



Designing a Dynamic Brand Equity Model Concentrating on Fake News in Coca-Cola Company

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ABSTRACT

One of the most valuable assets for organizations is the brand of their products and services, as building a strong brand is critical to achieving competitive advantage and long-term survival in the marketplace. In this regard, it is necessary to constantly pay special attention to the status of the brand value compared to competitors to avoid the effects of fake news. Brand equity should be considered and investigated from different aspects because different factors, such as brand awareness, brand loyalty, brand association, perceived quality, and brand awareness, can affect brand equity over time. So, this concept is dynamic in marketing management. Therefore, in this research, using the system dynamics approach, a dynamic model is presented to investigate brand equity, focusing on fake news from the Coca-Cola Company, to understand better the marketing managers of the mechanism of brand equity changes over time.

The simulation outcomes demonstrated that the unique brand value and the factors influencing it do not change instantly but interact via feedback loops and build-up over time. The second stage's simulation findings revealed that fake news dissemination, brand equity, perceived quality, and brand awareness changed more than they did in the first. Customer loyalty is also influenced by perceived quality. The number of consumers who believe in the reputation and credibility of the company declines with the spread of fake information. Based on the outcomes of the simulation and the application of the policy of increasing customer knowledge, it was determined that the organization's investment to increase the customer's knowledge of the products and remove the misunderstandings brought on by fake information could increase trust in the brand and lead to the neutralization of the effect of fake news on the brand value and the factors affecting it.

Keywords

Dynamic model, Brand equity, Fake news, Customer knowledge, Coca-Cola company.

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1. Introduction

Fake news is now a topic of discussion in politics, everyday life, and the business sector (Flastrand et al., 2019). Fake news is being produced, broadcasted, and used more often than ever, costing businesses a fortune to stop it. Fake news has experienced two fundamental changes compared to the past: first, its scope has significantly grown; and second, the passionate communication circles that are produced by the transmission of fake news, which is both technologically facilitated by the Internet, encourage the spread of fake news (Berthon and Pitt, 2018). One of a company's most precious assets is its brand, and nowadays, building a strong brand that adds value to goods is a critical success element for many businesses (Nik Farjam and Abdulvand, 2015). Leading businesses and industry experts consider building brand equity to be a source of competitive advantage because it generates cash flow for the company, boosts brand loyalty, improves the effectiveness and efficiency of marketing initiatives, and lessens reliance on promotional costs, all of which lead to the creation of competitive advantages (Borkovsky et al., 2017). According to Berthon & Pitt (2018), fake news may be directly targeted at consumers or close to advertising algorithms, affecting brands and brand management.

As a consequence, fake news may harm some companies. Fake information on fake news about brands is disseminated by an unethical rival or a hostile fake news maker, which may enhance the buyer's perception of risk and reduce sales of an organization's goods (Flostrand et al., 2019). Brand managers create and improve a brand's value and image. Managers may develop methods to cope with fake news damaging consequences by looking at how it affects brand equity (Bronstein et al., 2019).

A thorough and systematic strategy is needed to examine fake news and its effects on brand equity and dimensions. However, only a few studies have been done in this area, and they have yet to approach the problem systematically. As a result, the systemic perspective of the present study may influence the knowledge and choices of product and marketing managers and provide light on the effect of fake news on the crucial variables that drive brand equity. The behavior of complicated and nonlinear systems may be investigated effectively using dynamic systems. Brand management comprises a complex system including delays, feedback, and nonlinear behaviors between various factors. Therefore, by using this tool, managers may broaden the mental model's bounds and limitations and foresee the results and ramifications of their actions before they occur. It is essential to provide a model to investigate the complex relationships between the key variables affected by the publication of fake news

and predict the behavior of the variables over time. It will help managers protect their brand with timely investments and appropriate measures, give the company a competitive advantage, and avoid losing customers and market share. Therefore, it is necessary to provide a model to investigate the complex relationships between the key variables affected by the publication of fake news and predict the behavior of the variables over time.

2. Literature review

Fake news is crucial for brands and their management, according to [Berthon and Pitt \(2018\)](#), for two reasons. First, companies may become targets of fake news, suffer direct harm, or distribute more fake news by utilizing the algorithm to position advertisements, i.e., by acting as fake news promoters ([Mills et al., 2019](#)). Using the brand equity model, [Karroubi et al. \(2017\)](#) concluded that the variables of brand loyalty, brand awareness, perceived quality, brand association, and brand image have a positive and significant effect on brand equity in their study titled "Evaluation of factors affecting brand equity among sportswear customers." The findings further demonstrated that brand loyalty had the most influence on brand equity, followed by brand image, perceived quality, brand association, and brand awareness, in that order. Their findings demonstrated that the elements mentioned above considerably affect consumers' attitudes about counterfeit goods and that consuming them significantly affects the brand value of genuine goods. The research titled "Online Consumers' opinion of brand fake news" was undertaken by [Borges et al. \(2020\)](#). The study's conclusions revealed that consumers' attitudes regarding fake news vary across European nations. Users who are young and tech-savvy are more likely to be able to spot fake news, and as a consequence, they are better equipped to assess digital news sources without the need for government involvement to lessen the effect of fake news.

The research named "The Effect of fake news on the Attitude of social network users toward the Company" was undertaken by [Bahadur \(2020\)](#). The findings of his study show fake news had little effect on brand attitudes. People need to use their full cognitive ability while processing information online, which is one reason. Additionally, the findings showed that the gender of the customer affects the link above; hence, fake news only significantly affects brand perception among women. Further proof that exposure to fake news makes liberal customers dislike the news source is provided by [Kwon and Barron \(2020\)](#) "A World of Mistrust; Fake News, Distrust Mindsets, and Product Evaluations". They have less faith in the businesses offering the good or service, which negatively affects their opinion of that good or service.

Together, these results show how fake news may affect liberal consumers' perceptions of all sources, leading to a "mindset of mistrust" that affects how they assess vendors' goods and services. Fake news or actual false on marketing? The research title was done by [Di Domenico et al. \(2020\)](#). This research's overall finding is that the present methods are insufficiently capable of combating fake news. According to research by [Tandoc et al. \(2020\)](#), most Singaporean social media users dismiss fake news they see online. They only deal with fake news when it is pertinent to them and the individuals they have close relationships with. According to [Flostrand et al. \(2019\)](#), there is broad agreement that fake news is an increasingly common phenomenon and significantly affects brand management. Additionally, as service brands are more susceptible to fake news, brand management must be improved, or tactics to lessen fake news must be implemented. The study "Fake news identification in social networks using deep geometric learning" was done by [Monti et al. \(2019\)](#). It shows that one key characteristic that make it possible to identify fake news accurately is how social networks are structured and distributed. In addition, fake news may be accurately identified in the first phases, even only a few hours after publishing. The modeling results give managers more understanding of publication-based methods for spotting fake news as complementary to content-based methods.

[Pesonen's \(2018\)](#) study revealed that customers need more confidence in social networking sites and other online businesses. Customers believed that digital giants like Facebook had a duty to combat fake news and that it was immoral for online businesses to collaborate with sites that spread it. Additionally, most consumers accept whether the news is real or untrue, which inspires mistrust. However, some customers attempt to check the news's accuracy, and even if it is wrong, they uphold their trust and encourage others. [Ruiz-Meza et al. \(2022\)](#) propose a System Dynamics model of destination brand equity to assess the evolution of the future behavior of related variables, including tourist arrivals. [Zhang \(2023\)](#) analyzes the growth mechanism of We-media brand equity from the perspective of the user's mind, applies the system dynamics method to carry out modeling and simulation analysis, and explores the general law of We-media brand equity growth. His paper finds that the external environment and similar We-media have no obvious effect on the growth of We-media brand equity. However, brand communication will have a direct positive effect.

So far, many types of research have been conducted in the field of brand equity and the impact of fake news, but most of them, such as [Pesonen \(2018\)](#), [Bahadur \(2020\)](#), [Borges et al. \(2020\)](#), are statistical or like the study of [Monti et al. \(2019\)](#) are qualitative. However, different variables affect the extraordinary value of the brand, and the effect of some variables is determined over

time, so it is a complex system.. The use of statistical methods cannot thoroughly investigate and analyze the characteristics of this complex system. Therefore, in this research, the system dynamics method has been used. A review of the research background shows that limited studies such as [Crescitelli and Figueiredo \(2009\)](#), [Jing-Bo et al. \(2017\)](#), and [Zhang \(2023\)](#) have been done in the field of a brand with the method of system dynamics. However, these studies have not investigated the effect of fake news on brand equity. Therefore, the current research is innovative in this sense.

