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Analyzing Online Marketing for Contemporary Snacks Through Instagram using SIR Model

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HIGHLIGHTS

- SIR model for online viral marketing can be used as an essential tool to help the marketers to identify the effectiveness of their online promotion in varieties of platform.
- Among the three most used types of posting for online marketing through Instagram are Feed, Reels and Stories. Based on this study, reel is the most viral posting ($R_0 = 3.043 > 1$).
- The virality of the posting can be changed when a certain value of parameters such as virality rate and recovery rate changes.
- The virality rate (β) and recovery rate (γ) can be obtained through the number of interactions in Instagram such like.

ABSTRACT

During the implementation of the Movement Control Order (MCO), e-marketing became a favourable solution for sellers to interact with customers at home. Today, even though the MCO is no longer in existence, online shopping behaviours have become a new norm because of a long-term impact on the interactions between seller and buyer. Since the number of online marketing is growing, sellers must understand the concept of viral marketing that suits their products. This study analyses the virality of contemporary snack marketing on the Instagram platform using the Susceptible-Infected-Recovery (SIR) model. It is essential for sellers or marketers who want to see how users react to various types of posting. It also makes it easier for customers to get the information from the postings. The parameters used in this model are the number of followers, number of reached users, and number of homepage visits. Data are collected from 14 July 2021 until 11 October 2021 at an Instagram account that promotes a type of chocolate-in-jar snack. There are three types of posting that the admin of the Instagram account frequently uses to gain customer interaction, which are Feed, Reels, and Stories. The most viral posting from each type is observed. The results reveal among the viral posts, Reels recorded the highest virality posted on 11 September 2021 (Saturday).

Keywords: *Digital marketing, Instagram, Viral marketing, Contemporary snacks, SIR model.*

INTRODUCTION

Nowadays, most promotional strategies are carried out via electronic devices such as laptops, mobile phones, tablets, or other electronic devices (Varma, 2020). There are nine major types of business in digital marketing models. But, we only consider two of them which are Business to Customer (B2C) and Business to Business (B2B) because both of them are the most relevant to this study. B2C refers to the process of selling goods and services directly to customers who are the end-users of the company's products or services (Kenton, 2021). In this study, it refer to the relationship between the founder of a product and the consumers. On the other hand, B2B eCommerce (also known as wholesale eCommerce) (Dunne, 2020) can be seen in this study as the relationship between the founder and his agents.

Presently, there are many social media platforms that support digital marketing such as Instagram (Chatterjee, 2020). Instagram is also known as a go-to-shopping platform that are attached with their own features such as reels, stories, feed and insight features (Ki, 2020). In Instagram, there is a specific space called the Instagram shop that allows sellers to promote their products(Appel, 2019). Every user can go through the shop space to view the availability of a product in the market that they are intended to buy. In the same time, Instagram insight help the sellers to manage their marketing activities to make their posting become viral. It is advantageous for businesses to analyze and create features that make the process of buying a product can be done based on the suggestion of the Instagram user (Storozhenko, 2019).

Companies use viral marketing as a core marketing technique to accomplish their mission and vision in order to improve the performance of organizations (Bai, 2020). In viral marketing, individual instincts are used to connect, to exchange information, and to interact with customers since the internet has become familiar to people of all ages (Taillon, 2020). They tend to spend more time online (Al Muala, 2018). In other words, E-marketing allows sellers to form favourable interactions with customers at home (Francisco, 2021). As a result, online marketing or e-marketing is gaining popularity worldwide (Storozhenko, 2019). It can reduce the problems associated with traditional marketing, such as the rapidly declining number of customers. E-marketing is also effective in lowering the cost of marketing. Based on a study by Huey, L. S. (2014), it has been proven that by utilizing social media, large corporations achieve greater success and small businesses can become more well-known without having to spend a lot of money on marketing. In the same time, sellers should be exposed and proficient in e-marketing related to the particular business sector or industry that they are involved with (Hasan,2020). By reaching into viral marketing or building online social networks, the social network advertisers able to affect a brand's culture and customer behaviour itself (Miller, 2010 & Jayasinghe, 2021)

One of the most important things that sellers can do to address the issue of viral marketing in online business is to use their creativity for advertising their products. They must devote themselves to being a user of their product, as this will enable them to comprehend the feelings of their customers. Sellers must expand their minds to improve their social media content to attract more customers (Chen, 2021). It implies that they should avoid posting the same stuff repeatedly. The more attractive the posting, the more customers they can attract. Since they market their goods on social media, sellers must also be active in their business's marketing daily. It is critical to ensure that customers do not lose interest in the products and encourage them to repeat orders (Dahnil, 2021).

