Design a Management System for the Influencer Marketing Campaign on Social Network

Hien D. Nguyen[1,2(✉)], Kha V. Nguyen[3], Suong N. Hoang[3], and Tai Huynh[3,4]

[1] University of Information Technology, Ho Chi Minh City, Vietnam
`hiennd@uit.edu.vn`
[2] Vietnam National University, Ho Chi Minh City, Vietnam
[3] Kyanon Digital, Ho Chi Minh City, Vietnam
`{kha.nguyen,suong.hoang,tai.huynh}@kyanon.digital`
[4] Ton Duc Thang University, Ho Chi Minh City, Vietnam

Abstract. Influencer marketing is an effective kind of digital marketing. It is useful to reach target audiences, and brands will be exposed to more valuable online consumers. The system for managing the influencer marketing campaign on a social network is very necessary to increase the effectiveness of an influencer marketing campaign. In this paper, a method for designing a management system for this marketing campaign is proposed. This system can collect data on the social network and extract information from data to detect emerging influencers for the brand to run the campaign. It works based on the measures of amplification factors, the passion point of a user with the brand, and the ability about content creation. This management system is also the foundation to establish commerce activities and build an advocate community of the brand. The built system shows the results of the campaign as a visual report in real time to support the brand giving the decision. The system has been tested in the real-world influencer marketing campaign and got positive feedback from the brands.

Keywords: Influencer marketing · Social network · Business intelligence · Information propagation · Passion point · Content creation score

1 Introduction

Digital marketing is the component of marketing which the brands use internet and digital technologies to advance their products and services [1]. Influencer marketing is a kind of digital marketing. Influencers are people with the ability to impact emerging customers of a product by recommending the items on social media [2, 3]. They play as endorsements for products. The influencer marketing focuses on using influencers to viral the information of a product/brand to the larger market [4]. It helps brands get campaign goals. Most influencer marketing campaigns are influencers expected to spread the word through their personal social channels [5].

An influencer marketing campaign is effective if it makes brands to build trust and expand reach to influencer followers, strengthen brand messaging through authentic

endorsements, influence consumer buying decisions, reach more engaged and better-qualified audiences [6]. The influencer marketing really works if the brands can match the influencers to their target audience and their campaign goals. Thus, identifying the suitable influencers is necessary. There are three ways marketers find social media influencers are social search, influencer platforms, and having influencers reach out to them [5, 7].

The management system for an influencer marketing campaign on a social network is a system which manages the working of this campaign. Firstly, this system can collect data on social network based on the information of the determined brand, the consumer. Data is also organized to represent the relationships between objects of the social network. Secondly, though collected data, the system can detect emerging influencers for the brand who are able to be used to run an influencer marketing campaign. The measures, which computes the impact of a user to his/her audience, are studied and used to detect the potential influencers. Finally, in the influencer marketing campaign, the management system can trace the quality of customers and traffic from each influencer in the real time. It may show the visual report of the campaign results, such as the total of interactions, the rate of the conversation per click, the revenue. That report supports the brand to give the decision at the moment.

In this paper, a method for designing a management system for an influencer marketing campaign on a social network, called ADVO system, is proposed. Beside the working of a management system, this system is also the foundation supporting the businesses to deploy their commerce activities and build their advocate community. The system detects potential influencers for a brand based on the measures: amplification factors, the passion point of a user with the brand, and the ability about content creation. The architecture of the ADVO system includes three main functions: *AdvoSights* - use for social listening and analyze the users' behaviors on a social network, *AdvoBiz* – the foundation to establish commerce activities of the brand, and *AdvoFair* - help the brands building an advocate community of the brand. The ADVO system has been tested through real-world influencer marketing campaigns and got positive experimental results from the customer.

The next section presents some related works about the studying of detecting influencers on a social network. Section 3 presents the architecture of a management system for an influencer marketing campaign, called ADVO system, and its working. This architecture has advocates including three main functions: AdvoSights, AdvoBiz and AdvoFair. Section 4 presents some measures for detecting emerging influencers for a determined brand. Section 5 shows experimental results by testing in practice. The last section concludes the paper.

2   Related Work

There are many systems for supporting the influencer marketing, but those systems only search the influencers based on their set of users joining them, they have not supported the running of the campaign completely. Moreover, the methods for detecting influencers are only built based on some amplification factors about the number of relations between users and others, they have not mentioned to some characteristics of a user to the brand, such as the favorite of a user to a brand, the ability about creating content on the social network to attract audience.

Laroche et al. [7] studied the positive affect of brands to customers and their loyalty through social media. Based on the nomological network representing those relations, they proposed some measures for computing the impact of a brand to the community on a social network.