3. Research method

Due to its goal of demonstrating the feedback effects of fake news on brand equity and its variables in the Coca-Cola Company, the present study is classified as applied research. The findings of this study may influence the knowledge and choices made by product and marketing managers and provide light on how fake news affects important brand equity-determining elements. The present study is quasi-experimental because the researcher employs simulation to test several policy options without interfering with the studied condition. The Coca-Cola Company is the focus of this investigation. Additionally, this study is grounded on mixed data, which refers to studies combining quantitative and qualitative research approaches ([Mobini Dehkordi, 2012](#)). This issue is brought on by the research's unique methodology, namely the systems dynamics approach. Models of system dynamics are under the umbrella of mathematical causal models. The research is qualitative in the phases of understanding the system, understanding the research topic, and developing the model based on the dynamic assumptions gained through the study of statistics, literature review, and expert interviews. The quantitative portion of the study includes creating the model in "Vensim" software, defining the model, and assessing the findings.

3.1. Dynamic hypothesis

When the value of the brand equity had increased, the price of the products will also increase. Therefore, with a price increase, the perceived quality increases, which leads to an increase in brand equity value ([Hidayatno et al., 2013](#)). Nevertheless, the price increase from another direction leads to a decrease in customer retention, and as a result, sales and profitability decrease. With the decrease in profitability, the competitive advantage and, as a result, the particular value of the brand equity decreases (Figure 1). In this research, the effect of fake news on brand equity has been investigated. Fake news, as an exogenous variable, indirectly

affects brand equity by negatively affecting perceived quality and trust in the brand and leads to its decrease over time (Pesonen, 2018).

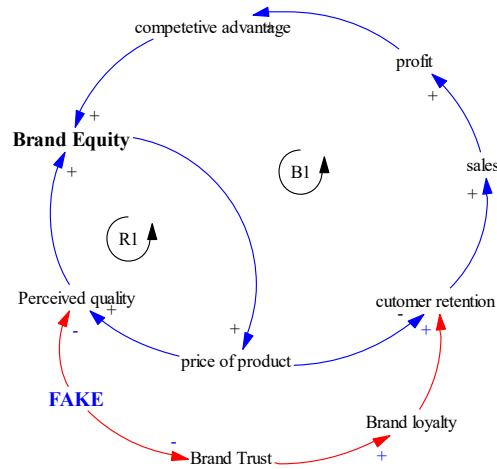


Figure 1. Dynamic research hypothesis

3.2. Model assumptions

To decrease the complexity of the model and make modeling possible, the following assumptions are regarded in the model of this study.

Due to simplify the model and facilitate modeling, the following assumptions were considered in this study's model:

- (1) Only the effect of negative fake news on brand equity was examined during the planning horizon, while the effect of positive fake news was excluded due to insufficient information.
- (2) The simulation in this study covers a period of 60 months (from 2020 to 2025), equivalent to 5 years.
- (3) Qualitative variables such as brand experience and uniqueness were excluded from the model due to their subjective nature and the challenges involved in quantification.
- (4) The variable of mental involvement was omitted from the model due to limited information. It depends on external factors such as location, product, and communication, as well as internal factors such as individual pronouns and core values.
- (5) In this study's model, the role of competitors in shaping the brand's unique value is considered solely in terms of their investment in customer communication and the presence of other commercial brands in customers' purchasing decisions.

3.3. Causal loop diagram

The system dynamics method typically involves conducting interviews with experts to develop causal and circular diagrams and flow diagrams. This study initially constructed a causal and circular model around brand equity, incorporating findings from various background research. Subsequently, the model was refined and finalized through experts' opinions and adjustments.

The causal relationships in the model are referenced in Table 1. These relationships were initially identified based on the background research and subsequently refined, adjusted, and completed through the opinions provided by the expert team.

Table 1. The reference of causal relationships in the causal and circular model of the current research

Relationships	Sign	Author
Investing in public relations → brand awareness	+	Otto & Bois (2001)
Word of mouth advertising → brand awareness	+	Crescitelli and Figueiredo (2009); Maria et al (2019)
Customer Loyalty, Perceived quality → Brand equity	+	Ebrahim (2020); Otto & Bois (2001)
Efficiency and effectiveness of marketing programs → investing in advertising	-	Karroubi et al (2017); Datta et al (2017)
Fake news → brand trust	-	Pesonen (2018); Berthon et al (2018)
Brand equity → Customer retention	+	Stahl et al (2012)
Perceived quality → Customer Satisfaction	+	Hidayatno et al (2013)
Brand awareness, brand association → Brand equity	+	Hidayatno et al (2013); Azzari and Pelissari (2021)
Price product → perceived quality	+	Keller (2003); Iranzadeh et al (2012)
Price product → customer retention	-	Baldauf et al (2009); Iranzadeh et al (2012)
Customer retention → competitive advantage	+	Baldauf et al (2009); Yoo et al (2000)
Brand association → Perceived quality	+	Yoo et al (2000); Kim (2010)
Relationship quality → Brand loyalty	+	Chattopadhyay et al. (2010)

The causal loop model was constructed by integrating the research background and incorporating the opinions of the expert team. This model encompasses numerous variables, feedback relationships, and the resulting causal loop diagram, labeled Figure 1. The loops within the diagram are explained below in sequential order. The final brand equity causal loop diagram can be found in Figure 2.

R1: Customer satisfaction and brand trust rise as perceived quality rises. Due to word-of-mouth marketing, devoted consumers also boost perceived quality and brand loyalty. Additionally, the exogenous variable of fake news has a detrimental and diminishing effect on perceived.

B1: As the price of a brand's goods rises in response to increased brand value, customer retention suffers, which lowers sales and profits and, ultimately, the brand's competitive advantage.

R2: Product prices rise due to rising marketing expenses brought on by a decline in brand value. As a result, it becomes challenging to attract and keep consumers, and as sales, profitability, and competitive advantage all decline, so does the brand's unique value.

R4: As brand value rises, so do consumer attractiveness, sales volume, profitability, and competitive advantage—all to a more significant degree than previously. Consequently, the brand's worth rises as well.

B2: The organization's overall investment level declines as brand equity rises. Consequently, less money is spent on public relations, and customer communication is of lower quality than before, which lowers customer loyalty. Customer retention suffers as a consequence, which reduces the brand's competitive edge and, eventually, its unique value.

B3: Marketing expenses rise as brand equity declines. The product's cost may also rise due to this procedure. The buyer associates more outstanding quality with a more expensive product. Therefore, improving perceived quality may result in an improvement in brand value.

R3: As brand value has improved, customer retention has increased, which results in the desire to repurchase. This process creates pressure from consumers to raise quality, which over time compels businesses to increase their expenditure in R&D. As a result, brand equity and perceived quality also grow with time.

B4: Marketing efforts become more efficient and successful as brand equity rises. Therefore, corporations tend to make fewer investments to save expenses. As a result, less money is spent on point-of-sale and sales marketing. It has a detrimental and diminishing effect on brand association, perceived quality, and brand awareness, which eventually causes a decrease in brand equity. The final causal loop diagram of this study is depicted in Figure 2.

