International Journal of
INTELLIGENT SYSTEMS AND APPLICATIONS IN ENGINEERING
ISSN:2147-6799 www.ijisae.org Original Research Paper

Do Gen Z buy Cosmetics using Augmented Reality Impulsively? A Deep Learning-Based SEM-ANN Analysis

Anish Kaushal[1], Ashish Kaushal[2], Vandana Devi[3]

Submitted: 03/02/2024 **Revised**: 12/03/2024 **Accepted**: 20/03/2024

Abstract: Social media marketing is effective tools in relation to Generation Z's impulse purchasing behaviour within fashion industry in the context of cosmetics purchase. However, there is research gap on mediating roles of media types and ease of payments on social platforms in awakening the interest of Gen Z females and moderating roles of virtual reality (VR). SEM-ANN was conducted based on 287 valid responses. The findings reveal that media can trigger a stronger urge to buy impulsively and impulse buying intention. Moreover, the awakening of interest and ease of payment options plays mediating roles in this process. Secondly, with the recent advancements of virtual reality (VR) technologies, VR applications in cosmetics are increasingly becoming an inevitable trend of future shopping. The empirical results show that media types and ease of payments results in creating urge to impulsive purchase behaviour. Furthermore, the role of AR and VR strengthens the impulsiveness trait in driving the urge to buy impulsively.

Keywords: *urge, impulsively, behaviour, SEM-ANN, impulsiveness*

Introduction

Generation Z demographic account for approximately 32 percent of the global population. whereas in Indian scenario it is estimated to be over 472 million individuals (Bloomberg 2019). The current cohort, nurtured by Generation X, exhibits a notable contrast to the wandering millennials. Gen Z prioritise acquisition of skills over financial compensation, value experiences over traditional career paths, and exhibit little tolerance for societal conventions or parental validation. The demographic composition of the cohort in India has yet to be classified; however, it is noteworthy since they are maturing amidst worldwide and significant economic turmoil.

The beauty and fashion sectors are experiencing significant growth on electronic platforms, as seen by the increasing number of advertisers utilising social media channels to interact with consumers [4]. Generation Z individuals often initiate their consumer behaviour by making autonomous purchases in the realm of fad product categories. The members of Generation Z utilise cosmetic products as a means of self-expression. The acquisition of cosmetic products typically does not necessitate significant problem-solving efforts, resulting in impulsive purchasing of some things. [6] found that a significant proportion of Generation Z customers (41%) exhibit impulsive buying tendencies as prevalence of social media platforms has become a customary means for seeking inspiration, as this cohort has matured alongside the internet [6]. Therefore, it is imperative to design strategies that effectively address the demands of this specific target demographic in a timely manner. [34] consumer cryptography experience positively impacts digital trust during impulse buying as consumers exhibit reduced brand loyalty and display a propensity for rapid consumption of cosmetic goods [6]. Exploring this topic further could yield valuable insights into the impulsive buying tendencies of Generation Z.

[1]*Assistant Professor, School of Management Studies, Baddi University, Himachal Pradesh*
[2]*Assistant Professor, O P Jindal Global University, Sonipat, Haryana*
[3]*Swiss School of Business Management, Geneva, Switzerland*

Review of Literature

e-Impulse purchase behaviour

Impulsiveness positively affects the intention to engage in online purchasing [13] due to immersive shopping experience [32], marketing stimuli and individual's impulsive characteristic [25], psychological, emotional, and situational circumstances [39], [34] technological progressions,

IoT, social media. time-saving, trust, convenience play [29], [21], high levels of ease and facilitating mobile payments through smartphones [15], influence of social media [40] have been explored as determinants for e-impulse purchase behaviour. However, in past two decades researchers began to investigate the factors and consequences of online impulse buying, known as e-impulse buying (e-IB), [13] highlighted that augmented reality (AR) combined with determinants create shifts in e-impulse behaviour creating noteworthy alteration in e-shopping context [30], [38] internet buyers are expected to surpass 920 million by the year 2025. Furthermore, it is evident that there exists a dearth of scholarly literature pertaining to the intermediary role played by owned/earned media, as well as the influence of digitalization of payments on the reinforcement of impulsive buying tendencies.

