RESEARCH IN MANAGEMENT OF TECHNOLOGY AND BUSINESS
e-ISSN: 2773-5044

RMTB

Vol. 6 No. 2 (2025) 280-295
https://publisher.uthm.edu.my/periodicals/index.php/rmtb

A Foresight Study on Virtual Reality (VR) in Online Shopping in Malaysia

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DOI: https://doi.org/10.30880/rmtb.2025.06.02.023

Article Info

Received: 30 September 2025
Accepted: 01 November 2025
Available online: 01 December 2025

Keywords

Virtual reality, online shopping, foresight, issues, driver

Abstract

Virtual Reality (VR) is used to describe a three-dimensional (3D), computer-generated environment which can be explored and interacted with. It is a virtual environment that allows people to interact from their own places. People entered the virtual world by using VR headsets, which were placed over the eyes and fully immersed them in the virtual environment, creating a realistic experience in the simulation. The environment could be interacted with using hand controllers, gloves with sensors, or the VR headset itself. Using VR in online shopping has improved the shopping experience for users. The purpose of the study was to identify the issues, challenges, and trends of VR in online shopping, to study the key drivers of VR in online shopping, and to explore the future image of VR in online shopping. The target respondents were selected and mainly covered the users of VR in online shopping, totalling 384 respondents. The research used a combination of qualitative and quantitative methods. This study employed foresight instruments such as STEEPV Analysis and SPSS analysis. STEEPV analysis was used to identify the issues, challenges, and trends of VR in online shopping. SPSS analysis was used to show the results of the key drivers of VR in online shopping in the second phase of the research, with impact-uncertainty analysis. Ten key drivers were identified. The approach of impact-uncertainty analysis was used to determine the future image of VR in online shopping. The top two drivers are law and regulation, and shopping experience. 384 questionnaires were distributed to the respondents online, and the survey return rate was 57.03%. The future image was formed based on the top two drivers and represented the possible future outcomes from 2024 to 2034. The best result using VR in online shopping is Secure and Immersive VR Online Shopping, which means laws and regulations are very developed, and the shopping experience of users is good. This study aimed to help future researchers and developers increase their awareness of adopting VR in online shopping in the future.

1. Introduction

Virtual Reality (VR) is the word used to describe a three-dimensional (3D), computer-generated environment which can be explored and interacted with. It is a virtual environment that lets people interact from their own places. People can enter the virtual world by using VR headsets, which are placed over the eyes and fully immerse people in the virtual environment, creating a realistic experience in the simulation. The environment can be

interacted with by using the hand controllers, gloves with sensors or the VR headset itself. VR can let people go anywhere, helping people learn about different places and ideas by experiencing them as if they were actually there. Virtual reality has four characteristics, which are believable, fully immersive, computer-generated, and interactive. For the believable, your senses of sight and sound transport you to a virtual environment. For the fully immersive experience, with the VR headset on, you can move your head around to see things differently, exactly as in real life. For the computer-generated, most VR environments are made with intricate 3D computer visuals that adapt to our movements in real time. For the interactive, whether it's pushing a button or opening a door, you can interact with various elements in the scenario (Dom Barnard, 2023). Virtual reality is transforming online retail (VR). In order to enhance the customer's purchasing experience, e-commerce has fulfilled its promise by developing a virtual environment that mimics the touch and feel of a physical store. In actuality, there are instances when virtual reality buying provides advantages over traditional retail, such as the ability to see how a piece of furniture will fit in your living room. You can test before you buy, which will prevent you from being unhappy once you buy. Virtual reality can occasionally be more helpful to customers than a physical business (Rheude, 2023). VR can help companies close the gap between their online and physical storefronts.

Virtual Reality (VR) is the word used to describe a three-dimensional (3D), computer-generated environment which can be explored and interacted with. It is a virtual environment that lets people interact in their own places (Yasar, Writer, & Sheldon, 2024). People can enter the virtual world by using VR headsets, which are placed over the eyes and fully immerse people in the virtual environment, creating a realistic experience in the simulation. The environment can be interacted with by using the hand controllers, gloves with sensors or the VR headset itself. VR can let people go anywhere, helping people learn about different places and ideas by experiencing them as if they were actually there. Virtual reality has 4 characteristics, which are believable, fully immersive, computer-generated, and interactive. For the believable, your senses of sight and sound transport you to a virtual environment (Gibson Verity, 2024). For the fully immersive experience, with the VR headset on, you can move your head around to see things differently, exactly as in real life. For the computer-generated, most VR environments are made with intricate 3D computer visuals that adapt to our movements in real time. For the interactive, whether it's pushing a button or opening a door, you can interact with various elements in the scenario (Barnard, 2023). Virtual reality is transforming online retail (VR). In order to enhance the customer's purchasing experience, e-commerce has fulfilled its promise by developing a virtual environment that mimics the touch and feel of a physical store. There are instances when virtual reality buying provides advantages over traditional retail, such as the ability to see how a piece of furniture will fit in your living room. You can test before you buy, which will prevent you from being unhappy once you buy. Virtual reality can occasionally be more helpful to customers than a physical business (Rheude, 2023). VR can help companies close the gap between their online and physical storefronts.

