU	0,001	Non-significant	PEoU → ATU	0,12	Significant	PEoU → ATU	0,087	Significant
PEoU → PU	0,101	Significant	PEoU → PU	0,064	Significant	PEoU → PU	0,221	Significant
PEoU → BI	0,002	Non-significant	PEoU → BI	0,015	Significant	PEoU → BI	0,026	Significant
RA → BI	0,004	Non-significant	RA → BI	0,002	Non-significant	RA → BI	0	Non-significant
RA → PU	0,718	Significant	RA → PU	0,374	Significant	RA → PU	0,352	Significant
IN → BI	0,002	Non-significant	IN → BI	0,001	Non-significant	IN → BI	0,013	Non-significant
IN → PEoU	0,084	Significant	IN → PEoU	0,106	Significant	IN → PEoU	0,013	Non-significant
HM → ATU	0,087	Significant	HM → ATU	0,072	Significant	HM → ATU	0,087	Significant
HM → HBT	0,152	Significant	HM → HBT	0,316	Significant	HM → HBT	0,21	Significant
HBT → BI	0,012	Non-significant	HBT → BI	0,003	Non-significant	HBT → BI	0,002	Non-significant
HBT → ATU	0,064	Non-significant	HBT → ATU	0,008	Non-significant	HBT → ATU	0,038	Significant
SI → HM	0,173	Significant	SI → HM	0,16	Significant	SI → HM	0,113	Significant
SI → ATU	0,041	Non-significant	SI → ATU	0,083	Significant	SI → ATU	0,055	Significant
SI → AF	0,055	Non-significant	SI → AF	0,054	Significant	SI → AF	0,108	Significant
ATU → BI	3,374	Significant	ATU → BI	1,847	Significant	ATU → BI	1,605	Significant

Hypotheses significance and strength of relationship aka f2 are shown at Table 1. 8 out of 16 relationships for Gen X, 12 out of 16 relationships for Gen Y, and 12 out of 16 relationships for Gen Z are statistically significant. Relationships between I → BI, HBT → BI and RA → BI are statistically non-significant for all generations.

f^2 values represents impact between casual relationships. Definition of f^2 values in a manner of linguistic terms as these: <0.02 represents there is almost no impact; .02-0.015 represents there is weak impact; 0.15-0.35 represents there is average impact and >0.35 represents high impact between relationships [20]. From this point of view general structures of HFCM is created. When creating this construction linguistic terms which are represented by f^2 values taken as at least.

The following part consists of the simulation of divergent scenarios under HFCM model and suggestions towards web-page design. Scenarios have been run under hyperbolic tangent function and λ value, which represents time dependent changes, is taken as 0.25. For each generation a scenario has been generated. For Gen X "what if PEoU lack of for the web-page?" question has been asked and for Gen Y and Z "what if HM lack of for the web-page?" question has been asked.

The following part consists of the simulation of divergent scenarios under HFCM model and suggestions towards web-page design. Scenarios have been run under hyperbolic tangent function and λ value, which represents time dependent changes, is taken as 0.25. For each generation a scenario has been generated. For Gen X "what if

PEoU lack of at the web-page?" question; for Gen Y "what if HM lack of at the web-page?" and "what if SI lack for Gen Z?" questions have been asked.

4.1 Scenarios

This scenario is generated for Gen X and simulates situation that lack of PEoU at web-page. Figure 2 shows lack of PEoU condition. Lack of PEoU decrease ATU which represent positeve idea towards online shopping, firtly and BI which represent intention to shop decrease afterwards. As regards to this scenario, web-page has to seems wieldy and emphasise and convince Gen X web-page is easy for shopping.
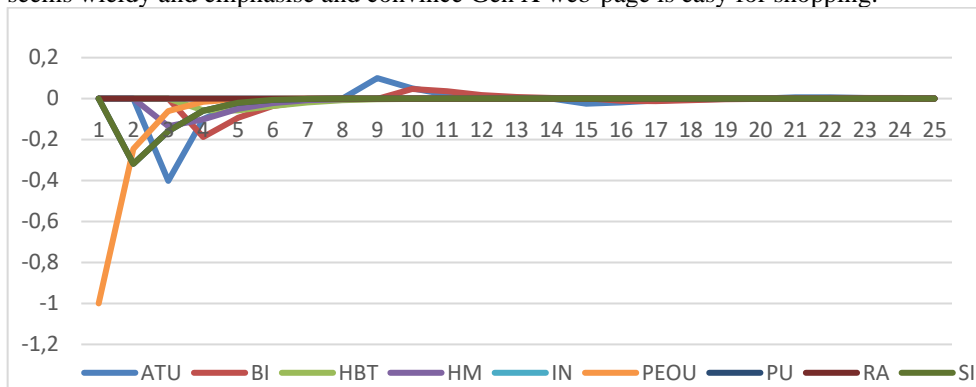

Fig. 2. HFCM simulation for Gen X.