Role of social media in impulsive behaviour

Social media's importance is particularly pronounced due to the crucial role that visual elements play in the promotion of fashion products [26] [22] and fashion influencers credibility [20], pleasure attribute evades the estimation phase of decision-making process [26], acts as catalyst for impulsive buying behaviour [22], [17] online shopping enjoyment and emotional brand attachment as urge to buy impulsively on the internet [14]. Despite the limited amount of existing literature on the influence of social media mediates in fashion purchase decisions impulsively, such as product images, [33] [39] [42]. Hence, the following hypothesis are proposed:

H1: Social media mediates the urge to purchase cosmetic goods by Gen Z females.

Ease of payments

Act of engaging in online transactions or payments is virtual process creates an illusion for consumers that they are not actually spending their own money [37] [39] [30]. But there is not enough empirical evidence regarding the mediating role of digitalization of payment methods in influencing the urge to make impulsive purchases of cosmetic products among Generation Z individuals. Hence, the following hypothesis is proposed.

H2: Ease of payment option positively creates urge to buy cosmetic goods by Gen Z impulsively

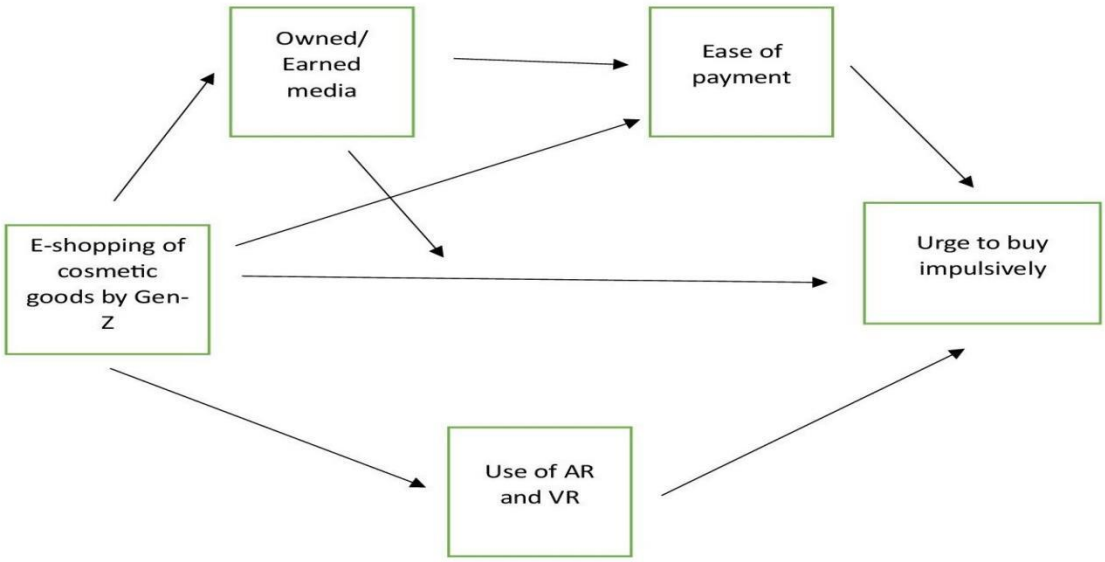
Role of augmented reality and virtual reality in e-purchase of cosmetic goods

Virtual environments trigger sensory perception, spatial awareness, and social interaction [8]. In e-commerce domain, it's essential to acknowledge that the internet world offers sensory-rich information that stimulates different human senses. [17] [34], in return, positively effects attitudes and the thoroughness of purchase intentions [1] [13] factors such as entertainment, personalization, and credibility, allowing users to actively engage [14] [5] [24] edit, or modify product information in accordance with their individual preferences. [10] for luxury goods purchase, increased visual interaction are correlated to favourable perception of the products. Moreover, [2] [36] [43] analysis of mobile try-on technology, stimulates their interactivity significantly influences role in enhancing customers' conative behaviours and affective reactions. Thus, based on the impacts of impulsivity on consumer decision-making, we put up the subsequent hypothesis within the context of virtual reality (VR) shopping we expect that mediating role of AR and VR in strengthening e-shopping of cosmetic goods by Gen Z females.