Virtual reality in the future of online shopping can bring advantages and disadvantages. The first advantage of Virtual reality in online shopping is improving the online shopping experience for the customer (Hidayati, 2022). It is because the immersive product visualisation, VR, enables customers to interact with products virtually, just like they would in a physical store. Consumers can inspect the product in all directions and zoom in to see the details. Hence, it is better to see the same size as the actual item. Consumers can even use the product's functions in a simulated environment, allowing consumers to get a more realistic and better experience of online shopping (Kamil, 2023). VR can also enhance the product information to the consumers, to let the consumers make the decision to purchase by exploring product features and benefits through an interactive VR experience and not just reading the product descriptions or watching the videos that promote the product. VR can also make online shopping more accessible to people with disabilities or limited mobility. They can move freely in the virtual world and will not be unable to move due to their own defects (Hooper, 2023). The disadvantage of using VR is that customers need special gear – VR headsets – to shop in VR mode (Barnard, 2023). The needs for VR headsets may stop some people online shopping by using the VR. It is because the VR headsets are expensive, not everyone wants to spend the money to buy one. Because of this, not so many people can try using VR for online shopping, which means only a few people might use VR for online shopping. Also, using VR headsets can be tricky. People have to set them up and use them properly; it is not easy for everyone (Jain, Kalnas, Roberts, Srivastava, Su, & Wu, 2024). Sometimes, if the VR headsets have some problems, such as not working with other devices or just not working directly. This will make people unsatisfied with the VR to online shopping. Needing the special equipment is a big problem for people using VR in online shopping. While VR can make online shopping more fun, not everyone can try it because of the extra cost and hassle of getting VR headsets. Clearly, there exist advantages and disadvantages of VR in online shopping. This creates uncertainties to a certain level regarding the application of VR in online shopping in the future. Therefore, this research intends to study the foresight of VR in online shopping by analysing its drivers.

Therefore, to achieve the research objectives, issues, challenges, and trends of VR in online shopping in Malaysia are determined. Furthermore, the key drivers of VR in online shopping in Malaysia were also determined. Consequently, the future image of VR in online shopping in Malaysia is identified.

2. Literature Review

A literature review is a survey of scholarly sources on a specific topic. It provides an overview of current knowledge, allowing the researcher to identify relevant theory, methods, and gaps for the research that the researcher can apply to their paper or thesis (Shona, 2023). Horizon scanning was used to gather data on emergent current issues, challenges, and trends of VR in online shopping. The primary sources that have been used are journals, books, websites, and other online sources. Moreover, the STEEPV analysis was used to categorise the issues, challenges, trends, and threats pertinent to VR in online shopping.

2.1 Online Shopping

Online shopping is for when you suddenly need the thing that you found that is gone in your home, but you are too lazy to go out. The best choice for you is to buy it online. You just need a smartphone, find the grocery or food online delivery app and order it, and then you just need to wait for the thing to come to your home. It is easy and simple. Not only can you buy food or groceries, but you can also buy apparel, gadgets, electronics, furniture, books, footwear, accessories, jewellery, and other items online. The rapid development of digital literacy and awareness has made online shopping an integral part of our lifestyle. The best thing about this mode of shopping is that it can be done in a few minutes with just a click of a tag and can be done easily and comfortably at home or anywhere. Online shopping was already popular, but after the COVID-19 pandemic, it has undoubtedly taken the lead and become one of the most favoured and chosen shopping methods by most people (Maheshwari, 2023).

2.2 Virtual Reality (VR)

Virtual Reality (VR) originated in the 1960s within computer science and aerospace. It faced setbacks in the 1990s when early attempts to commercialise in the gaming area had failed. But by the mid-1990s, it was found that VR had the potential to treat anxiety disorders, which was recognised by clinical psychologists. VR can create a fully controllable, flexible, and interactive environment. Even though in the early days the VR equipment was too big and may have caused cybersickness, the research has shown promising results in reducing symptoms. The 2000s saw a surge in VR clinical applications, with meta-analyses confirming its efficacy. The study also explored the role of "presence" in VR therapy and patient and clinician attitudes towards VR, laying the groundwork for its integration into regular clinical practice (Lindner, 2021).

2.3 Benefit of VR in Online Shopping

According to Sohail (2024), the benefits of implementing VR technology in online shopping include excellent customer service. Having satisfied customers is key to a business thriving – especially for sensitive industries that rely on the retail shopping experience. VR stores offer such a powerful “virtual reality” shopping experience that their customers won’t go elsewhere to find something based on the visual experience alone. For obvious reasons, online stores face challenges in communicating with customers and understanding their needs and buyer behaviour. VR-integrated mobile apps and software programs can support this task as they can clearly show how visitors choose products and their decision-making process. Virtual assistants can conveniently replace real-life staff and provide customers with suggestions and shopping recommendations. In a nutshell, VR benefits are displaying product details, increasing the shopping experience and providing more suitable suggestions.

2.4 Challenges of VR in Online Shopping

The challenges of VR in online shopping are the high cost of implementation. This is one of the most significant challenges of VR technology. VR headsets, hardware, and software are expensive, which makes it difficult for users to adopt the technology. And not all customers are willing to spend money on VR headsets for online shopping. This may limit the potential of customers to use VR in online shopping, as well as retailers' investment in VR technology. Privacy and security issues: The use of VR technology may also face privacy and security issues related to customer data. Retailers must ensure that customer data is safe and protected when using VR technology (Rwizen Technologies, 2023). In a nutshell, the challenges are high implementation costs, and privacy and security issues.

2.5 Table with Issues, Challenges, and Trends

Table 1 shows Issues, Challenges, and Trends with elaboration. The table shows Issues, Challenges, and Trends that merged with the STEEPV analysis, which includes a table with Issues, Challenges, and Trends for Social, Technological, Economic, Environmental, Political and Value. For the STEEPV analysis, journals, websites, books, online newspapers, and other internet sources were analysed to decide the key issues, challenges, and trends

appropriate to VR in online shopping. Ten drivers have been determined after merging the key terms of issues, challenges, and trends by using the STEEPV analysis. The drivers used in the questionnaires were for data collection purposes. Table 1 shows the drivers related to merged issues, challenges, and trends.