Second scenario is about Gen Y and HM. Figure 2 shows lack of HM situation. When HM doesn't exist for shopping Gen Y doesn't want to shop in online. ATU and BI decrease rapidly in a short term. To more attract Gen Y, a web-page should contain hedonic items. Gen Y has to be entertained when they are shopping online.
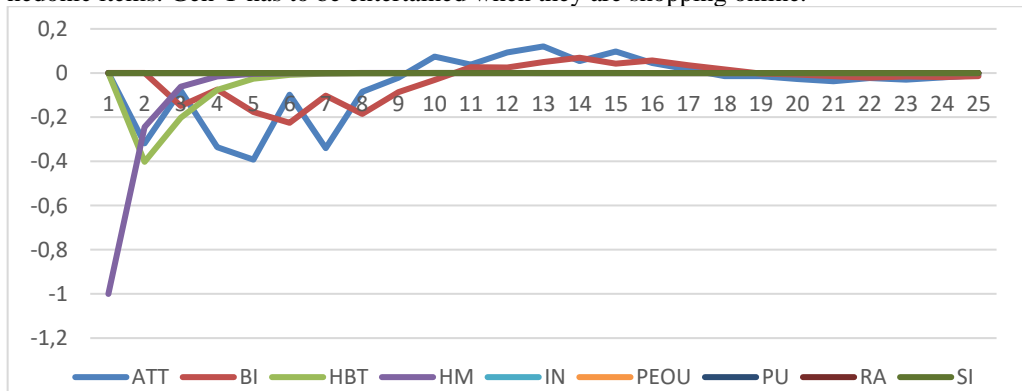

Fig. 3. HFCM simulation for Gen Y.

Third scenario is simulated for Gen Z. Figure 4 shows lack of SI case. Lack of SI decrease ATU after first iteration and BI fallowing ATU at other iteration. To

increase attractability of web-page for Gen Z, Gen Z has to be convienced about most of people use this web-page. For that purpose influencer may be usefull to affect Gen Z.
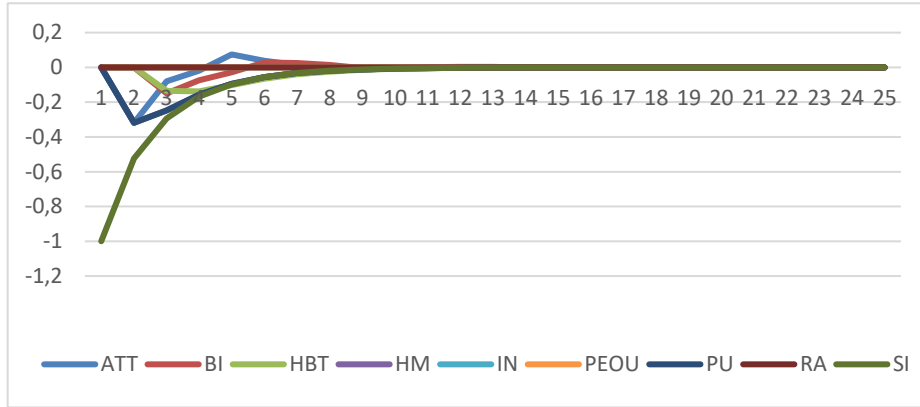

Fig. 4. HFCM simulation for Gen Z.

5   Conclusion

In this study we focused on factors that affects online shopping and web-page design. For these purposes we used PLS-SEM and HFCM methods. First of all, we developed a model which is gathered by 3 main model and contains 9 factors. We examined their relation and we found statistically significant relations for each generation separately. Solutions which obtained from PLS-SEM is used to generated scenario. Effect size between significant relationships were transformed to linguistic terms for HFCM method. For each generation a different scenario was generated. One factor is taken away from the model which affects the ATU and BI. Simulation has been shown and result of simulation interpreted briefly for each generation separately.

Although study analyzes lots of conditions it has several limitations. İncreasing sample size may changes the either relationship between factors or simulation of lack of PEoU for Gen X. To construct HFCM, PLS-SEM results used only.

Future studies may also construct the HFSM construction with an expert opinion. And also, future research may remove factors from the model that are non-significant for all factors and additional factors may be add in the model.

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