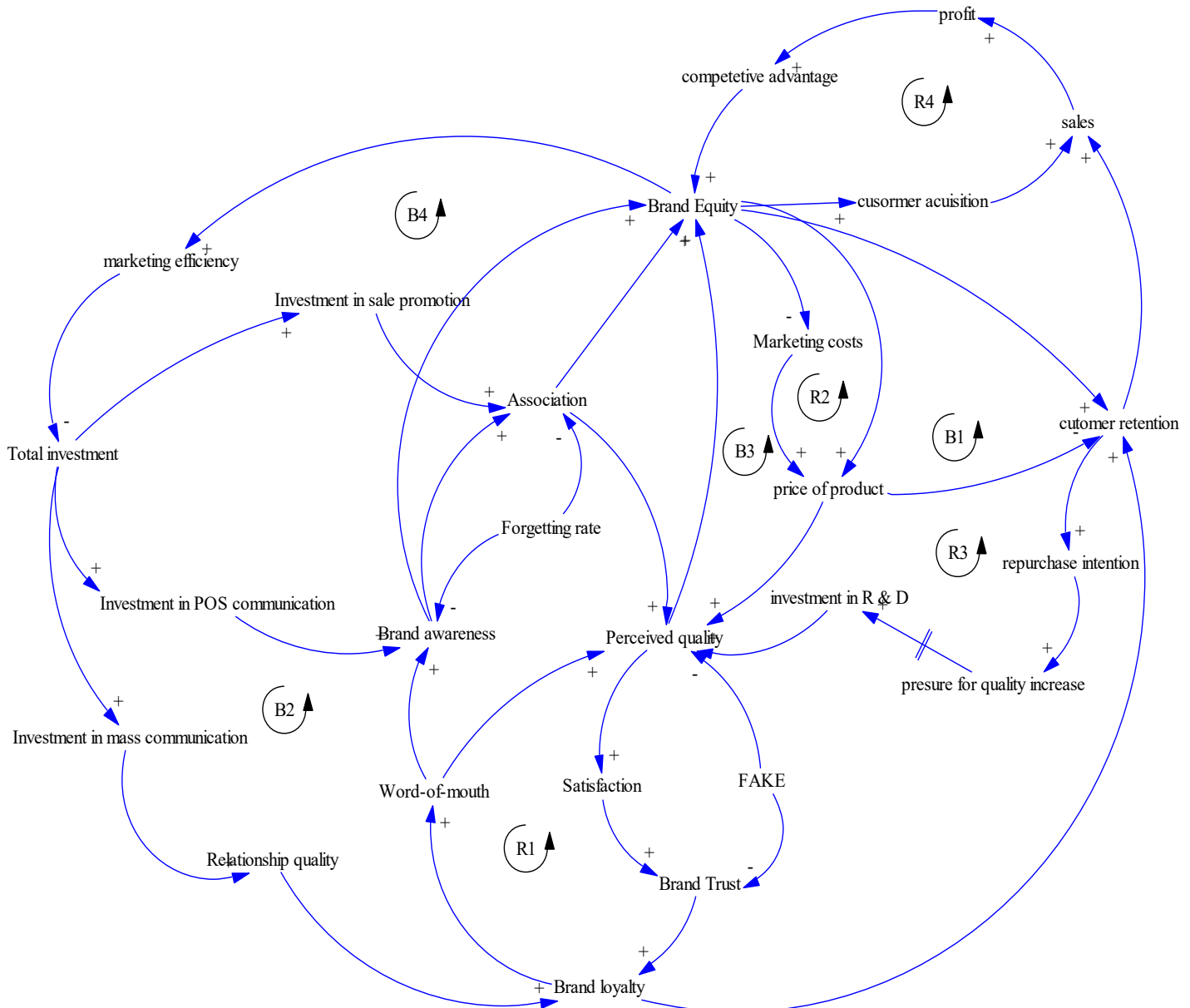


Figure 2. Final causal loop diagram of this study

3.4. Stock and flow model

Considering a kind of division of variables in the Stock and flow model of dynamic systems in this study, these variables are as follows. Table 2 indicates the types of variables applied in this study.

Table 2. Introducing the type of research variables

Row	Variable name	Variable type
1	Brand equity, brand association, brand awareness, perceived quality, brand loyalty.	level
2	The decrease and increase rate of brand equity, the decrease and increase rate of brand association, the decrease and increase rate of brand awareness, the decrease and increase rate of brand loyalty, and the decrease and increase rate of perceived quality.	Rate
3	Forgetting rate, percentage of investment in direct communication, percentage of investment in media advertising, percentage of investment in point of sale.	Fixed
4	Efficiency and effectiveness of marketing activities, total investment, product price, quality of communication, competitive advantage, profit, sales, word of mouth advertising, customer satisfaction, investment in direct communication, brand trust, investment in research and development, customer pressure to increase product quality, repurchase intention, customer retention, customer acquisition, marketing costs, competitors' investment in communication, availability of other competitors' products.	Auxiliary

In this part, the stock and flow diagram of the model is drawn due to the causal loop diagram described in the previous section. The stock and flow model drawn in Figure 3 shows how various factors affect brand equity.

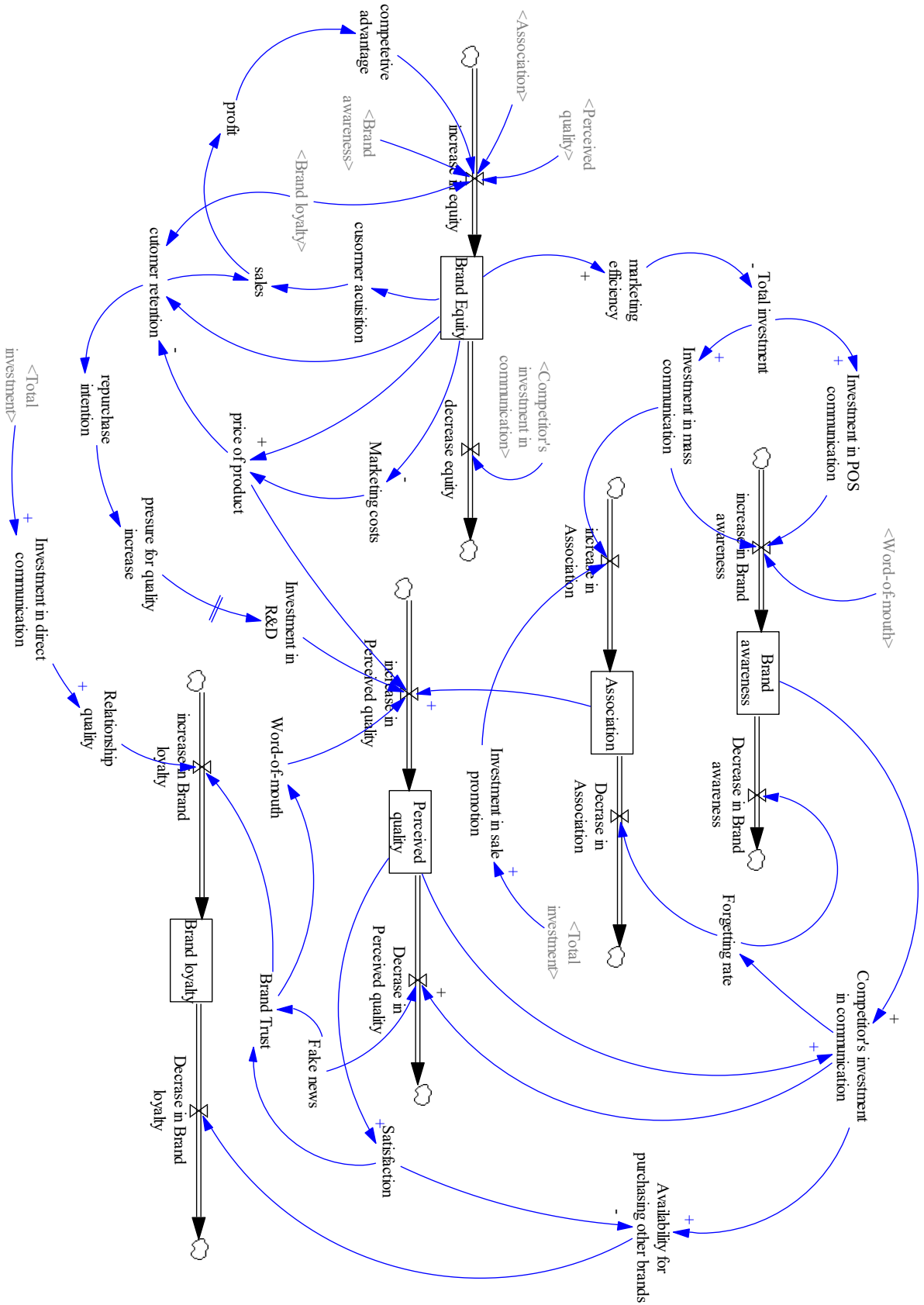


Figure 3. A comprehensive of stock and flow diagram of components affecting the brand value

3.5. Formulating stock and flow model

3.5.1. Endogenous (dependent) variables in the model

Brand equity: It is a factor that builds over time. The value of this variable in 2020, as determined by the papers that are readily accessible, was equal to 84 billion dollars, which is considered the beginning value at the time of the simulation. Its input rate is the sum of the primary determinants of brand value (including dimensions of brand awareness, brand association, perceived quality, and brand loyalty). This variable (competitors' activity and investment in communication) is considered an output rate; throughout time, the quantity of this variable is defined by changes in the elements affecting the brand's unique value. It is also important to note that the brand's unique value rises as the competitive advantage does. It is important to note that [Acker's \(1993\)](#) brand equity framework was used to describe this process in stock and flow modeling. Equations 1, 2, and 3, compute brand equity variables, gain, and drop rate.