Table 1 *Table of driver related to Merged Issues, Challenges, and Trends*

No.	Issues, Challenges, and Trends	Drivers
D1	Realistic and believable Try product in home Customization and personalization Virtual shopping with friends Increase communication No language barrier BNPL becomes popular	Shopping Experience
D2	VR headsets, hardware, and software can be expensive	Investment Required
D3	Opportunities for business Reduces rate of return Opportunities for product marketing Attract customer purchasing	Economic Growth
D4	Following regulations and keeping customer information safe, Virtual contract is legal Electronic evidence Can be cybercrime	Law and Regulation
D5	Visualize how a product would look Reduces rate of return Reduce time and effort spent Evaluate product quality and suitability	Decreases potential returns
D6	Technology can be used to create realistic stores Use power of AI, Combine AI and VR Evolve haptic feedback technology Use 3D simulation technology	Technology Reliability
D7	Keep safety Crafting devices that are energy-efficient and environmentally considerate Minimize transport emissions Reduce waste	Personal Safety
D8	Sustainability Reduce the need to physically shop Environmental considerations	Sustainability
D9	Immersive technology Create unique and memorable brand experiences Bridge the gap between physical and online stores	Technology Innovation
D10	Increase buyer confidence Heightened customer satisfaction Empower customers confident	Improve Communication

3. Research Methodology

In this part, focus on explaining the purpose and implementation of the research methodology. Both qualitative and quantitative methods will be used to analyse and interpret data. In the quantitative method, a foresight analysis approach known as STEEPV is used, which helps identify external factors that will influence future trends. STEEPV analysis considers Social, Technological, Environmental, Economic, Political, and Values factors (Black, 2021). This part begins by outlining the research design process and presenting a flowchart that illustrates the research stages. It will also discuss the foresight process and the insights of the population and sampling for this study. Moreover, explain the data analysis techniques and the analysis of the research instrument. The types of data used for data collection, pilot testing, and data analysis will also be described.

3.1 Research Design

Both qualitative and quantitative data will be used to analyse the data to understand the research. The research is to analyse the issues, challenges, and trends of VR in online shopping through a mixed-method approach to the

foresight process. This foresight process can be elaborated by using a combination of qualitative and quantitative methods to study the future of VR in online shopping.

The foresight study was conducted ten years into the future between the years 2024 and 2034. This research focuses on the resources and information associated with the trend of VR in online shopping. All relevant information and data are collected from various sources, including data from journals, books, conference proceedings, and other research materials related to VR in online shopping. The scope of this study is limited to online shopping users. The respondents for this study will be users of VR in online shopping. The target respondents mainly include organisational users of VR in online shopping. Questionnaires were sent to the advocate respondents, and the purpose of the questionnaire is to collect data from the respondents, and the data collected will be analysed and used for data analysis.

3.2 Research Flow Chart

The flowchart in Fig. 1 illustrates a visual display of the flow of activities in a process. The researcher understood the processes and the work for all levels within the framework. This research flowchart can help the researcher ensure that the research is carried out properly.

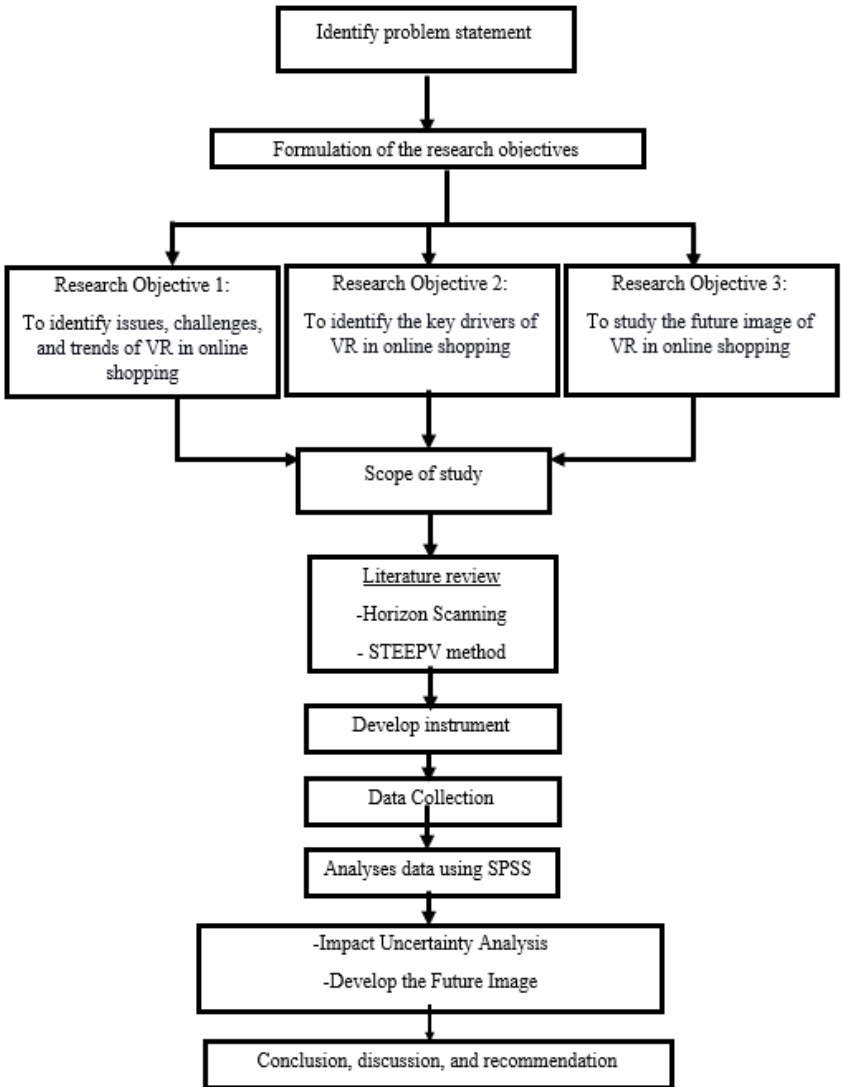

Fig. 1 *Research flowchart*

3.3 Foresight Process

The foresight process predicts what will happen in the future, collects the data, and interprets it so that it can let people know how the processes will happen (Jacobsen, & Hirvensalo, 2023). The foresight process proceeds by a few processes, the first is the horizon scanning, after that using the STEEPV to analyse data, and finally identifying the change drivers for VR in online shopping.

3.4 Horizon Scanning

Horizon scanning involves reading a range of accoutrements (e.g. academic papers, newspapers, blogs and early exploration reports) to identify signals of change. These signals of change are generally collated, clustered into themes and connections between them are considered. This information provides a base to consider and bandy with stakeholders how arising trends may affect your policy area (DPMC, 2023).