In [8], the authors proposed measures of influence for a user on Twitter. Those measures cover almost all impact values of a user to his/her audience on Twitter. Nonetheless, they have not yet mentioned the tweet propagation. Although the result in [9] presented an influential measure based on the speed of the post propagation in the duration time, this measure has not yet reflected the impact of users' information on a social network.

Tidke et al. used Heterogeneous Surface Learning Features to identify and rank influential nodes on social networks [16]. They proposed two methods Average Consensus Ranking Aggregation and Weighted Average Consensus Ranking Aggregation and tested them on real-world data collected from Twitter for topics about politics and economy. However, the results of those methods are not suitable for brands to use in their influencer marketing.

Beside that, some current systems for managing the influencer marketing campaign support the searching relationships between a brand and their sets of determined influencers [10–12]. The parameters measuring the influence of a user are the amplification factors, such as the number of friends, followers, reactions. In the real-world, the value of the loving of a user to a brand combing the user's amplification factors supports to compute the attraction of a post created by the user [13]. The evaluation of the post's impact on audience helps to recognize the users' reactions on that post [14]. Those are parameters need to measure the user's influence. However, those current methods have not yet mentioned the combination between the favorite of a user to a brand and the ability about creating post content for determining emerging influencers to run an influencer marketing campaign of a brand.

The SCWord in [15] is a system presenting the changes of users' sentiment on a social network in real time. This system gets a view of the relationship between dynamic topic clusters on social networks. Besides, the system also provides charts showing the changes in attitudes of users on the network. It reflects the aggregate polarization of social media posts. However, this system has not yet been used to identify influencers on social media.

The current management systems of the influencer marketing campaign only detect the influencers which are celebrities and key opinion leaders (KOL), they have not found the minor influencers, so the effectiveness of the marketing campaign is not optimal. Besides, those systems have not yet supported to manage real-time parameters in an influencer marketing campaign.

3   The Architecture of a Management System for an Influencer Marketing Campaign

The management system for an influencer marketing campaign, called ADVO system, has to be able to measure the impact of influencers to their audiences. It evaluates through the analyzing of the information on a social network. It also can trace the behaviors of users to recognize potential customers of the brand. This management system is the foundation for the brands to evaluate their influencer marketing campaigns and build

an advocate community for those brands. In this section, the architecture of the ADVO system and its working are proposed.

3.1 The Architecture of the ADVO System

From the determined consumer of the brand, the ADVO system will be set up for automatically collecting data on a social network suitably. The data is crawled in the duration time. Based on the information of collected data, the system computes the measures to detect emerging influencers of that consumer for the brand. Those measures are studied in [9, 13], they consist of the amplification factors on a social network in a duration time, the passion point of a brand or a consumer, and the ability to create the post's content [14]. Besides, the ADVO system can manage all interactions with the emerging influencers in the influencer marketing campaign. It estimates the information propagation for each influencer, and determines the number of clicks on interactions, the conversion rate of clicks and orders, and the revenue. It also produces a final report for the campaign with the data visualization of results. The architecture of this management system is as Fig. 1. The advocates in this architecture include three main functions: AdvoSights, AdvoBiz and AdvoFair.
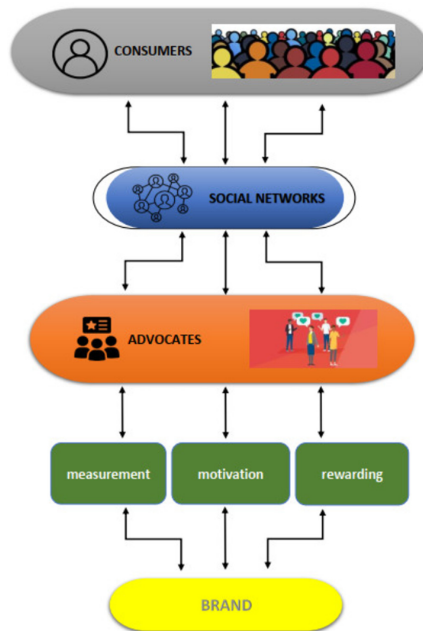

Fig. 1. The architecture of ADVO system.

AdvoSights: This is an important tool of ADVO system. It is used for social listening and analyzing the users' behaviors on a social network. It also measures the values to

detect emerging influencers for a brand to run its influencer marketing campaign. Those measures for a user are the estimating the information propagation on a social network in a duration time, the passion point of a brand or a consumer, and the ability to create the post's content (content creation score). They are values to evaluate the affection of a user and the attraction to the audience to interact with the user's posts.