$$\text{Brand Equity} = \text{INTEG} (\text{increase in brand equity} - \text{decrease in brand equity}, 8.4) \quad (1)$$

$$\text{Increase in brand equity} = \text{Brand Association} + \text{Brand awareness} + \text{Brand loyalty} + \text{Perceived quality of brand} + \text{competitive advantage} \quad (2)$$

$$\text{Decrease in brand equity} = \text{Competitor's investment in communication} * 0.59 \quad (3)$$

Research and development spending: This variable serves as an auxiliary variable. This approach assumes that increasing brand value increases client retention and their likelihood of making another purchase. Customers now have higher expectations for quality. Thus to enhance quality, the company must engage in research and development. This auxiliary variable has been explained using the delay function (Delay) since it varies over time and with a delay. Equation 4 is based on a concept from study of [Ishii \(2014\)](#).

$$\text{Investment in R \& D} = \text{DELAY1} (\text{pressure for quality increase}, 24) \quad (4)$$

Brand awareness: This accumulation-type variable is taken into account at three different input rates. The quantity of word-of-mouth advertising, point-of-sale investment, and mass communication investment all contribute to an increase in this variable. On the other hand, the forgetting rate, which is influenced by rivals' actions, successfully lowers this variable over time. Equation 5 is used to get the value of this stock variable from the integral of the difference between the total sources of increasing and decreasing brand awareness. Equations 6 and 7 are also used to calculate the variable input and output rates, respectively. The paper by [Shafeiha et al. \(2016\)](#) has been cited for elaborating on this concept and providing the necessary equations.

Brand awareness= INTEG (increase in brand awareness rate- decrease in brand awareness rate, 7.69) (5)

Increase in brand awareness rate =Investment in POS communication+ Investment in mass communication) + Word-of-mouth (6)

Decrease in Brand awareness rate= forgetting rate (7)

Brand association: This variable is regarded as a state variable in the stock and flow model. This study assumes that spending on direct marketing and sales promotions would affect brand association growth. On the other hand, the forgetting rate, which is influenced by rivals' actions, successfully lowers this variable over time. Using Equations 8-4, the value of this variable is determined by taking the integral of the difference between all causes of rising and decreasing brand association. Additionally, Equations 9 to 11 have been used to calculate the variables of input and output rates and the variable of forgetting rate depending on the activity and investment of rivals, respectively. The formulae listed here were taken from a scientific literature survey, mainly from works by [Hidayatnoa et al. \(2013\)](#) and [Cristelli and Figueidoro \(2009\)](#).

Brand association = INTEG (increase rate in brand association- Decrease rate in brand association, 7.9) (8)

Increase rate in brand association= Investment in mass communication+ Investment in sale promotion (9)

Decrease rate in brand association= Forgetting rate (10)

Forgetting rate = 0.1*Competitor's investment in communication (11)

Marketing costs: This auxiliary variable, which quantifies the number of marketing expenses, is anticipated that the quantity of marketing expenses would drop as brand equity increases, according to an interview with marketing managers and a study of research literature. Because the smooth function is often used to calculate time averages and display expectations, it is utilized to get the value of this variable. While designing this function, it was thought that after 14 months, marketing costs would fluctuate and be anticipated to reduce whenever the brand's worth increased. Equation 12 depicts the effect of the brand equity variable's relationship to marketing expenses.

Marketing costs= SMOOTH (1/Brand Equity, 14) (12)

Product price: Marketing expenses and brand equity presumptively influence this auxiliary variable in this study. In this model, it is presumable that brand equity has an 80% effect on product price and that marketing expenses have a 10% effect. The examination of unofficial materials like websites and experts' views have been utilized to determine this variable's value. This variable may be calculated using Equation 13.

$$\text{Price of product} = 0.8 * \text{Brand Equity} + 0.1 * \text{Marketing costs} \quad (13)$$

Fake news: In the model execution mode for the current circumstance, this variable is regarded as an exogenous variable (Base Run). (Based on the STEP function, this variable has been added to the system to emulate it. Equation 14 displays the creation and dissemination of fake information throughout 24-28 and 38-41 months. This formula illustrates how the amount of fake news published doubled over the simulated period. The policy part of the next chapter has further details. Ideas from works by [Burton and Pitt \(2018\)](#) and [Pesonen \(2018\)](#) were used to create in Equation 14.

$$\text{Fake news} = \text{STEP}(-1, 24) + \text{STEP}(1, 28) + \text{STEP}(-2, 38) + \text{STEP}(2, 41) \quad (14)$$

3.5.2. Exogenous (independent) variables in the model

The following values for the variables in the model have been obtained from information from informal sources such as websites and oral information from experts and marketing managers in the food industry and the Coca-Cola brand in Mashhad. The results are shown in Table 3.

Table 3. Exogenous variables of the model

Variable name	Value
Percentage of investment in direct communication	30%
Investment percentage in media advertising	30%
The effect of brand equity on product pricing	80%
Investment percentage at the point of sale	30%
Forgetting rate	10%
The effect of increasing customers' access to other competitors' products on reducing loyalty to the company's product	30%

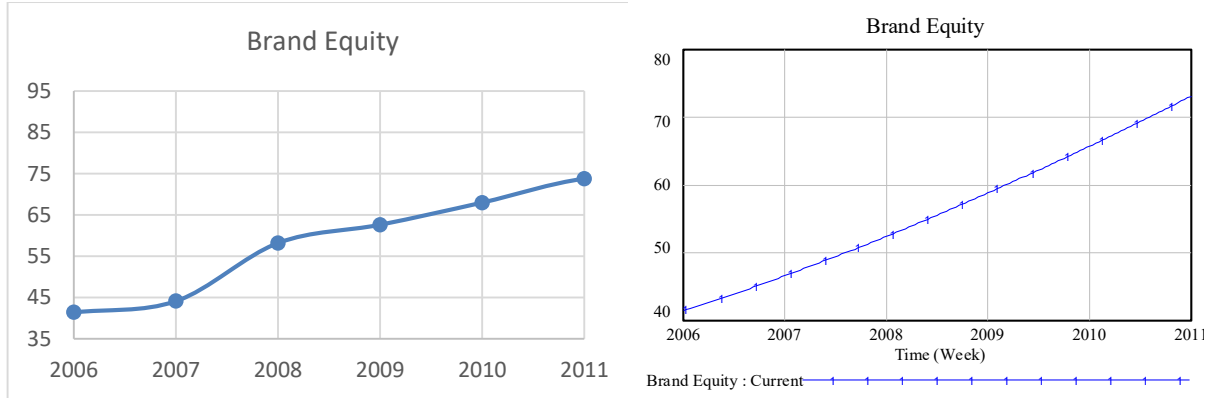
4. Validation of the designed model

4.1. Structural validation of the dynamic model

There are several tests to verify the dynamic model in terms of structure and behavior. Vensim software is used as one of the structural validation techniques for the dynamic model. The accuracy of the performed model can be checked by pressing CTRL+T. The model's structure includes rate and state variables. The equations utilized are compatible, and the model is structurally authorized and appropriately applied according to the message provided by the expressive software.

4.2. Behavior reproduction test

To verify the correctness of the model's behavior, this test will compare the simulation results with actual data. The figures' findings demonstrate how well the researched variable may be replicated. The results are shown in Figure 4.



Source: www.statista.com (Coca-Cola's brand value)

Source: Research results

Figure 4. Comparison test with reference behavior

4.3. Behavioral validation

4.3.1. Examining the model's capability under extreme conditions

Extreme condition test is conducted to see if the model operates realistically under extreme conditions. In this test, the extremely high and shallow values of the model's primary variables are investigated for behavior, and the model's sensitivity to these changes is examined. This test compares the produced behavior to the expected behavior by assigning limit values to the model's chosen parameters.

For this test, it is assumed that the variable brand awareness decline rate—caused by rivals' actions and forgetting rate—has instantly achieved zero. It follows that a rise in the brand awareness stock variable is anticipated. The model's behavior is contrasted with the base state in Figure 5 (a), and the test's behavior is consistent with expectation. The outcome of this test and the state variable's non-negativeness provide evidence that the model structure results in acceptable behavior under extreme conditions.