During COVID-19 pandemic season, the Malaysian government has implemented Movement Control Order (MCO) that restricts civilian movement. People are stuck at home. People are needed to work from home (WFH) and to study online, also known as Online Distance Learning (ODL). Snacking has become a habit of eating and drinking varieties of food. To put it another way, any food can be a snack (Becker, 2018). Contemporary snacks are in demand. Thus, the snack business become one of the most popular

businesses. Chocolate-in-jar is one of the chosen snack because it suites for eating during leisure, tea time, or to satisfy a sweet food craving. It is a snacks made with a small chocolate crunch or chocolate ball, corn oil, vegetable oil and three varieties of premium chocolate, including dark and white chocolate. To seek for the snacks, people will go for online shopping.

The situation has finally gone back to normal since the MCO is no longer in existence. It is possible to conduct business as normal, and it is face to face. The percentage of online businesses is used to be predicted to decrease slightly, logically. However, these thoughts are no longer relevant to this day. This is because online shopping behaviours make a long term impact on both the seller and the buyer (Varma, 2020). Many sellers prefer doing online business because it allows them to make a higher profit. After all, they can reduce costs since they do not need to pay for building rent. Meanwhile, buyers prefer shopping online because it is easier and saves their time. The business transaction can be done anytime at anywhere.

The epidemiological model such as Susceptible-Infected-Recovery (SIR) model is often used to study the widespread COVID-19 by investigating the pandemic data set (Rojas, 2020). Its goal is to develop numerical solutions to the entire SIR model based on the available data from the pandemic. Thus, this SIR model is being used in this study since the virality of a particular posting for marketing behaves in a similar way to the infections of chronic disease. Therefore, this study would use SIR model to examine how a particular posting related to chocolate-in-jar products spreads through Instagram.

The main objective of this study is to analyze the virality of contemporary snacks marketing on Instagram using the SIR model. The specific objectives of the study are:

i. To construct a SIR model for online viral marketing from selected posting.
ii. To simulate an experiment to identify the output when the value of particular parameters changes.

The findings of this study will help vendors see how online marketing can help them improve their marketing skills. As a result, sellers will understand the importance of marketing through social media. This study is significant to prove that poor execution of online marketing, such as insufficient interactions with consumers, may lead to poor business performance. Social media is vital for sellers as it can help them in their business life. In this new normal era, this study will aid in the investigation of viral marketing for contemporary snacks via Instagram using the SIR model. Online marketing necessitates a high-level discipline of sellers to fulfil viral online marketing requirements. Buyers benefit from online marketing since they can shop whenever and anywhere using social media, reducing their shopping time.

METHODOLOGY

The data for this study was gathered using the insights feature of the chocolate-in-jar at an Instagram account between 14 July 2021 and 11 October 2021. The collected data in this study is based on the hourly peak periods generated by the insights feature. In addition, the number of followers, the number of accounts reached, and the percentage of homepage visits of the relevant posting were all observed.

The model used for this study is the SIR model, which is based on the epidemiological model. It is one of the simplest models in mathematics. The S, I, and R in the model name stand for susceptible, infected, and recovered, respectively. Susceptible individuals are those who are at risk of infection, infected individuals are those who have been infected, and recovered individuals are those who have recovered or died. The majority of epidemic models divide the population into a small number of compartments, each containing identical individuals in terms of their disease status (Rodrigues & Fonseca, 2016). Since viral marketing spreads in the same way that pandemic infections do, this study will use an epidemiological model to

investigate how viral marketing spreads, specifically on Chocolate-in-jar products via Instagram. The SIR model is illustrated in Figure 1.

Figure 1: The SIR model.

where

S (t) is the number of followers at time t (susceptible),
I (t) is the number of reached users at time t (infected), and
R (t) is the number of homepage stop visited at time t (recovered)

Parameter β (rate of virality) denotes the number of Instagram users who reached, watched, and forwarded Instagram posting. In contrast, γ (recovery rate) represents the number of users who did and stopped visiting the Instagram account. The formulas to calculate β and γ are shown in Equations (3.1) and (3.2), respectively.

$$\beta = r \times p, \tag{3.1}$$

$$\gamma = \frac{1}{D}. \tag{3.2}$$

where

r = the ratio of the number of reached users out of the number of followers.

p = the number of interactions (likes) per time.