AdvoBiz: This is the foundation supporting the entrepreneurs to deploy their commerce activities. It is used to collect data on a social network. AdvoBiz is a tool to manage the influencer marketing campaigns. Using the AdvoBiz, the brand can create and observe a campaign. At a time, the system visualizes the report of the campaign about the total interactions, the rate of the conversation per click, etc. Through that, the brand can evaluate the effectiveness of the campaign and give a decision accordingly.

AdvoFair: This is a foundation to help the brands building their advocate community. It optimizes the value of the advocate community on social networks by oriented spreading the information of the brand quickly. The information will be given targeted customers naturally.

3.2   The Working of the ADVO System

The ADVO system has some working to establish its main functions. It needs to crawl data from the social network automatically. Those data are the resources to detect the emerging influencers for digital marketing. Besides that, the system has to have the ability to statistic the results of an influencer marketing campaign and visualize them on the campaign dashboard.

Data Crawling
The collected data is organized into three separate databases: Command and Mapping database, Raw crawled database, and Processed database. The data crawling system is shown in Fig. 2.
    The data crawling system consists of 4 components:

- *Command receiver*: As the input of the system, the "command receiver" introduces a set of APIs for external systems to point out which should be crawled and when to start and end the crawling commands. The commands will be saved to the "command & mapping" database and parsed to messages which will be sent to the message queue for further processing.
- *Crawling worker*: It is the core of the system. It is responsible for collecting the requested data. Due to the fact that the variety of data sources are wide, several kinds of crawling workers are used. At the time of this material, there are two versions of crawling workers: API requesting and user emulating. The data collecting tasks are sent to crawling workers via message queue, the workers will decide how to get the desired data, and which part of information should be saved to the "raw" database. Besides, simple matching steps can be performed in order to narrow down the amount of data collected. When the desired data is saved, workers will notify the "data processor" using the message queue.
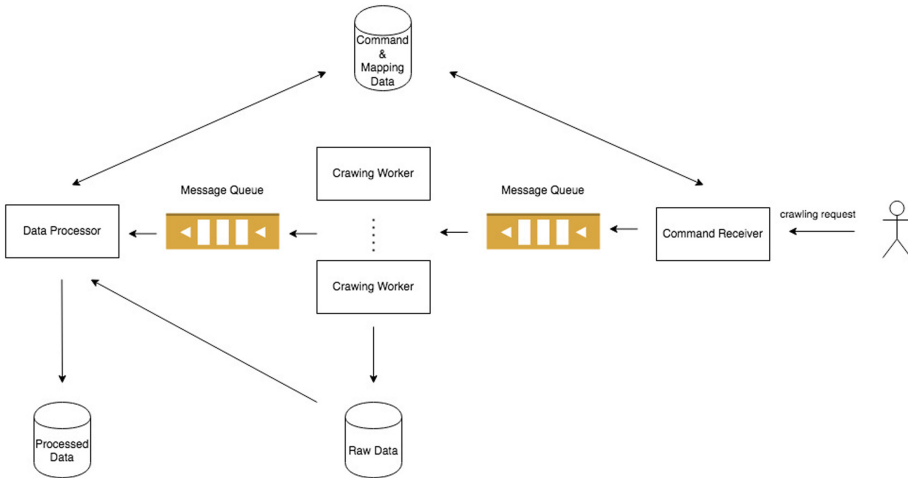
Fig. 2. Data crawling system.

- *Data processor*: This component is making the rough crawled data ready for external systems including removing html tags, adding missing information or connecting different pieces of data together. The final result is saved to the Processed database. At this level, the data is considered clean and ready to be processed by external systems. External systems can consume the processed data via API (provided by a sub component of the crawling system) or reading the database directly.
- *Message queue*: It distributes requests to different parts of the system, ensuring the stability by using asynchronous communication. Applying asynchronous communication style, a message queue system can be used to deliver crawling tasks to crawling workers, processing tasks to instances of data processors. This approach guarantees the stability and performance of the whole system. To be specific, popular message brokers such as RabbitMQ [17], ZeroMQ [18] or streaming platforms such as Kafka [19] can be utilized.

Detecting of the Emerging Influencers for the Brand

The influencers for a brand are determined based on the measures of users on the social network. Those measures are the estimating the amplification factors, such as information propagation, on a social network in a duration time, the passion point of a brand or a consumer, and the ability to create the post's content (content creation score). They evaluate the impact of a user to the audience, and the user's brand loving. The details of those measures are presented in Sect. 4.

With a brand, the system will collect information of a user which are related to this brand/product. Using the collected data, the measures of a user are computed. The system uses those values to detect the list of emerging influencers of the consumer for the determined brand.