Since it is assumed in this test that the variable measuring the perceived quality loss rate would be zero, it is anticipated that the perceived quality will increase somewhat. The behavior from this test aligned with what had been anticipated, and Figure 5 (b) compares the model's behavior to the initial state. The outcome of this test demonstrates that, according to

experimental and theoretical data, the model structure generates appropriate behavior under extreme conditions.

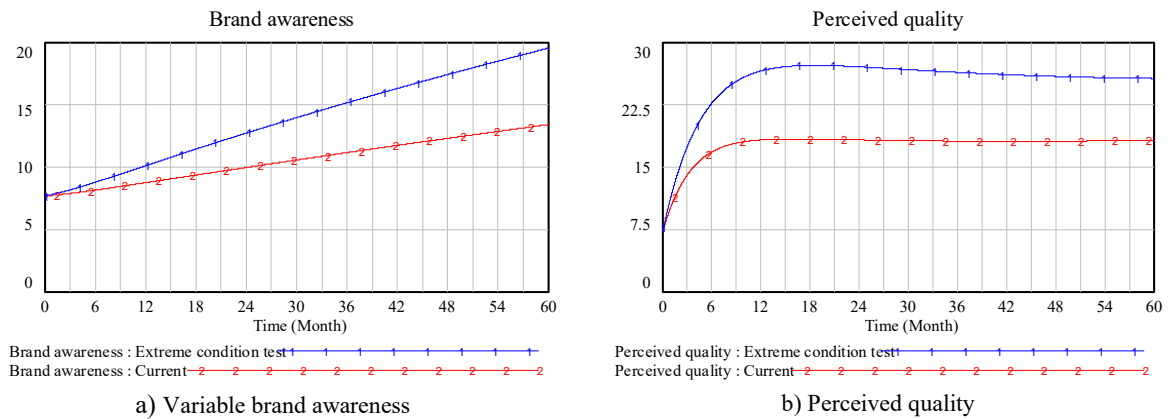


Figure 5. Extreme condition test

4.3.2. Sensitivity analysis

This test serves as another method to validate the behavior of the model. It addresses the question of whether the model's conclusion can still hold even in the absence of precise parameter values. This test demonstrates that the system does not respond significantly to changes in parameter values, which lowers the modeler's uncertainty level on the variables' behavior. It is hard to conduct a thorough sensitivity analysis since it would entail testing all conceivable combinations of assumptions about the variables' uncertainty range due to the examined model's complexity and the abundance of variables. The developed model's validity was tested for this aim by altering various parameters. In Table 4, this sensitivity analysis is shown.

Table 4. Validation of the designed model by sensitivity analysis

Cause		Intermediate variables	Disabled		
Variable	Action		Variable	Waiting for the researcher	Result
Brand equity	Increase	price of products	Customer retention	Decrease	Decrease
Customer satisfaction	Decrease	Brand trust activities	Brand loyalty	Decrease	Decrease
Brand trust	Decrease	No interface variables	loyalty	Decrease	Decrease
Sale	Increase	Profit	Competitive Advantage	Increase	Increase
Brand equity	Increase	The effectiveness and efficiency of marketing	The amount of investment in advertising	Decrease	Decrease
Brand awareness	Increase	Brand associations	Perceived quality	Increase	Increase

For instance, brand loyalty also declines in proportion to a decline in brand trust. Additionally, due to the favorable effect that rising sales have on an organization's profitability,

its competitive edge also grows. On the other side, growth in brand value may result in higher product prices, which makes it harder to keep consumers and may even result in a customer decline.

Interviews should be utilized as an effective technique to validate the model based on the opinions of experts and current management, and it should be mentioned. For this aim, marketing managers and specialists in the food sector examined and approved the causal loop diagram, stock and flow diagrams, and behaviors generated by the models. They thought the model's structure accurately reflected natural processes, and its predictions accurately captured the system's actual behavior.

5. Simulation results

The model has produced the following results as a consequence of the behavior of the key factors and key indicators in the brand's unique value by the relationships between the model's variables that were indicated.

5.1. Implementation and evaluation of policies

This part introduces the implementation policies and the analysis of each one.

5.1.1. The policy of the status quo

One of the most valuable subjects in brand management and branding is the brand's unique value, which is the primary variable in this study. Figure 6 shows this variable's state over a 60-month (from 2020 to 2025). The marketing division specialists and managers claim that this graph's behavior is precisely in line with how this variable evolves and how it is right now. Equity in a brand is increased over time through positive developments. In other words, there has to be much work done to raise other important variables like brand recognition, brand loyalty, perceived quality, and brand connection to enhance this variable.

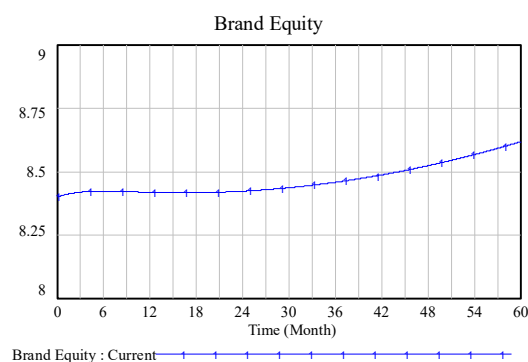


Figure 6. The amount of equity of the existing brand

5.1.2. The policy of surveying the effect of fake news on brand equity and the factors affecting it

Reviewing the study literature revealed that the publication and spread of fake information harm consumers' perceptions of the brand's reliability and trust. Over time, due to feedback loops, the brand equity variable also changes. This strategy assumes that fake news will appear twice during 24–28 and 38–41 throughout five years. Exogenous fake news is used in this changeable policy, harming the brand's perceived quality and consumer confidence. The evolution of brand equity throughout the experiment is seen in Figure 7. Indeed, it is evident that the brand equity value initially experienced a decline over four months, with a gradual slope. Subsequently, it rises over the same duration, again with a gradual slope. This example demonstrates the distinct value that a great brand has in the eyes of the consumer. Although the dissemination of fake news initially skews consumer perceptions, brand recognition will eventually rise if marketing and investment efforts are sustained. The effect of posting fake news a second time is what matters in the diagram given. The diagram's behavior demonstrates that brand equity declines more rapidly and substantially in the second order. Because of this, if marketing managers do not address the issue and stop the spread of similar news, the brand's unique value will gradually decrease.

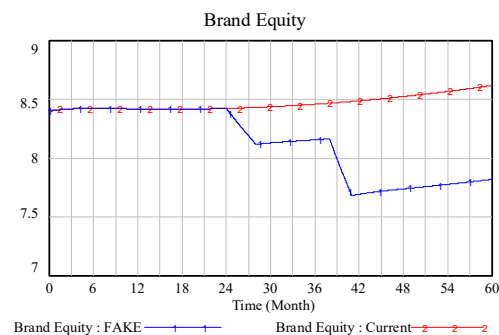


Figure 7. The special value of the brand after the publication and spread of fake news

In that order, the behaviors of brand awareness, brand association, brand loyalty, and perceived quality variables are shown in Figure 8. Customers' perceptions of quality have declined significantly after the distribution of fake information, particularly in the second neighborhood. It is because, within a short period following the dissemination of fake news, consumer perceptions of quality are more immediately affected. It should be mentioned that the Coca-Cola brand's perceived quality has stabilized over time due to the brand's maturity stage of its life cycle. Because of this, even word-of-mouth marketing, proper pricing, and better distribution accessibility do not affect perceived quality. The feedback loops connected to brand trust, word-of-mouth marketing, and organization marketing actions affect brand awareness

most among the previously stated elements. Compared to the baseline, brand loyalty likewise declined; nevertheless, the brand association variable has marginally altered. These actions indicate that, in contrast to any assault by fake news, mature brand loyalty and association are quite robust.