Hypothesis 3: Use of AR and VR mediates e-shopping of cosmetic goods by Gen Z females.

The present research is motivated by a lack of previous studies that have specifically examined the intermediary effects of digitization of payments [[39], the influences of owned and earned media, and the reinforcing role of augmented reality (AR) [9] and virtual reality (VR) [11] [18] on the inclination of Generation Z to engage in e-impulse buying of cosmetics (e-IB).

From the above review a model has been proposed for the present study.



Hypothetical model of the study

Methodology

In this section, a representative example will be provided to illustrate the concept being discussed. The approach of non-probability purposive sampling was selected as the optimal method for this investigation. The sample for this study consisted of customers from Generation Z who were above the age of 18, as well as those who actively engage with social media platforms [7] [24] [25]. Young professionals and college going Gen Z females exhibited a tendency to engage in frequent online shopping. The survey questions were created using the Google Form platform and thereafter sent to the target group. The data gathering process ended upon reaching a sample size of 287 respondents. The participants said that they utilised online platforms such as Amazon, Flipkart, Myntra, and Nykaa to make purchases of cosmetic items. The age range of the participants ranged from 18 to 25 years, with a mean age of (22.3) years.

The assessment encompasses distinct variables, specifically Interactivity, Vividness, Telepresence [31], Perceived Diagonsiticity, Impulsiveness, Urge to Buy Impulsively and Ease of payment options. In addition to utilising the measurements of Interactivity and Vividness [44], this study also incorporates research to measure Perceived Diagnosticity. Furthermore, efficacy of social media was assessed from [41], [19], research was utilised to evaluate the Urge to Buy Impulsively. Additionally, five statements borrowed from [8] study are employed to measure Impulsiveness. Upon conducting a thorough examination of the existing body of research, a self-administered survey was meticulously crafted by incorporating scale questions that were borrowed from firmly established and precise measurements. The e-IB construct is operationalized using three items derived from the work of [3].

This exploration espoused identical methodologies as earlier studies [37] [32] [26] [28] [12] [6] to validate exploration models and test stated assumptions for exploration. In this study, two-stage logical approach is utilized, which combines artificial neural networks (ANN) with partial least structural equation modelling (PLS-SEM). PLS-SEM aimed to get a thorough grasp of the factors that significantly influence the tendency of Gen Z girls to make impulsive e-purchases of beauty products. The relinquishment of friction- grounded PLS-SEM was needed due to the intricate nature of the model and the expansive volume of pointers involved. In addition, the exploratory character of this disquisition as opposed to a conformational one, provides fresh explanation for employing PLS-SEM [20] [4] [12] [29] flexible to non-normal distribution; still, it is unfit to assay non-linear relationships between factors. Therefore, this issue is resolved by integrating the Artificial Neural Network (ANN) method with Partial Least Squares Structural Equation Modelling (PLS-SEM) to determine the relative importance of the significant variables [29] [23]. The second phase involves employing the Artificial Neural Network (ANN) methodology to ascertain the significance of the

predictors [5] [15] [43]. The use of Artificial Neural Networks (ANN) in this study enabled the detection of intricate connections (both linear and non-linear) among the elements in the constructed model, leading to the determination to continue employing contactless mobile payment technologies. In addition, the artificial neural network (ANN) method has demonstrated superior predictive capabilities compared to traditional regression approaches, as evidenced by studies conducted by [4] [21] [29].

Furthermore, the study incorporated control factors such as gender [30] [38] income [29] frequency of online purchasing [27] [38] and products categories [6].