Statistic of Parameters in the Campaign
As a matter of fact, for a business campaign, real-time tracking is often a required feature. A requirement such as "tracking this number on a daily basis" or "how this figure varies over time" might be demanded. Therefore, the simple approach of consuming processed data mentioned before would not be appropriate. In order to tackle the problem, an external system can provide a set of APIs to be called at run time ensuring the real-time feature. However, this method can lead to the coupling between our system and the external ones. On the other hand, whenever a new system occurs, some effort must be made to integrate it, and the crawling system will eventually do what is not its main responsibility. A better solution would be to create API hooks, which other systems can register on their interested data. This way, each change in the "processed" data can be considered as an event, and the burden of formatting the shape of data to be sent will be minimized. The crawling commands must now contain information at which rate a piece of data should be re-crawled.

Campaign Dashboard
After tracking and analyzing processes for the running of an influencer marketing campaign, the bunch of texture and numeric data is not easy for humans to quantify. For decision support based on those results that are tracked in the campaign, the data need to be shown in the visual form. With this insight, a dashboard to visualize the results is developed. To meet business requirements, the dash-plot is used to build the dashboard with an interactive interface. Viewers are allowed to define the benchmarks and sort it. The system allows viewers to identify concerned areas on the dashboard.

4 The Measures for Detecting Influencers on Social Network

AdvoSights is an important tool of the ADVO system. It can help the brands detect emerging influencers in their consumer to run their influencer marketing campaigns. For determining the influencers, there are measures to evaluate the impact of a user to their audience: amplification factors, the passion point of a user with the brand, and the ability about content creation. Those measures have been presented in [13, 14].

On a social network, we denote:

- $\mathbf{U}$ is the set of users on the social network,
- P_u is the set of posts of the user $u \in \mathbf{U}$,
- $word(p)$ is the number of words in a post p on the social network.

4.1 The Measure of Amplification Factors

For a user on a social network, besides the number of his/her friends and followers, the interactions on each post is an amplification factor to measure the influence on audience.

Moreover, an influencer marketing campaign is run in the duration time, so the parameter about the number of interactions for each post in the determined time is important to detect emerging influential users. In this section, the value of the average of interactions in the duration time is proposed.

Definition 4.1 [20]: (Social pulse) Given a post p, a user u on the social network, t_p is the timestamp of the post p, the time window δ.

(a) A set of users who are interested in post p in the time window δ.

$$I_p^u(\delta) = \{v \in U | v \neq u, \ v \text{ interacted with } p \text{ in the time} \in [t_p, t_p + \delta]\} \quad (1)$$

where, "v interacted with p" means "v reacted, shared or commented with the post p"

(b) The social pulse for the post p in the time window δ is the value:

$$S_p(\delta) = \sum_{v \text{ shared post } p} card(I_p^v(\delta)) \quad (2)$$

Definition 4.2 [9]: (Average of Interactions) Let $u \in U$ be a user; the average of interactions for each post of user u in the time window δ is computed by:

$$AI_u(\delta) = \frac{\sum\limits_{p \in P_u} S_p(\delta)}{card(P_u)} \quad (3)$$

4.2 Passion Point

Passion point computes the loving of a user with a brand. If a user really likes the brand X, he/she will usually post information related to that brand. Besides, the user tends to have positive posts for the brand X. The sentiment of posts is determined based on the analyzing of their grammar structure and the improvement of self-attention network [21]. The formula of this point is computed based on the distribution of positive posts to the total of the user's posts. In this case, this distribution can be set as a binomial normal distribution [22]; hence, the Wilson score interval method may be used to determine the binomial proportion confidence interval [23].

Definition 4.3 [13]: (Passion point) Given a user u, the brand X.

(a) The ranking score for the user u with the brand X:

$$ranking_X(u) := \frac{\rho + \frac{z^2}{2.card(P_u)}}{1 + \frac{z^2}{card(P_u)}} - \frac{z}{1 + \frac{z^2}{card(P_u)}} \sqrt{\frac{\rho(1-\rho)}{card(P_u)} + \frac{z^2}{4(card(P_u))^2}} \quad (4)$$

where, $P_u^{positive}$ is the set of positive posts of the user u with the brand X.

$$\rho = card(P_u^{positive})/card(P_u) : \text{ the binomial proportion}$$
$$z : \text{ the quantile of a standard normal distribution.}$$

(b) *The passion point of the user u with the brand X is computed by:*

$$PP_X(u) := \text{ranking}_X(u) + \log(card(P_u)) \tag{5}$$

4.3 Content Creation Score

In the real-world, although some posts do not have any meaning, they get lots of inter-actions from the audience because of the seeder's authority. In this study, a post is called meaningless if the number of words in that post is lower than the average number of words in each post. The quality of the user's content creation is only computed on the meaning posts.