D = the duration of postings to likely stop.

$$r = \frac{\text{number of reached users}}{\text{the number of followers}}, \tag{3.3}$$

$$p = \frac{\text{interaction(likes)}}{\text{duration}}. \tag{3.4}$$

In this study, the population is assumed to be constant, which means that:

$$N = S(t) + I(t) + R(t), \tag{3.5}$$

where N represents the total population of Instagram users at time t. It is essential to give the model a set of parameters to describe it. The differential equations that represent the viral marketing trends are shown in Equations (3.6)-(3.8) below.

$$\frac{dS}{dt} = -\beta S(t)I(t), \tag{3.6}$$

$$\frac{dR}{dt} = \gamma I, \tag{3.7}$$

$$\frac{dI}{dt} = \beta SI - \gamma I. \tag{3.8}$$

Equation (3.6) indicates the decreasing number of reached users, also known as the unreached user. The number of followers and the number of people reached will be assumed to be decreasing at the same rate. Equation (3.7) indicates the increase in the number of homepage visits. The number of Instagram users who reached the post and those who visited the homepage changed at the same rate as the number of Instagram users who saw the posting. The increment in the number of reached users is derived from Equation (3.8), which can be solved using the Equation (3.5) formula. This model is subject to the initial conditions , $S(0) = S_0$, $I(0) = I_0$, $R(0) = R_0$ where

$$R_0 = \frac{\beta}{\gamma}. \tag{3.9}$$

The R_0 conditions are as follows:

i. When $R_0 < 1$ is reached, the number of Instagram users reached for the posting drops.
ii. When $R_0 > 1$ is reached, the number of Instagram users reached for the posting rises.
iii When $R_0 = 1$ holds, the number of Instagram users reached for the posting remained constant.

The final stage is the process of solving the model. The actual behaviour of the model was analyzed using Maple software. The outcome will be analyzed based on the graph presented by the software. There is a specific command that has been used to create the chart.

Lastly, A quantitative procedure is a method for examining the impact of various variables. It will be used to assess the virality of snack products advertised via Instagram. In this case, the variables to see if they impact other users' ability to provide feedback on upcoming postings. It also determines how widely the post will be seen on Instagram and who will be most susceptible to seeing it again.

FINDINGS AND DISCUSSIONS

Data Collection

The data are obtained from an Instagram business account insight feature, from 14 July 2021 to 11 October 2021. The target market is focused on Instagram users, especially their followers. The total number of followers of Instagram up until 11 October 2021 is 5772. In the time frame mentioned, 25 postings were made, with three types of postings gaining the greatest attention from followers. The three types of posting that the admin of the business Instagram account frequently uses and gaining customers interaction are Feed, Reels, and Stories.

Table 1 contains information for the top postings from 14 July 2021 to 11 October 2021. There are three kinds of posting: Reels, Feed, and Story.

Table 1: Details for the top post from 14 July 2021 to 11 October 2021.

No	Posting	Posting Description	Top Post		Number of Reached users
			Date	Day	
1.	Reels	Introducing the new product	11 September 2021	Saturday	1166
2.	Feed	Congratulating the success of an athlete	31 July 2021	Saturday	552
3.	Story	Video of the ingredient used in the product	31 August 2021	Tuesday	167

Feed content allow users to contribute in photos and videos. The photo posted in feed on 31st July 2021 viral since the feed are attached with a hashtag related with current issues. Next, the story is a concept that allows you to use video, photo, or a boomerang to deliver the storyline of your day but only for 24 hours before it totally disappear. Last but not least, the Reel will maintain to be a single video powered by the creativity that will be featured in the feed. The afford of the style in reels may attract users attention towards the contents. Thus, this may be the reason why reels are become the most viral posting among the top 3 viral posting.

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Data Analysis

According to Table 1, among the three types of postings, reels recorded the highest value of R_0 . Hence, the study will concentrate on these sorts of postings. The reels were posted on 11 September 2021, where the data generated are as follows:

The total number of followers, N = 5772.

The number of followers, S(0) = 4597.

The number of reached users, I(0) = 1166.

The number of homepage stop visited, R(0) = 0.