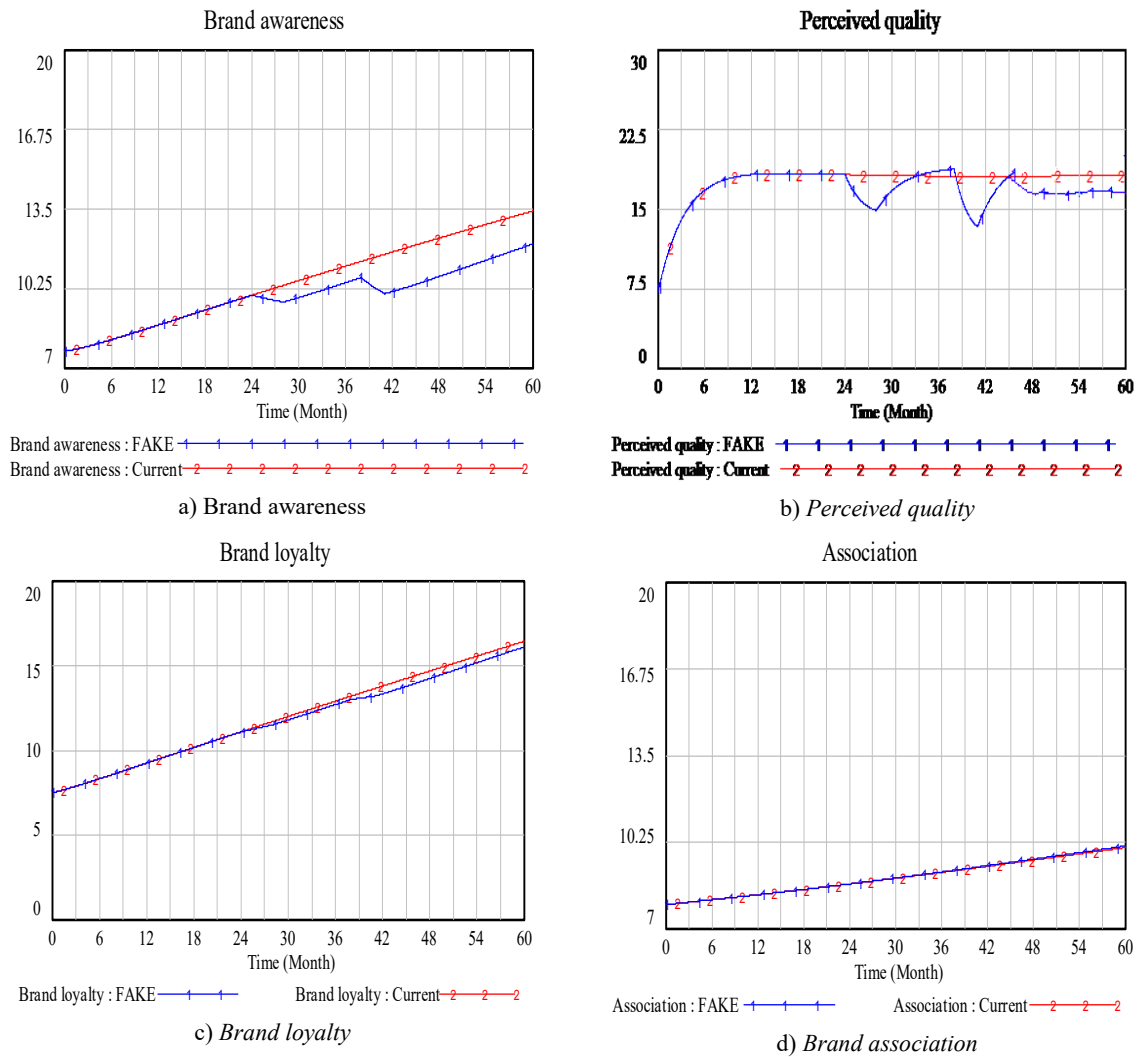


Figure 8. Results of policy influence of fake news on brand awareness, perceived quality, brand loyalty, and brand association

Figure 9 illustrates the investments in point of sale, sales marketing, and public relations. In the long run, as equilibrium loops exist, the behavior of the diagrams reaches a state of equilibrium. When fake news is released, companies are compelled to increase their investments in advertising to mitigate the potential decrease in their brand equity value.

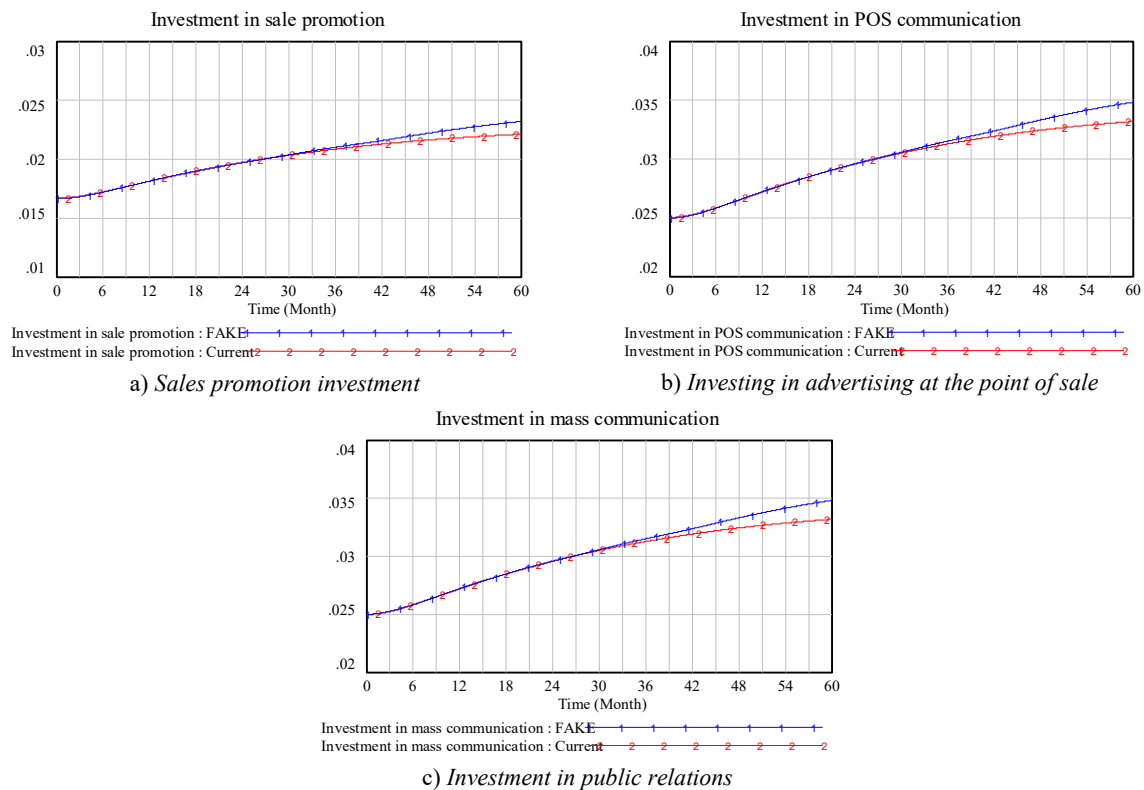


Figure 9. Results of policy influence of fake news on sales promotion investment, investing in advertising at the point of sale, and investment in public relations

5.1.3. The policy of Increasing customer knowledge

The ability to comprehend and connect with consumers' preferences, behaviors, and expectations plays a significant role in shaping the brand's unique value and effectively engaging with the target audience in the digital realm of social media. Indeed, the understanding of consumers is another crucial aspect of a brand's unique value, especially in social media. Depending on client demands, employees may exchange information using tools, methods, and contexts provided by knowledge management (Wang et al., 2017). Knowledge is seen as a business's competitive advantage, particularly in the modern period when the extensive use of information technology serves as a marketing signal. By raising the level of knowledge, a company can also raise the level of the quality of its services by gathering knowledge about its customers (from the perspective of the organization) and, at the same time, the quality of the relationship between the customer and the company also improves as a result of the knowledge acquisition. (Round and Roper, 2012); Therefore, increasing brand equity depends greatly on consumer understanding.

Fake news is regarded as an endogenous variable in this strategy, and its effects on brand equity are examined by including the variable of growing consumer awareness in the model. This policy assumes that the firm would dedicate part of its expenditures to improving customer

knowledge. Figure 10 depicts the evolution of consumer understanding. The atmosphere focuses on this variable's behavior, eventually reaching its peak degree. When customers are well-informed, they tend to respond less to fake news. The effect of this variable on brand equity and the variables affecting it is shown in charts Figure 10.