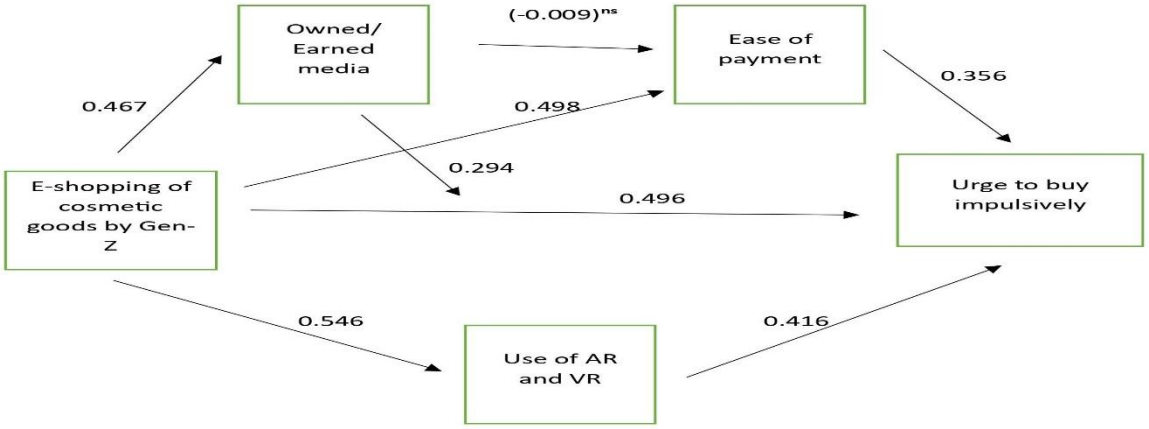
Table 1: Mean SD and Factor Loading

Items for research	**Mean**	**Std. dev**	**Factor Loading**
Interactivity	**Cronbach's Alpha: 0.741**		
The virtually equipped store offers a realistic way of interacting with the displayed goods.	5.39	1.031	0.823
In the virtual reality store, the unveiled objects respond swiftly whenever I touch them.	5.07	1.221	0.709
Vividness	**Cronbach's Alpha: 0.751**		
All the virtual reality store's items are lively and interesting.	4.59	1.283	0.673
In the virtual reality store, I can use all my senses to learn about the products.	4.64	1.106	0.675
The VR shop's appealing product information arouses the senses.	4.67	1.212	0.707
Telepresence	**Cronbach's Alpha: 0.769**		
Virtual reality makes shopping feel more like going to the store than browsing online.	4.80	1.202	0.606
I became ignorant to my nearby environment while I was exploring product in virtual reality mode.	4.49	1.861	0.709
On completing my VR shopping experience, I experienced a sense of reverting to reality, as if I had been on a journey.	4.98	1.610	0.796
Perceived Diagnosity	**Cronbach's Alpha: 0.807**		
Using virtual reality (VR) is advantageous to me purely for its own purpose, rather than solely for the stuff I may have acquired.	5.18	1.039	0.798
Exploring the function and components of anything may be an enjoyable experience.	4.49	1.904	0.729
Impulsive buying instinct	**Cronbach's Alpha: 0.893**		
The VR store made me want to buy more than my shopping objective.	4.63	1.146	0.894
While experiencing the product in VR mode, I wish to buy products that are not relatable to my shopping goal.	4.43	1.091	0.946
During my VR store experience, I find myself inclined to buy things that are not directly related to my planned purchasing objective.	4.18	1.304	0.798
Impulsiveness	**Cronbach's Alpha:0.885**		
"Go for it" my approach during purchasing anything.	3.76	1.389	0.678
I buy something without giving it any thought.	3.31	1.361	0.787
"I view, I purchase it" characterises my shopping behaviour.	2.79	1.343	0.876
I think later after the purchase describes me.	2.61	1.498	0.791
At times, I experience an inclination to make impulsive purchases.	2.98	1.483	0.647
Sometimes, I display a tendency to be impulsive in my purchasing decisions.	2.98	1.387	0.606
Ease of payment option	**Cronbach's Alpha: 0.794**		
I unintentionally make purchases of items that were not originally part of my intended shopping list.	2.95	1.289	0.729
I am unable to refrain from purchasing if I have a strong affinity for it.	2.93	1.289	0.698

Discounted pricing offers leads me to make impulsive purchases.	2.79	1.349	0.789
I make purchases based on my current emotional state.	2.81	1.362	0.679
I exceed my anticipated expenditure when purchasing the goods.	2.94	1.378	0.809
It is easy to use e-wallet whenever I want.	3.81	1.398	0.798
Electronic wallets are widely accepted leads me to use it.	4.09	1.109	0.794