3.5 STEEPV Method

The data designing, data listing, data classification, data identification, theme comparison, repeat, data inspection, revision, data merging, and final confirmation are the ten steps of the STEEPV method.

3.6 Drivers

The factors of the drivers will change, shape, or influence future development. Used STEEPV to determine or identify each of the drivers that were collected. Cases include impact-uncertainty analysis, the S-curve, and the future wheel. For this study, impact-uncertainty analysis will show the drivers or future factors that influence and change the issues, challenges, and trends of VR in online shopping.

3.7 Population and Sampling

This research concentrates on VR in online shopping. Therefore, the target consisted of the users of VR in online shopping. Consequently, this research was targeted to collect data from the users of VR in online shopping in Malaysia, which is 15,630,000. In this research, purposive sampling was used. Purposive sampling selects the sample based on the research objective and the population characteristics. According to the Krejcie and Morgan Table, the sample size for this study will be 384 respondents based on a population of 15,630,000 (Commission Factory, 2023). The sample size for this study comprises 384 respondents from the users of VR in online shopping in Malaysia.

3.8 Research Instrument

The research used a questionnaire as the research instrument. For this research, a questionnaire was used to collect the data because the data collected from the questionnaire is more efficient and simpler to understand. The questionnaire was used in this research because it can help identify the issues, challenges, and trends of VR in online shopping in the future. The questionnaire will be out to the users of VR in online shopping in Malaysia. This research questionnaire was divided into four parts: Part A, Part B, Part C, and Part D. Part A shows the respondents' demographic information and Part B identify the important drivers that should be chosen or ranked. Part C studied the level of uncertainty for the key drivers of VR in online shopping, and Part D determined the level of the impact of key drivers of VR in online shopping.

3.9 Data Collection

Data collection is the process of collecting and analysing data to ensure the data can be used to achieve the objectives of the research. The two components of the data collection method are primary data and secondary data. Primary data is collected from interviews, experiments, and others (Formplus Blog, 2020). It means primary data is the variety of data that is collected for the first time. For example, a questionnaire is used to collect the primary data. Secondary data is collected from previous studies (Formplus Blog, 2020). Normally, the sources of the secondary data come from journals, articles, newspapers, books, websites, and others. This research used secondary data for data collection. The sources of VR in online shopping were gathered and analysed to identify the issues, challenges, and trends in VR in online shopping. Secondary data collection was commonly used in much research because secondary data can be a support resource to primary data from the primary sources.

3.10 Pilot Test

The pilot test is having a brief study of some of the respondents to test the research questions before the research starts. Pilot test has many advantages, for example, assessing the feasibility of the research and exploring the potential of the new research methods for future use (Formplus Blog, 2021). By using the pilot test, the research process can run smoothly, and it can identify further improvements to the study. SPSS software can perform a pilot test that aims to evaluate the reliability of the questionnaire and the reliability of the data. In this research, the pilot test focuses on the purpose of enhancing the questionnaire's reliability and ensuring that the questions. The pilot test uses a sample size of 30 respondents. The Cronbach's Alpha value was calculated using SPSS software. Three parts of the questionnaire have been tested in the pilot test for this study, which are the level of importance, the level of impact, and the level of uncertainty. The results of the pilot test are displayed in the table

below. Cronbach's Alpha value for level of importance is 0.856, level of impact is 0.867, and level of uncertainty is 0.850.

3.11 Analysis of Data

3.11.1 Descriptive Analysis

Descriptive analysis is the process of summarising or describing past and present data using statistical methods (Bush, 2024). 'Statistical Package for Social Science' (SPSS) will be used to analyse the data collected by the questionnaire. SPSS can help researchers generate statistical results based on numerical data. Moreover, SPSS will present the data gathered in percentages, means, and standard deviations.

3.11.2 Impact Uncertainty Analysis

Impact Uncertainty analysis was developed by using the list of drivers. Ranking of the drivers based on their importance, impact, and uncertainty. The top two variables on the list with a higher level of impact and level of uncertainty will be chosen to develop the future image. Impact-uncertainty analysis was conducted after calculating the mean value from the data analysis, and the development of the future image ensued.

3.11.3 Reliability Analysis

Reliability Analysis is used to measure the reliability of the research questions, and a good test must have high reliability (Bobbitt, 2021). In this study, we will use Cronbach's Alpha value to examine the consistency and reliability of the data.

3.12 Development of Future Image

The future image was advanced using the top two drivers from the impact-uncertainty analysis. By regarding the favourable or unfavourable results, it will have four different alternatives reflected by the future effects of events and trends of VR in online shopping. The implications and recommendations were discussed at the end of the study. These four future images are the four possibilities that might happen from 2024 to 2034.

4. Data Analysis and Findings

This part shows the results of data collected by a questionnaire that was given to the users of VR in online shopping through social media platforms. The Statistical Package for the Social Sciences (SPSS) software was used to analyse all the data. In this part, the analysis included the demographic analysis, descriptive analysis and impact-uncertainty analysis. The demographic data would be provided using frequency, percentage, and cumulative percentage, while the problem and causes would be given using mean and standard deviation. The data would be sorted in decreasing order, and the top 50 per cent of issues and drivers with the highest mean would be selected for impact uncertainty analysis.

4.1 Pilot Test Result

In this study, a sample of 30 respondents was used to do the pilot test. The Cronbach's Alpha value was calculated using SPSS software. Three parts of the questionnaire have been tested in the pilot test for this study, which are the level of importance, the level of impact, and the level of uncertainty. The results of the pilot test are displayed in Table 2 below. Cronbach's Alpha value for level of importance is 0.856, level of impact is 0.867, and level of uncertainty is 0.850. Cronbach's Alpha value for level of importance, level of impact, and level of uncertainty is categorised as "Good" because Cronbach's Alpha Value is above 0.8. To conclude, three of the factors can be categorised as accepted Good.