The probability of the number of reached users and the number of the followers is

$$r = \frac{\text{number of reached users}}{\text{the number of followers}} = \frac{1166}{5772} = 0.25364.$$

It shows that only 25 percent of the users will be reached in the first hour of posting.

$$p = \frac{\text{interaction (likes)}}{\text{duration (hour)}} = \frac{12}{90} = 0.13333.$$

The number of interactions or likes within 90 hours is 13.33 percent, indicating that only this amount of users will be involved in interaction within three months.

$$\beta = r \times p = 0.25364 \times 0.13333 = 0.03382,$$

$$\gamma = \frac{1}{D\ (\text{duration})} = \frac{1}{90} = 0.01111.$$

The rate of virality, β for the number of Instagram users that viewed and forwarded the post among the number of reached users is 0.03382. The recovery rate, γ, denotes the number of users who did and stopped visiting the Instagram account is 0.01111.

The decreasing number of reached users or the number of the unreached user:

$$\frac{dS}{dt} = -\beta S(t)I(t) = -0.03082(4597)(1166) = -181269.60.$$

The number of reached users increase about 181269 every hour if reels are the types of posting.

The increase in the number of homepage visits:

$$\frac{dR}{dt} = \gamma I = (0.01111)(1166) = 12.95556.$$

The number of profile visit increases by about 13 users every hour.

The increase in the number of reached users:

$$\frac{dI}{dt} = \beta SI - \gamma I = [0.03382(4597)(1166)] - [(0.01111)(1166)] = 181256.65.$$

There is about 181256 number of reached users increment every hour after reels are posted.

The basic reproduction number is obtained for reels as one of the posting types are as follows:

$$R_0 = \frac{\beta}{\gamma} = \frac{0.03383}{0.01111} = 3.04365.$$

The reproduction number is 3.04365, which is more than 1. The number of Instagram users reached for the reels rises or can be said as viral.
Table 2 shows the reproduction number of the population after 90 hours.

Table 2: Reproduction number by the types of posting.

Type of posting	Reels	Feed	Story
R_0	3.04365	2.52164	2.72460

Based on the table above, the Reels, Feed, and Story are three types of posting that go viral. The postings went viral since their $R_0 > 1$. However, among those three types of different postings, reels have the highest value reproduction number. After run the data in Maple software, a graph are generated as below: The initial value of S, I and R are recorded exactly after one hour of the posting are made. It is recorded that the number of followers are 4597, the number of reached users are 1166 while and the number of people stop visited the posting are zero. According to Figure 2, the number of unreached users dropped to zero in 15 hours. At the same time, the increase in the number of homepage visits hit the highest number of users (4857) after 14 hours of posting. Within 15 hours, about 2870 users stopped visiting the profile. The lines show the trend of the population change from the initial value of (S, I, R) = (4597, 1166, 0), which are recorded after one hour of posting to (S, I, R) = (0, 2870,2870) in 64 hours. The above figure shows that the posting is going viral within 90 hours as R_0=3.04365. There is a probability that the postings pop up in the explored. People who like to see posting from exploring might be interested in photos or reels uploaded by the account.

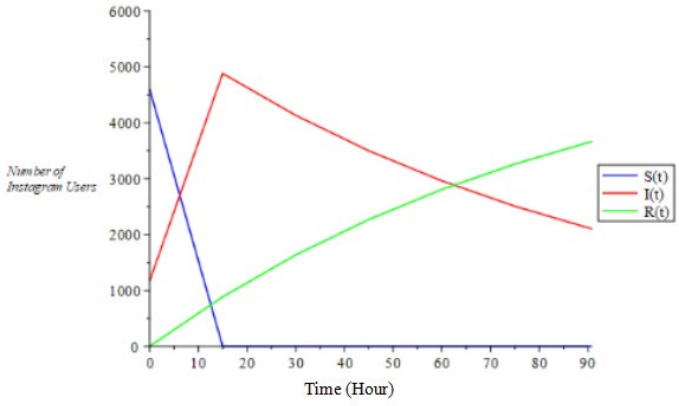

Figure 2: The spreading of Reels posted on 11 September 2021 for 90 hours.

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The graphs in Figure 3 shows how four distinct values of β change while the initial values of γ (0.01111) remain the same. S(0) = 4597, I(0) = 1166, and R(0) = 0 are the initial values for differential equations.

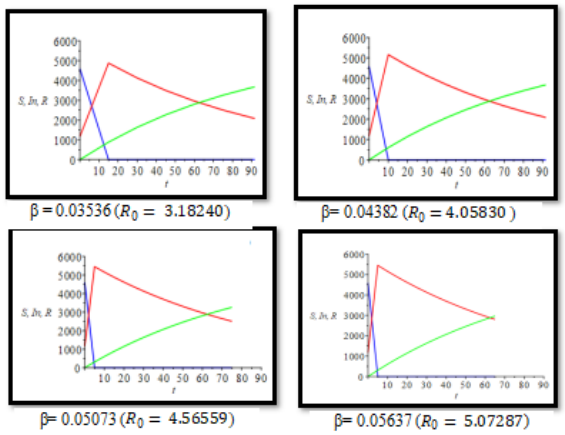

Figure 3: SIR Model for γ=0.01111 (constant) and different parameter β of Reels posted on 11 September 2021.