Table 2: RMSE values

Neural network	Model 1 Input: MT, AR and VR Output: UBI		Model 2: Input: E of P, AR and VR Output: UBI		Model 3: Input: MT, E of P Output: UBI	
	Training	Testing	Training	Testing	Training	Testing
	RMSE	RMSE	RMSE	RMSE	RMSE	RMSE
Model 1	0.087	0.091	0.101	0.094	0.096	0.084
Model 2	0.089	0.081	0.104	0.116	0.094	0.114
Model 3	0.087	0.113	0.105	0.132	0.104	0.096
Model 4	0.318	0.079	0.103	0.114	0.095	0.069
Model 5	0.091	0.083	0.104	0.143	0.093	0.089
Model 6	0.089	0.153	0.105	0.075	0.096	0.121
Model 7	0.089	0.073	0.102	0.083	0.095	0.079
Model 8	0.112	0.119	0.092	0.128	0.094	0.121
Model 9	0.095	0.109	0.106	0.073	0.097	0.113
Model 10	0.092	0.093	0.103	0.105	0.093	0.112
Mean	0.1149	0.0994	0.1025	0.1063	0.0957	0.0998
SD	0.068	0.024	0.003	0.024	0.0032	0.0188



ns= non-significant at $p < 0.01$ level

Table 3: Sensitivity analysis

Neural network	Model 1: UBI		Model 2: UBI		Model 3: UBI	
	MT	AR and VR	E o P	AR and VR	MT	E o P
Model 1	0.600	0.400	0.641	0.359	0.507	0.493
Model 2	0.619	0.381	0.666	0.334	0.491	0.509
Model 3	0.596	0.404	0.591	0.409	0.390	0.610
Model 4	0.524	0.477	0.529	0.471	0.527	0.473
Model 5	0.719	0.281	0.635	0.365	0.522	0.478

Model 6	0.602	0.399	0.527	0.473	0.517	0.483
Model 7	0.597	0.403	0.638	0.362	0.473	0.527
Model 8	0.615	0.384	0.679	0.321	0.478	0.522
Model 9	0.538	0.461	0.556	0.444	0.480	0.520
Model 10	0.565	0.435	0.648	0.316	0.430	0.570
ARI*	0.598	0.403	0.611	0.385	0.482	0.519
NRI**	1.000	0.674	1.000	0.631	0.929	1.000

ARI* = Average relative importance; NRI** = Normalized relative importance

[33] defines an Artificial Neural Network (ANN) as a highly parallel distributed processor composed of basic processing units that possess a neural capacity to store empirical information and make it accessible for utilisation. Furthermore, ANN has been found to outperform conventional regression techniques. Three artificial neural network models were built. Table 3, however, displayed the prediction accuracy of Models 1, 2, and 3. The mean values for Root Mean Squared Error (RMSE) for both the training and testing rounds varied from 0.083 to 0.117, indicating reasonably minimal errors. Hence, it can be inferred that the artificial neural network (ANN) models exhibit a high degree of prediction precision [4] [23]. Subsequently, a sensitivity analysis was conducted to determine the relative relevance of the exogenous components compared to the endogenous constructs, using a normalised ranking. The findings presented in Table 3 indicate that in ANN Model 1, media types (MT) have the highest predictive power for urge to purchase impulsively (UBI) with a normalised relative relevance of 100%, compared to AR and VR which have a relative value of 67.4%. In relation to ANN Model 2, the factor of Ease of payment options (E o P) is highly significant for UBI, with a weightage of 100%. On the other hand, the predictors of UBI, such as AR and VR, have a weightage of 63.1%. Ultimately, in the case of ANN Model 3, Ease of payment (E o P) (100%) has been identified as the primary determinant of UBI, with MT (92.9%) being the subsequent factor of significance.