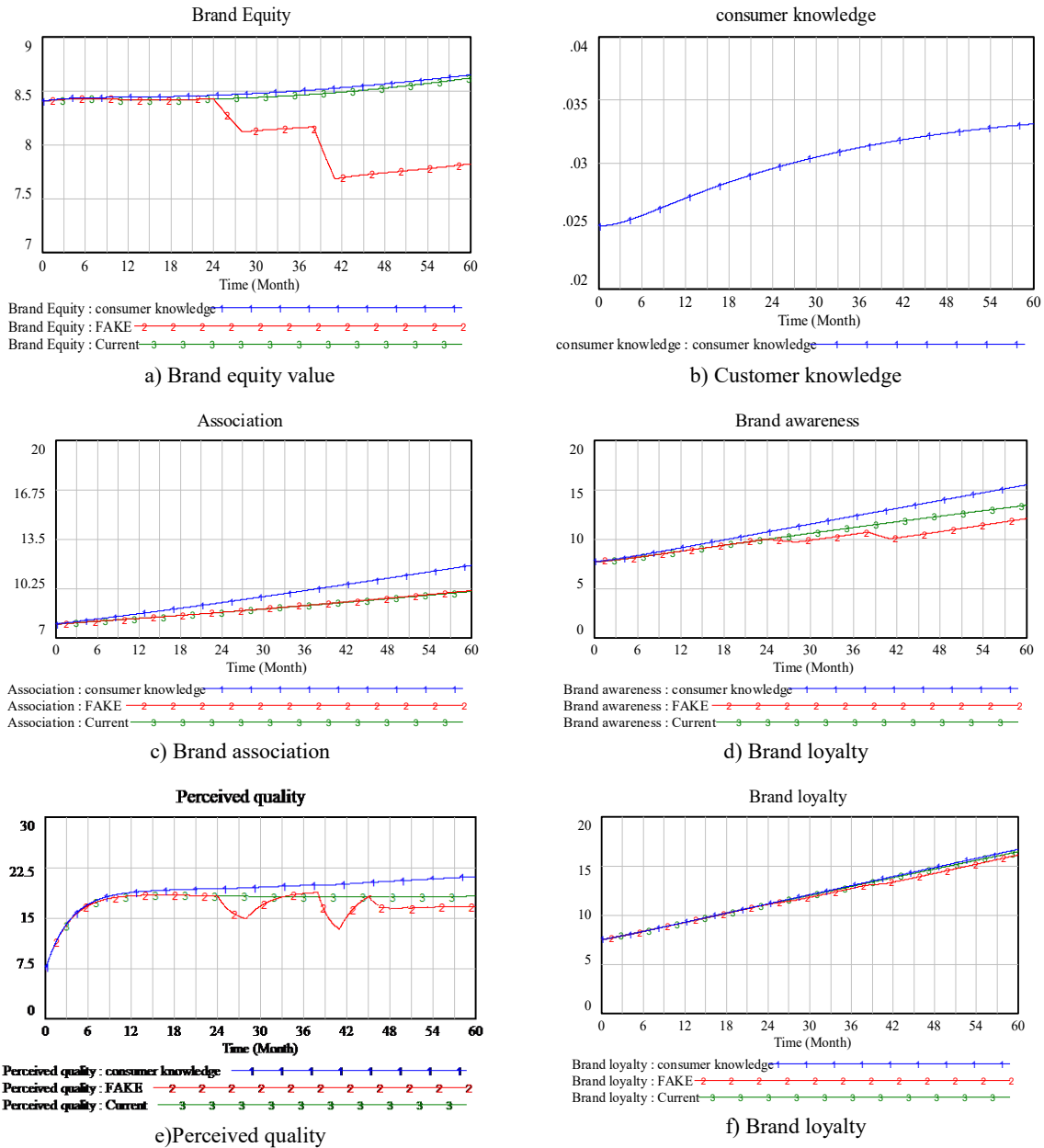


Figure 10. Results of key variables after applying the policy of increasing customer knowledge

The behavior the diagrams behave implies that when brand trust rises along with consumer understanding, the effect of fake news diminishes. As a result, brand equity, brand recognition, brand association, brand loyalty, and perceived quality. Due to Coca-Cola's status as a mature brand with limited significant competitors in the industry, brand loyalty has less growth than the previously described factors. Owing to the change in consumer awareness, the brand

association variable may be more sensitive to fake news than it was under the prior strategy. As a result, the brand's perceived quality may be higher than it was at the baseline.

6. Discussion and conclusion

Today, brands serve as the key capital for many organizations since they serve to present the product and highlight its unique qualities. Although brand equity has received much attention in previous studies, the effect of fake news on this measure and the factors that influence it has not been thoroughly and consistently investigated. Therefore, using the system dynamics technique, this study has attempted to model the consequences of fake news on the brand's unique value and how to enhance it by creating policies. The simulation findings from this study may broaden marketing managers' perspectives and aid them in making choices that will enhance brand value. Because in the spicy food industry, this long-term consumption period is considered, the model described in this study was simulated for 5 years (Hedaytno et al., 2013). The simulation's findings demonstrated that the brand's unique value and affecting factors interact via feedback loops and build up over time. These results are consistent with the results of the studies of Shafeiha et al. (2016) and Aker (1993). The findings of this study suggest that spreading fake news about the organization and its goods often may eventually lessen the brand's unique worth. The simulation's findings demonstrated that brand equity, perceived quality, and brand awareness characteristics changed more in the second stage of fake news broadcasting than in the first. Customer loyalty is also influenced by perceived quality. The amount of consumers who believe in the reputation and credibility of the company declines with the spread of fake information. Large companies like Coca-Cola are thus compelled to boost expenditure in advertising and sales promotion, even though it may be challenging to penetrate a brand that has attained high recognition. These findings are consistent with Pesonen's (2018) and Ebrahim's study (2020). Based on the outcomes of the simulation and the application of the policy of increasing customer knowledge, it was determined that the organization's investment to increase the customer's knowledge of the products and remove the misunderstandings brought on by fake news could increase trust in the brand and lead to the neutralization of the effect of fake information on the brand equity and components affecting it. By investing a small amount of money in applying this strategy, the company can strengthen the bond between its brand and its consumers by reducing dangers like a drop in the brand's perceived quality and unique value. This result agrees with Berthon & Pitt (2018) and (Iglesias et al., 2017).

Marketing executives need to stop the dissemination of fake news. They may use deep learning artificial intelligence tools to detect suspect information or pay professionals to work on repairing and neutralizing it. They may do this by using modern techniques to restrict sites that disseminate fake news and by identifying and attempting to correct the weak places in their brand. By enhancing consumer communication, The Coca-Cola Company may utilize them to spot fake news, fake content, and associated websites. For instance, Coca-Cola brand fans may sign up on internet forums to notify managers and brand owners if they come across any commercials with questionable material. The business may also consider offering gifts and discounts on future purchases to entice more consumers to join. In certain of its advertising and marketing initiatives, the Coca-Cola brand may inform customers about online fraud and algorithmic targeting practices employed by marketers. In this approach, raising consumer knowledge may shield a brand's reputation from the damaging effects of fake news. The simulation findings of the current research demonstrated that the brand's unique value is dynamic and that all the factors and dimensions that affect it may vary over time depending on various policies. Therefore, marketing managers should carefully consider the brand's unique value in long-term and short-term strategies and concentrate on raising it via feedback linkages between the factors that affect it. By considering other contributing factors, researchers may use different strategies to defend against the damaging effects of fake news and utilize the model given in this study as a foundation for brand equity management. Future studies will be able to evaluate and contrast the hazards posed by fake news with other challenges to brand management by expanding the model that has been given. Future studies might assess the effects of fake news on the brand equity of particular categories of commercial brands that are more susceptible than others using the approach described in this study. Additionally, this methodology may be modified to assess the brand's unique value in various sectors. In order to maintain brand equity and promote it, considering other influencing elements like competitor activities and the significance of social networks in future research, it is required to apply the system dynamics method.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Aaker, D.A. and Biel, A.L., 1993. *Brand equity and advertising: An overview* (pp. 1-10). Hillsdale, NJ: Lawrence Erlbaum Associates.