Figure 4 shows the effect of changing parameter γ while maintaining parameter β = 0.03382, and the initial conditions also remain the same. The following graph is how the value of γ changes:

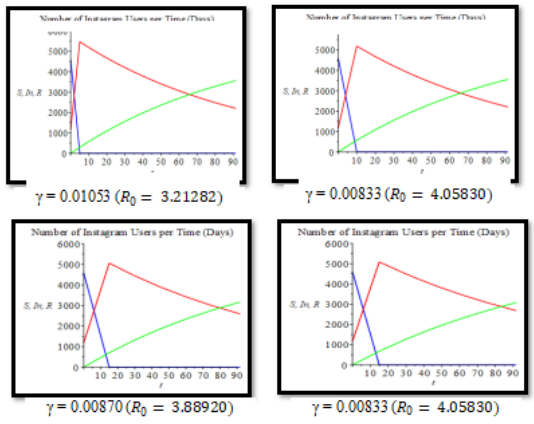

Figure 4: SIR Model for β=0.03382 (constant) and different parameter γ of Reels posted on 11 September 2021 .

According to Figure 3, the greater the β value, the less time takes for the posting to reach users. This is because, when the number of interactions (likes) rises, the β value rises as well. As a result, the number of interactions per time will increase. The decline in parameter value leads to an increment in the amount of information exchanged in Figure 4. The duration of posts is predicted to stop increasing when γ decreases. As a result, the reproduction number (R_0) rises, and if it is greater than one, the posting will be considered viral. To summarise, the three posts became viral due to the large number of Instagram users who watched and forwarded the posts within the total number of users reached. It is due to a large number of users reached and a large number of interactions (likes) per time.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Users are interested in the post for 3 days and 18 hours in this study. From 14 July through 11 October 2021, three most viral posting has been observed ($R_0 > 1$). The reels on 11 September 2021, among them, have the greatest R_0, indicating that it is the most viral among the most three most viral types of postings. Several factors could be causing the issue. There reel were posted on Saturday, which is weekend. The most active users are between the ages of 18 and 24, which is considered young adult. It is because the products are a perfectly fit for them. The Chocolate-in-jar product is the focus of the Reels. The Reels are in the form of a short video. This demonstrates that the users who have been reached are more interested in seeing a video than other types of posts. Feed and Stories both also have R_0 greater than 1, owing to the fact that the feed is also published on weekends, while the Stories are published on a public holiday, Independent Day. Based on the observation from Figures 3 and Figures 4, the higher the number of likes, the higher β and R_0 values. Meanwhile, the longer the duration of a posting, the lower the γ value, and the higher the R_0 value. In conclusion, the value of R_0 depends on the number of likes and duration of a post.

Recommendations

The product is quite famous on Instagram day by day. However, there might be a few recommendations that can help the marketer spread information about the product to the Instagram user and increase the number of interactions such as likes. First of all, it is recommended for the owner to deal a paid review with the most famous Instagrammer such as Azfar Heri. A famous Instagrammer has fans who always have an interest in everything they do. So we believe that the taste of Chocolate-in-jar product will make the Instagrammer impressed, and they will leave an honest review. This might attract their viewers to see the posting made by their favourite Instagrammer and buy the product to increase the product's sales.
The marketer should next discover a more appropriate way to approach Instagram users in order to convince people to buy their product. Since the photos that became viral in their feed are connected to the viral issue, why not create more and put them in their feed? They should include a hashtag connected to the current viral issues along with their product's branding and upload it as their Instagram content. This will enhance the chances of their product being discovered by other Instagram users.

Besides, researchers in future may observe the impact of sales from each posting. They may compare between the most viral and non-viral postings that have been made by the businesses. It helps to clearly identify the reason why a posting become viral or non-viral. Future researchers may choose another type of snack that also went viral. Then, they should compare the spread of the posting for that two different types of snacks. For example, Chocolate-in-jar and Cookies product. So, they can make a conclusion on which products have been selected to be are most viral product.

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CONFLICT OF INTEREST DISCLOSURE

All authors declare that they have no conflicts of interest to disclose.

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