Table 2 *Reliability of Pilot Test*

Factors	Cronbach's Alpha Value
Level of Importance	0.856
Level of Impact	0.867
Level of Uncertainty	0.850

4.2 Actual Study

A reliability analysis of the actual study has also been carried out. The reliability result for the actual study is displayed in the table below. According to Table 3, Cronbach's Alpha value for the level of importance is 0.838,

and the level of impact is 0.855. Besides that, Cronbach's Alpha value for the level of uncertainty is 0.842. These three factors were identified as having better reliability because Cronbach's Alpha value was above 0.8.

Table 3 *Reliability of the Actual Study*

Factors	Cronbach's Alpha Value
Level of Importance	0.838
Level of Impact	0.855
Level of Uncertainty	0.842

4.3 Survey Return Rate

The population of VR users in online shopping was 15,630,000 in this study. The total sample size is 384 respondents, and the data collected is primarily from Malaysia. This study's respondents were VR users in online shopping. Google Forms was used to create the questionnaire. The Google Form was chosen as a distribution channel because data can be conveniently collected online. There are 384 sets of questionnaires distributed, and they have been distributed to respondents through email and social media platforms such as RED note and WhatsApp. The survey response rate for this study is 219 respondents, which is 57.03% and the percentage rate is shown in Table 4 below.

Table 4 *Survey Return Rate*

Population	15,630,000
Sample	384
Questionnaire Returned	219
Questionnaire Distributed	384
Percentage	57.03%

4.4 Demographic Analysis

This section explains the respondent's demographic background. The questionnaire was designed into seven questions. For example, gender, age, education level, occupation sector, usage of Virtual Reality in online shopping, experience in using Virtual Reality in online shopping, and the type of product most suitable to use Virtual Reality in online shopping.

4.4.1 Respondents' Demographic Information

For the gender in this research, there are 98 males (44.7%) and 121 females (55.3%). For age, 97 respondents (44.3%) are below 30 years old. 46 respondents (21.0%) were between 31 and 40 years old. Respondents 41 and 50 years old are 59 respondents (26.9%). 17 respondents (7.8%) are 51 years old and above. For the Education Level, 49 respondents (22.4%) have the SPM/STPM/Diploma level. 106 respondents (48.4%) have a degree level in their education. 44 respondents (20.1%) with a master's level. Lastly, 20 respondents (9.1%) have a Ph.D. level. For the Occupation Sector, 81 respondents (37.0%) worked in the private sector. 100 respondents (45.7%) worked in the government sector. 38 respondents (17.4%) have their own business. For the use of Virtual Reality in online shopping, 151 respondents (68.9%) have used Virtual Reality in online shopping. 68 respondents (31.1%) have no use for Virtual Reality in online shopping. For the experience in using Virtual Reality in online shopping, 60 respondents (27.4%) have less than one year of experience using VR in online shopping. 93 respondents (42.5%) have 1 year to 5 years of experience in using Virtual Reality in online shopping. 51 respondents (23.2%) have between 5 years to 10 years of experience in using Virtual Reality in online shopping. Lastly, 15 respondents (6.8%) have more than ten years of experience in using Virtual Reality in online shopping. The type of product is most suitable to use Virtual Reality in online shopping, 73 respondents (33.33%) chose Apparel/Footwear. 71 respondents (32.4%) chose Gadgets/Electronics/Furniture/Books. 57 respondents (26.0%) chose Accessories/Jewellery. Lastly, only 18 respondents (8.2%) chose others.

The drivers were selected based on three aspects, which are importance, level of impact, and level of uncertainty. The result of the driver will also be shown as the mean. To form the scenario analysis, the top 50 per cent of drivers with the highest mean in level of impact and level of uncertainty will be chosen. The method of impact-uncertainty analysis was used to determine the top driver that could result in future impact and uncertainty.

4.4.2 Mean of Drivers in Corresponding with Importance

Table 5 below shows the mean of the first five leading Drivers based on level of importance. The mean of Shopping experience (3.7534), mean of Technology Reliability (3.6438), mean of Law and regulation (3.6347), mean of Personal safety (3.5890), and mean of Economic growth (3.5753).

Table 5 *Mean of the first five leading Drivers on Importance*

No	Drivers	Mean
D1	Shopping experience	3.7534
D2	Technology Reliability	3.6438
D3	Law and regulation	3.6347
D4	Personal safety	3.5890
D5	Economic growth	3.5753

4.4.3 Mean of the Drivers in Corresponding with the Level of Impact

Table 6 below shows the Mean of the five leading drivers on the Level of Impact. The mean of Shopping experience (3.6530), mean of Technology Reliability (3.5342), mean of Law and regulation (3.7169), mean of Personal safety (3.6164), and mean of Economic growth (3.4840).

Table 6 *Mean of the five leading drivers on the Level of Impact*

No	Drivers	Mean
D1	Shopping experience	3.6530
D2	Technology Reliability	3.5342
D3	Law and regulation	3.7169
D4	Personal safety	3.6164
D5	Economic growth	3.4840

4.4.4 Mean of Drivers in Corresponding with the Level of Uncertainty

Table 7 below shows the Mean of the five leading drivers on the Level of Uncertainty. The mean of Shopping experience (3.6393), mean of Technology Reliability (3.4429), mean of Law and regulation (3.7397), mean of Personal safety (3.5297), and mean of Economic growth (3.5342).

Table 7 *Mean of the five leading drivers on the Level of Uncertainty*

No	Drivers	Mean
D1	Shopping experience	3.6393
D2	Technology Reliability	3.4429
D3	Law and regulation	3.7397
D4	Personal safety	3.5297
D5	Economic growth	3.5342

4.4.5 Impact Uncertainty Analysis

Table 8 shows the mean value of the top five leading drivers based on the level of uncertainty and level of impact. The purpose of Table 8 is to help identify the different mean values of the driver based on the two aspects, and to easily find the driver which has higher uncertainty and impact on the future. The result of the analysis is presented in Fig. 2 below. Based on Figure 2, the top two drivers that have a high impact and uncertainty are chosen. D3 and D1 are chosen as the top two drivers. D3 is law and regulation, and D1 is the shopping experience.