Conclusions

The female participants in the study identified social media content as mostly consisting of visual elements. [35] found that women exhibit higher levels of engagement on social media platforms compared to men [25] [31]. According to a survey conducted among females belonging to Generation Z, it was found that they utilise social media platforms to gain valuable insights into the personal lives of celebrities, as well as to derive inspiration for their own fashion preferences. Engaging in the practise of monitoring celebrities and influencers, observing their activities and fashion choices [35]. This implies that females belonging to Generation Z utilise these platforms to fulfil various objectives, hence necessitating a distinct approach by brands when targeting this demographic. The findings suggest that while video on sites like Instagram Reels and YouTube Shorts does serve as a source of amusement, its primary function is for social interaction and information sharing [17]. The primary reason for this trend among Gen Z participants can be mostly allied to their increased exposure to a diverse array of products across various social media platforms. Prior to the emergence of influencer material, individuals would have to navigate through an entire brand's website to explore their offerings. However, with the advent of influencers, it has become much easier for Gen Z to stay informed about the current styles, which in turn significantly impacts their impulsive buying behaviour.

According to [26], the fashion sector is significantly impacted by influencer media, which has been identified as the primary driver of impulsive spending. This can be attributed to the influential role of visual content in marketing fashion. The utilisation of this platform possesses the potential to significantly impact the impulsive buying behaviour of female participants. The participants highlighted a notable change in consumer behaviour within the fashion business, wherein they expressed that influencer content on social media platforms serves as a source of inspiration and provides fashion enthusiasts with ideas and trends, as opposed to brand-generated content. Generation Z acknowledges the significance of social media as a crucial component of contemporary marketing,

potentially due to their upbringing in a world characterised by extensive commercialization [19].

Consistent with these findings [16] the present research also revealed that participants displayed a preference for fashion brands that engage in creative content creation, as opposed to those that heavily rely on product advertisements. The results direct that contemporary fashion trends are currently influenced by the content produced by social media influencers. Therefore, the utilisation of bold, vibrant colours (BGC) on a brand's social media platform was found to be ineffective in stimulating Generation Z's impetuous buying behaviour. The results of the study indicate that marketers would benefit by incorporating user-generated content from social media platforms as a means of fostering consumer interaction, rather than relying solely on brand -generated content on social media platforms.

Prior studies have suggested that Generation Z exhibits a preference for subtle marketing signals.

References:

[1] A. A. Alalwan, "Investigating the impact of social media advertising features on customer purchase intention," *International Journal of Information Management,* vol. 42, pp. 65-77, Oct 2018.

[2] A. Coley, B. Burgess, "Gender differences in cognitive and affective impulse buying," *Journal of Fashion Marketing and Management*, vol. 7, 3, pp. 282–295, Sep 2023.

[3] A. J. Badgaiyan, A. Verma, "Does urge to buy impulsively differ from impulsive buying behaviour? Assessing the impact of situational factors. *Journal of Retailing and Consumer Service*, vol. 22, pp. 145–157, Jan 2015.

[4] A. J. Lau, G. W.-H. Tan, X.-M. Loh, L.-Y. Leong, V.-H. Lee, K.-B. Ooi, "On the way: Hailing a taxi with a smartphone? A hybrid SEM-neural network approach," *Machine Learning with Applications*, vol. 4, pp. 1-11, Jun 2021.

[5] A. U. Zafar, J. Qiu, Y. Li, J. Wang, M. Shahzad, "The impact of social media celebrities' post and contextual interactions on impulse buying in social commerce," *Computer in Human Behavior,* vol. 115, Feb 2022.

[6] C. Liao, P-L. To, Y-C. Wong, P. Palvia, M.D. Kakhki, "The impact of presentation mode and product type on online impulse buying decisions," *Journal of Electronic Commerce Research*, vol. 17, no. 2, pp. 153-168, May 2016.

[7] D. Brewis, "What Gen Z expects from the online retail experience," IMRG. https://www.imrg.org/blog/generation-z-online-retail-expectations/

[8] D. Rook, R. J. Fisher, "Normative influences on impulsive buying behavior." *Journal of Consumer Research*, vol. 22, no. 3, pp. 305-313, Dec 1995.

[9] D. Shin, "How does immersion work in augmented reality games? A user-centric view of immersion and engagement." *Information, Communication & Society*, vol.22, no. 9, pp.1212–1229, Dec 2017.

[10] E. Beuckels, L. Hudders, "An experimental study to investigate the impact of image interactivity on the perception of luxury in an online shopping context," *Journal of Retailing and Consumer Services*, vol. 33, pp. 135–142, Nov 2016.