- Azzari, V. and Pelissari, A., 2021. Does brand awareness influences purchase intention? The mediation role of brand equity dimensions. *BBR. Brazilian Business Review*, 17, pp.669-685. doi.org/10.15728/bbr.2020.17.6.4.
- Bahadur, F.K., 2020. *Fake it till you break it?! Impact of fake news on implicit brand attitudes of social media users* (Master's thesis, University of Twente).
- Baldauf, A., Cravens, K.S., Diamantopoulos, A. and Zeugner-Roth, K.P., 2009. The impact of product-country image and marketing efforts on retailer-perceived brand equity: An empirical analysis. *Journal of retailing*, 85(4), pp.437-452. doi.org/10.1016/j.jretai.2009.04.004.
- Berthon, P.R. and Pitt, L.F., 2018. Brands, truthiness and post-fact: managing brands in a post-rational world. *Journal of Macromarketing*, 38(2), pp.218-227. doi.org/10.1177/027614671875586.
- Borges-Tiago, T., Tiago, F., Silva, O., Guaita Martínez, J.M. and Botella-Carrubi, D., 2020. Online users' attitudes toward fake news: Implications for brand management. *Psychology & Marketing*, 37(9), pp.1171-1184. doi.org/10.1002/mar.21349.
- Borkovsky, R.N., Goldfarb, A., Haviv, A.M. and Moorthy, S., 2017. Measuring and understanding brand value in a dynamic model of brand management. *Marketing Science*, 36(4), pp.471-499. doi.org/10.1287/mksc.2016.1020.
- Bronstein, M.V., Pennycook, G., Bear, A., Rand, D.G. and Cannon, T.D., 2019. Belief in fake news is associated with delusionality, dogmatism, religious fundamentalism, and reduced analytic thinking. *Journal of applied research in memory and cognition*, 8(1), pp.108-117. doi.org/10.1016/j.jarmac.2018.09.005.
- Chattopadhyay, T., Dutta, R.N. and Sivani, S., 2010. Media mix elements affecting brand equity: A study of the Indian passenger car market. *IIMB Management Review*, 22(4), pp.173-185. doi.org/10.1016/j.iimb.2010.09.001.
- Crescitelli, E. and Figueiredo, J.B., 2009. Brand equity evolution: a system dynamics model. *BAR-Brazilian Administration Review*, 6, pp.101-117. doi.org/10.1590/S1807-76922009000200003.
- Datta, H., Ailawadi, K.L. and Van Heerde, H.J., 2017. How well does consumer-based brand equity align with sales-based brand equity and marketing-mix response?. *Journal of Marketing*, 81(3), pp.1-20. doi.org/10.1509/jm.15.0340.
- Dehkordi, A., Rabbani, A. 2012. value-based strategic management at the organization level, *Strategy Quarterly*, 60, pp. 217-234. (In Persian).
- Di Domenico, G. and Visentin, M., 2020. Fake news or true lies? Reflections about problematic contents in marketing. *International Journal of Market Research*, 62(4), pp.409-417.
- Ebrahim, R.S., 2020. The role of trust in understanding the impact of social media marketing on brand equity and brand loyalty. *Journal of Relationship Marketing*, 19(4), pp.287-308. doi.org/10.1080/15332667.2019.1705742.
- Flostrand, A., Pitt, L. and Kietzmann, J., 2020. Fake news and brand management: a Delphi study of impact, vulnerability and mitigation. *Journal of product & brand management*, 29(2), pp.246-254. doi.org/10.1108/JPBM-12-2018-2156.
- Hidayatnoa, A., Putrib, D.N. and Rahmanc, I., 2013, June. Understanding the dynamics of 6P branding strategy with brand equity for a mature customer-goods brand using a system dynamics model. In *Proceeding of the 13th International Conference on QIR (Quality in Research) Yogyakarta, Indonesia* (pp. 25-28).
- Iglesias, O., Singh, J.J. and Batista-Foguet, J.M., 2011. The role of brand experience and affective commitment in determining brand loyalty. *Journal of brand Management*, 18, pp.570-582. https://doi.org/10.1057/bm.2010.58.
- Iranzadeh, S., Ranjbar, A. and Poursadegh, N., 2012. The effects of marketing mix elements on Brand equity. *New marketing research journal*, 2(3), pp.155-172.

- Ishii, Y., 2014. Quality–price competition and product R&D investment policies in developing and developed countries. *Economic Record*, 90(289), pp.197-206. <https://doi.org/10.1111/1475-4932.12076>.
- Jing-Bo, S., Wan-You, X. and Jun-Hui, Z., 2017, August. The Influence of Brand Extension on Customer Equity Value of Parent Brand Based on System Dynamics. In *2017 International Conference on Management Science and Engineering (ICMSE)* (pp. 203-209). IEEE. 10.1109/ICMSE.2017.8574385.
- Karroubi, B., Mohammadi, B., Bejaleh, J. 2018. Evaluation of the factors affecting brand value among sportswear customers (case study: Ali Daei brand). *Geography and Human Relations*, 1(1), pp.218-236. [In Persian].
- Keller, K.L., Parameswaran, M.G. and Jacob, I., 2011. *Strategic brand management: Building, measuring, and managing brand equity*. Pearson Education India.
- Kim, J.H. and Hyun, Y.J., 2011. A model to investigate the influence of marketing-mix efforts and corporate image on brand equity in the IT software sector. *Industrial marketing management*, 40(3), pp.424-438. doi.org/10.1016/j.indmarman.2010.06.024.
- Kwon, M. and Barone, M.J., 2020. A world of mistrust: fake news, mistrust mind-sets, and product evaluations. *Journal of the Association for Consumer Research*, 5(2), pp.206-219. doi.org/10.1086/708035.
- Maria, S., Pusriadi, T., Hakim, Y.P. and Darma, D.C., 2019. The effect of social media marketing, word of mouth, and effectiveness of advertising on brand awareness and intention to buy. *Jurnal Manajemen Indonesia*, 19(2), pp.107-122. doi.org/10.25124/jmi.v19i2.2234.
- Mills, A.J., Pitt, C. and Ferguson, S.L., 2019. The relationship between fake news and advertising: Brand management in the era of programmatic advertising and prolific falsehood. *Journal of Advertising Research*, 59(1), pp.3-8. doi.org/10.2501/JAR-2019-007.
- Monti, F., Frasca, F., Eynard, D., Mannion, D. and Bronstein, M.M., 2019. Fake news detection on social media using geometric deep learning. *arXiv preprint arXiv:1902.06673*. doi.org/10.48550/arXiv.1902.06673.
- Nik Farjam M., Abdulvand, S. 2015. Modeling brand value for fast consumption products with a dynamic system approach. *Brand Management Quarterly*, 4(8). [In Persian].
- Otto, P. and Bois, J.R., 2001, July. Brand management facilitation: a system dynamics approach for decision makers. In *Proceedings of the International System Dynamics Conference*.
- Pesonen, T., 2018. The effects of fake news on consumer trust in social media marketing: A quantitative study on consumer mindset.
- Round, D., 2012. *Exploration of Consumer Brand Name Equity for Established Products and Services: Using a Global Marketing Induced Change Analysis Approach*. The University of Manchester (United Kingdom).
- Ruiz-Meza, J., Sotaquirá, R. and Montoya-Torres, J.R., 2022. Effects of tourism planning and marketing strategies on destination brand equity: A system dynamics model. *Journal of Simulation*, pp.1-18. doi.org/10.1080/17477778.2022.2102945.
- Shafeiha, S., Saleh Ardestani, A., Kazemi, A. and Mirabi, V.R., 2017. Designing the brand equity model and forecasting the future process in alborz insurance company with using a system dynamics approach. *Future study Management*, 28(109), pp.75-89. [in Persian].
- Stahl, F., Heitmann, M., Lehmann, D.R. and Neslin, S.A., 2012. The impact of brand equity on customer acquisition, retention, and profit margin. *Journal of marketing*, 76(4), pp.44-63. doi.org/10.1509/jm.10.052.
- Tandoc Jr, E.C., Lim, D. and Ling, R., 2020. Diffusion of disinformation: How social media users respond to fake news and why. *Journalism*, 21(3), pp.381-398. doi.org/10.1177/146488491986832.

- Wang, Z., Singh, S.N., Li, Y.J., Mishra, S., Ambrose, M. and Biernat, M., 2017. Effects of employees' positive affective displays on customer loyalty intentions: An emotions-as-social-information perspective. *Academy of Management Journal*, 60(1), pp.109-129. <https://doi.org/10.5465/amj.2014.0367>.
- Yoo, B., Donthu, N. and Lee, S., 2000. An examination of selected marketing mix elements and brand equity. *Journal of the academy of marketing science*, 28(2), pp.195-211. doi.org/10.1177/0092070300282002.
- Zhang, J., 2023. Research on Modeling and Simulation of We-media Brand Equity Growth. *Advances in Economics and Management Research*, 4(1), pp.142-142. doi.org/10.56028/aemr.4.1.142.2023.