Table 8 *Mean of the five leading drivers on Level of Impact and Uncertainty*

No	Drivers	Mean	
		Uncertainty	Impact
D1	Shopping experience	3.6393	3.6530
D2	Technology Reliability	3.4429	3.5342

D3	Law and regulation	3.7397	3.7169
D4	Personal safety	3.5297	3.6164
D5	Economic growth	3.5342	3.4840

Fig. 2 *Impact Uncertainty Analysis*

5. Conclusion

The first objective of this research is to identify issues, challenges, and trends of VR in online shopping. This objective had been generated through the STEEPV analysis. The issues, challenges, and trends have been analysed based on previous research. Based on STEEPV analysis, technology is the most critical driver in VR adoption, followed by social, economic, values, political, and environmental factors.

The second objective is to study the key drivers of VR in online shopping. After the STEEPV analysis, the 10 drivers have been developed based on merged issues, challenges, and trends of VR in online shopping. The ten drivers are Shopping experience, Investment Required, Economic growth, Law and regulation, decreases potential returns, Technology Reliability, Personal safety, Sustainability, Technology Innovation, and Improve communication. The law and regulation of VR is uncertain because we currently have no information regarding the Virtual Reality Act. This issue will lead to uncertainty for users when it comes to using virtual reality for online shopping. This issue will lead to uncertainty among users about using VR in online shopping (Michalsons, 2022). Most scholars, with a few exceptions, would generally agree that actions in virtual environments, despite their growing realism, do not have the same impact on users as actions in the real world. Therefore, directly applying the legal norms used in other IT sectors to virtual reality is ineffective, as it remains a simulated space. This means that the legal regulations designed for the physical world are not suitable for governing interactions in VR (Dremliuga, Dremliuga, & Iakovenko, 2020). This higher impact and uncertainty are ascribed to the possible consequences of the shopping experience by using VR in online shopping in Malaysia. VR shopping spaces can eliminate geographical barriers, allowing customers to access global retailers and unique products (Bradford, 2023). Virtual shopping with friends, use a VR headset and meet your friends in a virtual mall where users can browse and try on clothes together, provide feedback, and make purchase decisions in a shared virtual space. This immersive social shopping experience will bridge the gap between physical and online shopping, making it fun and interactive (Techint Labs, 2023). It can improve the shopping experience of users by using VR in online shopping. VR shopping specifically could make life easier for people with a disability, especially if that disability prevents them from leaving home and making the trip to a physical store (Amo, 2023).

The third objective was to study the future image of VR in online shopping. This objective also needs to identify the forces that can change the future of VR in online shopping. Four different scenarios have been formed based on the top two drivers chosen from the impact-uncertainty analysis. These four alternative scenarios represent the four possibilities that might happen from 2024 to 2034.

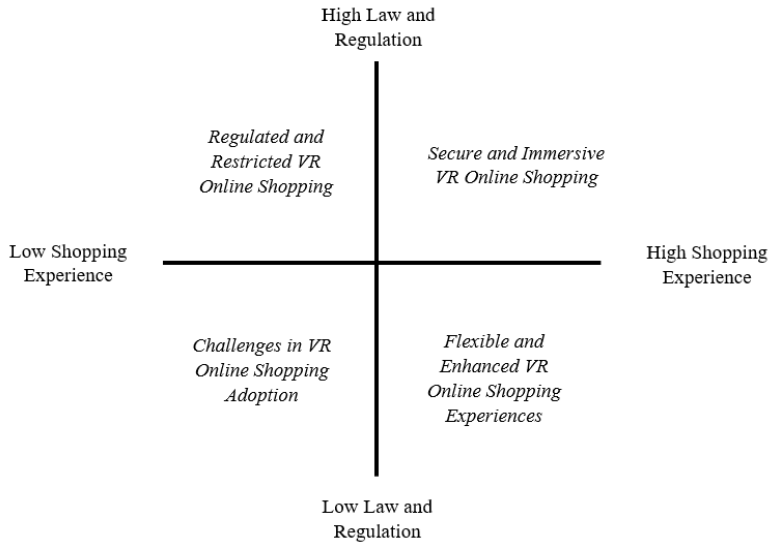

Fig. 3 *Development of four scenario analysis*

Scenario 1 shows the "Secure and Immersive VR Online Shopping". This is the best scenario, high law and regulation and high shopping experience. Basically, it will increase the potential of the implementation of VR in online shopping. When the law, regulation, and shopping experience are high, which means the users can "Secure and Immersive VR Online Shopping". The regulatory landscape is stringent, focusing on consumer protection, data privacy, ethical standards, and sustainability. This regulatory framework ensures that VR shopping platforms are safe for users, uphold privacy rights, and adhere to principles of fairness and sustainability. Retailers must comply with numerous regulations, including laws regarding the collection and storage of data, product safety, and ethical advertising practices. The shopping experience itself is extremely advanced, offering users a fully immersive, 3D environment where they can explore virtual stores that replicate the experience of shopping in the real world (Abehsera, 2024). Cutting-edge technologies such as haptic feedback, full-body tracking, and high-definition graphics make the virtual store feel realistic, with customers able to "touch" and "feel" products via advanced virtual interfaces (Kovelman, 2023). Virtual assistants, powered by AI, help guide the customers through their journey, offering personalised recommendations based on customer preferences, purchase history, and real-time interactions (Techint Labs, 2023). In this scenario, VR shopping is not just about viewing products; it is about a complete experience. Consumers can try on clothes virtually, test products interactively, and even participate in virtual shopping events such as fashion shows or live product demos. The experience is enhanced by the ability to interact with other shoppers or friends, adding a social component to the virtual shopping environment (Techint Labs, 2023). Retailers invest heavily in VR technology to provide a unique shopping experience that feels as real as possible, and these experiences are designed to create an emotional connection with customers, making them feel as though they are physically present in the store (Kovelman, 2023). Even though the advanced nature of the VR technology, the highly regulated nature of this scenario means that there are numerous legal frameworks governing the use of VR. Laws are in place to ensure that personal data is protected, user privacy is respected, and that there are clear guidelines for ethical use of VR technology (Dremliuga, Dremliuga, & Iakovenko, 2020). For instance, data privacy regulations would govern the collection of user data, ensuring that consumers have control over what personal information is shared (Rwizen Technologies, 2023). It will help to improve the confidence of users to use VR in online shopping because they are protected.