[11] E. Pantano, A. Rese, D. Baier, "Enhancing the online decision-making process by using augmented reality: A two country comparison of youth markets." *Journal of Retailing and Consumer Services*, vol. 38, pp. 81–95, Sep 2017.

[12] G. A. Alkwasi, N. Ali, A.S. Mustafa, Y. Baashar, H. Alhussain, A. Alkahtani, S.K. Tiong, J. Ekanayake, "A hybrid SEM-neural network method for identifying acceptance factors of the smart meters in Malaysia: challenges perspective," *Alexandria Engineering Journal,* vol. 60,1, pp. 227-240, Feb 2021.

[13] H. Gaber, L.T. Wright, K. Kooli, "Consumer attitudes towards Instagram advertisements in Egypt: The role of the perceived advertising value and personalization," *Cogent Business & Management*, vol. 6, no. 1, pp. 1-13, May 2019.

[14] H. Li, T. Daugherty, F. Biocca, "Characteristics of virtual experience in electronic commerce: A protocol analysis." *Journal of Interactive Marketing*, vol. 15, no. 3, pp. 13–30, Jul 2010.

[15] H. Zhang, H. Xiao, Y. Wang, M. A. Shareef, M. S. A. Akram, M. A. S. Goraya, "An

integration of antecedents and outcomes of business model innovation: A meta-analytic review," *Journal of Business Research,* vol.131, pp. 803–814, Jul 2021.

[16] J. Ahn, J. Kwon, "The role of trait and emotion in cruise customers' impulsive buying behavior: an empirical study," *Journal of Strategic Marketing*, vol. 30, no. 5, pp. 1–14, Aug 2020.

[17] J. Johnson, "Age distribution of Instagram users in Great Britain (GB) from the 1st quarter 2015 to 1st quarter 2018. https://www.statista.com/statistics/536660/age-distribution-of-instagram-users-in-great-britain/.

[18] J. Lim, R. Ayyagari, "Investigating the determinants of telepresence in the e-commerce setting." *Computers in Human Behavior*, vol. 85, pp. 360–371, Aug 2018.

[19] J. V. Chen, S. Ruangsri, Q. Ha, A.E. Widjaja, "An experimental study of consumers' impulse buying behaviour in augmented reality mobile shopping apps," *Behaviour & Information Technology*, vol. 41, 15, pp. 3360-3381, Oct 2021.

[20] J.F. Hair, W. Black, B.J. Babin, R.E. Anderson, *Multivariate data analysis. A global perspective*. 7th ed. Harlow: Pearson Prentice Hall, 2014.

[21] K. Ooi, V. Lee, G. Tan, T. Hew, J. Hew, "Cloud computing in manufacturing: the next industrial revolution in Malaysia?" *Expert Systems with Applications*, vol. 93, pp. 376-394, Mar 2018.

[22] K. Shamim, M. Azam, T. Islam, "Beauty influencers and educators the urge to buy impulsively? Social commerce context." *Journal of Retailing and Consumer Services*, vol. 77, March 2024.

[23] K. W. Lau, P. Y. Lee, "Shopping in virtual reality: a study on consumers' shopping experience in a stereoscopic virtual reality," *Virtual Reality*, vol. 23, pp. 255–214, Aug 2018.

[24] Khanom, R., 2018. Beauty influencers and educators – UK – august 2018. https://reports.mintel.com/display/859343/.

[25] King, M., 2019. Technology habits of generation Z – UK – September 2019. https://reports.mintel.com/display/918584/?fromSearch=%3Ffreetext%3D%2520technology%2520habits.

[26] L. Aragoncillo, C. Orus, "Impulse buying behaviour: an online-offline comparative and the impact of social media," *Spanish Journal of Marketing*, vol. 22, 1, pp. 42-62, Nov 2017.

[27] L. T. Huang, "Flow and social capital theory in online impulse buying" *Journal of Business Research,* vol. 69, 6, pp. 2277–2283, Jun 2016.

[28] L. V. Casaló, C. Flavian, S. Ibáñez-Sánchez, "Be creative, my friend! Engaging users on Instagram by promoting positive emotions," *Journal of Business Research,* vol. 130, pp. 416-425, Jun 2021.