So, the retailers who can master the balance between immersive technology and regulatory compliance will have a distinct advantage in the market. Consumers benefit from a highly immersive, safe, and ethically sound shopping experience, which could lead to stronger customer loyalty and satisfaction.

Scenario 2 shows the "Challenges in VR Online Shopping Adoption", which was the worst scenario for the future of VR in online shopping in Malaysia. "Challenges in VR Online Shopping Adoption" will occur when there are low law and regulation, low shopping experience. This scenario shows that the consumer will not be convinced to use VR in online shopping because of these issues. Even though there is a lack of strict regulations, which might allow for more flexibility in how retailers approach VR, the technological advancements in this scenario are limited. Retailers do not invest heavily in cutting-edge VR technologies, and as a result, the virtual shopping environment remains rudimentary. The use of VR is basic, focusing on simple features such as basic virtual tours, static 3D models of products, or simple "try before you buy" simulations that provide little interaction or immersion compared to more advanced VR systems. The regulatory environment in this scenario is relaxed, meaning that there are minimal legal constraints on data collection, privacy concerns, or ethical considerations

(Michalsons, 2022). While this freedom offers retailers greater leeway in shaping their VR offerings, it also reduces the urgency for them to implement advanced VR experiences that could provide a more engaging and interactive shopping experience for consumers. There may be little to no legal pressure for retailers to adopt high standards for data protection or ethical marketing practices, so there is a risk that businesses could misuse consumer data or fail to safeguard user privacy. The VR online shopping experiences in this scenario are relatively static and do not offer the deep immersion that comes with more sophisticated virtual shopping environments. Virtual stores may exist, but they are often rudimentary and lack interactive features that would make the experience truly immersive. For example, a retailer may offer a 3D model of a product, but the model might not allow customers to rotate or interact with it beyond simple visual inspection (Berberović, Denis, Alic, Adi, Činjarević & Merima, 2022). Additionally, VR try-on features, if they exist, might only provide basic simulations of how clothing fits or how a product might look in a particular environment, without the ability to try them on interactively or receive personalised recommendations. Despite the freedom in terms of regulatory restrictions, there is a lack of investment in the development of more advanced features like haptic feedback (which allows users to feel virtual objects), voice commands, or real-time, social shopping experiences. As a result, consumers may not feel particularly motivated to engage with VR in online shopping if they can only access simple, non-interactive displays of products that don't offer a strong sense of realism or interactivity.

Hence, this scenario will show the "Challenges in VR Online Shopping Adoption" of VR in online shopping in Malaysia because most of the users are not interested in further implementing VR in online shopping. Using VR in online shopping will not be supported by the users due to the lack of laws and regulations and a poor shopping experience.

Scenario 3 shows the "Regulated and Restricted VR Online Shopping". The third scenario will happen when there are high law and regulation, but a low shopping experience. This scenario, "Regulated and Restricted VR Online Shopping", will occur when there are high laws and regulations for users, but a low shopping experience for users when using VR in online shopping. This situation will cause limitations in the adoption of advanced VR in online shopping. It may stop the willingness to use VR in online shopping. The legal environment in this scenario is highly stringent. Laws are carefully crafted to protect consumers, especially in terms of data privacy, consumer rights, safety, and ethical practices. The goal is to prevent the misuse of sensitive data, such as information gathered from consumers while they use VR platforms, and to ensure that businesses do not exploit or manipulate consumers in ways that could be damaging to their well-being. For example, regulations could require retailers to disclose how they use consumer data, mandate that VR interactions are secure, and ensure that no harmful psychological or emotional manipulation occurs through the VR experience (Dremliuga, Dremliuga, & Iakovenko, 2020). These laws might also involve rigorous data protection standards, requiring businesses to store and process customer data in a way that prevents breaches or misuse. Consumer protection laws might require that businesses offer clear returns, refunds, or dispute resolution methods for items purchased through VR interfaces. Furthermore, there might be ethical regulations that govern how products are represented in VR, ensuring that advertising and product placement remain transparent and honest. Regulations might also require VR platforms to be accessible to people with disabilities, ensuring that all consumers can participate in VR shopping experiences in a way that does not discriminate (Iftikhar Rehan, 2023). When the shopping experience is low. In this scenario, the VR experiences provided by retailers might be limited to basic features such as virtual store tours, basic product demonstrations, or 3D models of items that consumers can rotate or inspect from different angles. These VR experiences lack the immersive, interactive features that could create a truly engaging shopping experience, such as live product trials, customizable virtual try-ons, or interactive, personalised shopping environments. For example, a customer might use VR in online shopping, but they are only able to navigate the aisles and view products from a distance, rather than picking up, interacting with, or trying on products. Virtual try-ons might be simplified, offering only a basic simulation that lacks the depth of real-world interaction (Taufik, Kunz & Onwezen, 2021). There may also be limited opportunities for social shopping experiences, such as the ability to shop with friends in a shared virtual space, or immersive brand experiences that take advantage of advanced VR features like haptic feedback or full-body tracking. It means the focus is on delivering a safe, clear, and easy-to-understand VR online shopping experience that complies with all relevant laws and regulations, but without pushing the boundaries of what VR technology can achieve. The primary concern is ensuring that the technology doesn't violate any privacy laws or consumer protection regulations, rather than creating a highly engaging, personalised, or interactive experience for the users. As a result, consumers in this scenario would be exposed to a less immersive VR shopping experience. While they might enjoy some of the novelty of visiting a virtual store and viewing products in 3D, the absence of rich interaction or personalisation means that the experience would feel flat. Instead of offering a seamless, interactive shopping journey, consumers might simply click through a digital catalogue in a 3D space without feeling fully immersed in the environment. The lack of interactivity could lead to a situation where consumers do not feel that VR offers any real advantage over traditional online shopping. Moreover, with limited features, such as simple product previews or static models, the sense of connection to the product or the retail environment is diminished. The customer cannot physically try on clothes, interact with products in real-time, or explore a fully immersive environment that feels like shopping in the real world.