[29] L-Y. Leong, T-S. Hew, K-B. Ooi, V-H. Lee, J-J. Hew, "A hybrid SEM-neural network analysis of social media addiction." *Expert Systems with Applications,* vol. 133, 296–316, Nov 2016.

[30] M. Al-Emran, A. Granić, M.A. Al-Sharafi, N. Ameen, M. Sarrab, "Examining the roles of students' beliefs and security concerns for using smartwatches in higher education," *Journal of Enterprise Information Management*, vol.34, 4, pp. 1229-1251, Jul 2021.

[31] M.A. Shareef, Y.K. Dwivedi, V. Kumar, G. Davies, N. Rana, A. Baabdullah, "Purchase intention in an electronic commerce environment: A trade-off between controlling measures and operational performance. *Information Technology & People,* vol.32, no. 6, pp. 1345–1375, Nov 2019.

[32] S. Abdelsalam, N. Salim, R. A. Alias, O. Husain, "Understanding Online Impulse Buying Behavior in Social Commerce: A Systematic Literature Review," *IEEE Access,* vol. 20, pp. 89041–89058, May 2022.

[33] S. Haykin, *Neural Networks: A Comprehensive Foundation*. 2nd ed. NJ: Pearson Prentice Hall, 2005.

[34] S. Kim, M. S. Eastin, "Hedonic tendencies and the online consumer: An investigation of the online shopping process." *Journal of Internet Commerce,* vol. 10, no. 1, pp. 68–90, Mar 2011.

[35] S.H. Lidholm, A. Radon, M. Sundstrom, J. Balkow, "Understanding on-line fashion buying behavior on impulse: feelings nothing more than feelings" in *Advanced Fashion Technology and Operations Management*, A.

Vecchi, IGI Global book series Advances in Business Information Systems and Analytics, pp. 235–249, 2017.

[36] V. Lavoye, A. Tarkiainen, J. Sipila, J. Mero, "More than skin-deep: The influence of presence dimensions on purchase intentions in augmented reality shopping," *Journal of Business Research*, vol.169, pp. 1-12, Dec 2023.

[37] W-C. Hsu, M. Lee, K. Zheng, "From virtual to reality: The power of augmented reality in triggering impulsive purchases," *Journal of Retailing and Consumer Services*, vol. 76, Jan 2024.

[38] X. Huang, "Optimization of Marketing Strategy for "E-Commerce Live Streaming Agricultural Products" in the New Media Era," *American Journal of Industrial and Business Management*, vol. 13, 10, pp. 1094-1103, Oct 2023.

[39] X-M. L, V-H. Lee, G. W-H. Tan, K-B. Ooi, Y.K. Dwivedi, "Switching from cash to mobile payment: what's the hold-up?" *Internet Research*. vol. 31, No. 1, pp. 376-399, Feb 2021.

[40] Y. Liu, H. Li, F. Hu, "Website attributes in urging online impulse purchase: An empirical investigation on consumer perceptions." *Decision Support Systems*, vol. 55, no. 3, pp. 829–837, Jun 2013.

[41] Y. Qasem, S. Asadi, R. Abdullah, Y. Yah, R. Atan, Mohd. A. Al-Sharafi, A. Yassin, "A multi-analytical approach to predict the determinants of cloud computing adoption in higher education institutions," *Applied Sciences*, vol. 10, no. 14, pp. 1-34, Jul 2020.

[42] Y. Zhao, Y. Li, N. Wang, R. Zhou, X. Luo, "A meta-analysis of online impulsive buying and the moderating effect of economic development level," *Information Systems Frontiers*, vol. 24, pp.1667-1688, Aug 2021.

[43] Y.C. Lee, C.L. Gan, T.W. Liew, "Rationality and Impulse buying: Is your emotion a part of equation?" *Computers in Human Behavior*, vol. 12, pp. 1-11, Dec 2023.

[44] Z. Jiang, I. Benbasat, "The effects of presentation formats and task complexity on online consumers' product understanding." *MIS Quarterly*, vol. 31, no. 3, pp. 475–500, Sep 2007.