Consequently, the basic nature of the VR experience may result in limited adoption, as consumers might not see the value in engaging with VR if the experience feels superficial or underwhelming compared to other advanced VR applications in gaming or entertainment.

Hence, this scenario showed that the low shopping experience will cause limitations in the adoption of advanced VR in online shopping. Therefore, the users in online shopping will be reluctant to implement VR, and the future adoption of VR in online shopping in Malaysia will decrease because of the Regulated and Restricted VR Online Shopping.

The last scenario, Scenario 4 "Flexible and Enhanced VR Online Shopping Experiences", happens when low law and regulation but a high shopping experience. The "Flexible and Enhanced VR Online Shopping Experiences" scenario will happen when low law and regulation but a high shopping experience. So, this scenario will show that the shopping experience in VR has a higher improvement for online shopping when implementing VR. However, the opportunity is not going to last too long because of the low laws and regulations. Low law and regulation, which means that governments or regulatory bodies have few rules or guidelines concerning data privacy, consumer protection, or ethical standards, especially when it comes to new technologies like VR. Retailers and tech companies have more freedom to innovate and experiment without worrying too much about legal constraints. VR technology has evolved to the point where it offers highly immersive, realistic, and interactive shopping environments. In this scenario, customers can shop in virtual stores, try on clothes, or test out products as though they were physically walking into the shop (Kovelman, 2023). Personalisation is at its peak, with advanced algorithms tailoring each user's experience to their preferences and behaviours. Additionally, the VR environment is deeply integrated with social media, allowing consumers to shop with friends or engage in virtual events like live fashion shows (Silversea Media Group, 2021). Highly engaging shopping experience due to advanced VR technology, consumers can enjoy interactive, lifelike shopping from the comfort of their homes (Abehsera, 2024). Imagine being able to walk around a store, pick up products, or try on clothes in a fully virtual environment. The shopping experience would feel almost like being in a physical store but without the need to leave home (Techint Labs, 2023). With fewer restrictions, retailers and VR developers can push the boundaries of what's possible in terms of customer engagement, personalisation, and product offerings. Consumer might see things like hyper-personalised stores that adapt to their shopping habits or virtual environments that are tailored specifically to their interests. Enhanced shopping experience, the ability to interact with products in a fully immersive way allows consumers to make better-informed decisions, trying out products in ways that go beyond just looking at pictures or reading reviews (Go, 2023). This could lead to increased customer satisfaction and potentially fewer returns, as people can visualise or test products more realistically (Opeoluwa, 2023). But without strict regulations, companies may collect and use vast amounts of data about their customers, including behavioural data, preferences, and even biometric data from VR interactions. This could lead to potential misuse of sensitive data, such as targeting vulnerable individuals or creating overly invasive marketing tactics (Dremliuga, Dremliuga, & Iakovenko, 2020). According to Skulmowski (2023), the lack of ethical oversight with no laws governing VR shopping raises concerns about the ethical implications of immersive shopping experiences. For example, VR could be used to manipulate consumers into buying more than they need or even addict them to the shopping experience, which could have a harmful psychological impact. The highly immersive nature of VR, combined with a lack of regulatory oversight, could lead to addiction to virtual shopping experiences. Consumers might spend excessive amounts of time in VR environments, losing track of real-world responsibilities and negatively impacting their mental health, especially the younger generation. It may also cause cybercrime (Michalsons, 2022).

Hence, "Flexible and Enhanced VR Online Shopping Experiences" is very attractive, but the balance between shopping experience and law and regulation is very important. While retailers and consumers benefit from highly engaging, personalised, and immersive VR shopping experiences, the lack of regulation creates a host of potential ethical, privacy, and psychological concerns.

In conclusion, best result using VR in online shopping is Secure and Immersive VR Online Shopping, which means law and regulation are very developed and shopping experience of users are good, this research aims to identify the issues, challenges, and trends, study the key drivers of VR in online shopping, and study the future image of VR in online shopping in Malaysia. VR growth and demand in online shopping have both expanded in the current era of digitalisation. The foresight method, SPSS analysis, SPEEEV analysis, and impact-uncertainty analysis were used in the research methodology. Based on the impact-uncertainty analysis, the top two drivers were formed, and the driver was used in the scenario analysis to create the future scenario of VR in online shopping. When the top two drivers were developed, the research objective was completed, and they can be used to form four future scenarios of VR in online shopping. The four scenarios indicated the law and regulation, and the shopping experience in VR in online shopping. The high law and regulation, and high shopping experience can positively affect the future of VR in online shopping in Malaysia. High laws and regulations can encourage the confidence of consumers using VR in online shopping. A high shopping experience can also increase the willingness of consumers to use VR in online shopping and attract them to continue using VR in online shopping. The law, regulation, and shopping experience have a strong relationship. Both factors can create the best scenario,

such as "Secure and Immersive VR Online Shopping", where users are more interested in using VR. But those two factors also will cause some adverse scenarios in the future, like "Regulated and Restricted VR Online Shopping", "Challenges in VR Online Shopping Adoption" and "Flexible and Enhanced VR Online Shopping Experiences". Hence, these future scenarios can benefit future researchers and industries in sustaining the future development of VR in online shopping.

Acknowledgement

The authors would like to thank the Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia for its support.

Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Ng Rui De, Alina Shamsuddin;* ***data collection:*** *Ng Rui De;* ***analysis and interpretation of results:*** *Ng Rui De;* ***draft manuscript preparation:*** *Ng Rui De, Alina Shamsuddin. All authors reviewed the results and approved the final version of the manuscript.*

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