Definition 4.4 [14]: (Quality of posts) Let $u \in U$ be a user on social network.

(a) The average number of words in each post:

$$\phi := \frac{\sum\limits_{p \in P_u} word(p)}{card(P_u)} \tag{6}$$

(b) The quality of u's posts, $Q(u)$, is computed by:

$$Q(u) := \frac{\sum\limits_{\substack{p \in P_u \\ word(p) \geq \phi}} \frac{word_{positve}(p)}{w(p)}}{card(\{p \in P_u | word(p) \geq \phi\})} \tag{7}$$

where, $word_{positve}(p)$ is the number of positive words in the post p.

Definition 4.5: (Content creation score) Given a user $u \in U$, and the brand X. The content creation score of the user u for the brand X, called $Content_X(u)$, is determined as follows:

$$Content_X(u) := PP_X(u) + \log(Q(u)) \tag{8}$$

where, $PP_X(u)$ and $Q(u)$ are computed by the formulas (5) and (7), resp.

The formula (8) combines the passion point and the quality of posts. If the user u likes the brand X, the value of $PP_X(u)$ will be increased; thus, the user will tend to have high quality posts for the brand X. Besides, $Quality(u)$ is determined based on the number of positive words, its value in the formula (8) will compute the iterated positive words in posts.

5   Experimental Results

Fashion is the consumer attracting many people. There are many seasons for stimulating fashion shopping. In this section, the results of the ADVO system for a practical influencer marketing campaign are presented. The customer of the system is a fashionable brand. The marketing campaign is run in February 2020 and it only considers Vietnamese users on Facebook.

5.1   Phases of the Influencer Marketing Campaign

There are two phases when the brand runs its influencer marketing campaign in February 2020:

- Phase 1: From Feb. 12–17, 2020. The customer used 31 micro-influencers who were determined by our customer.
- Phase 2: From Feb. 18–23, 2020. The customer used 11 micro-influencers who were detected by AdvoSights of the ADVO system using the measures in Sect. 4.

The dataset for determining of this phase are crawled from Vietnamese users on Facebook who are working in fashion. The data are collected from June 2019–Dec. 2019. Using the collected data, the measures of users are computed and used for detecting emerging influencers of the brand.

After that, the customer uses AdvoBiz of the ADVO system to manage its campaign. The results of this campaign is shown in the next section.

5.2   Experimental Results

Our experiment performs on a list of influencers including 31 influencers in phase 1 and 11 influencers in phase 2. During the time of the experiment, a sales campaign was carried out; the profiles' social influence and sales outcome were recorded. Figure 3 shows the total of interactions on the brand of our customer in the campaign. In those
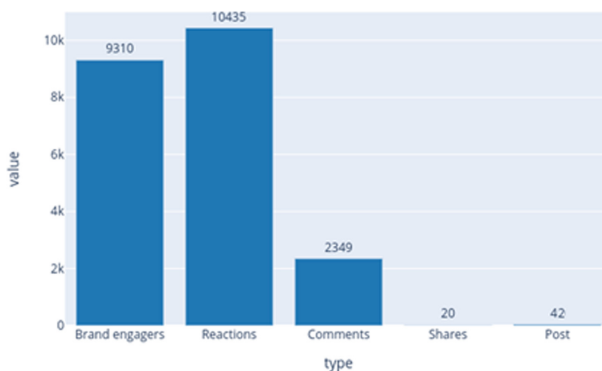

Fig. 3. Total of interactions of the influencer marketing campaign in Feb. 2020

results, the posts are only count for influencers. The details of interactions for each phase are shown in Table 1.

Table 1. Detail of interactions for each phase

Type of interactions	Posts	Reactions	Comments	Shares	Total of interactions
Phase 1	31	6,548	1,844	9	**8,410**
Phase 2	11	3,887	505	11	**4,403**
Total	**42**	**10,435**	**2,349**	**20**	**12,804**

When running a marketing campaign, the rate of click per interaction and the conversion rate for each click are important values to evaluate the effectiveness of a campaign. The values of those rates for the marketing campaign in Feb. 2020 are as Table 2.

Table 2. The values of effective rates for each interaction and click

	Phase 1	Phase 2
Interactions	8410	4403
Clicks	1511	636
Orders	**7**	17
Rate of click per interaction	**17.98%**	**14.44%**
Conversion rate per click	**0.46%**	**2.67%**

Through the results in Table 2, although phase 1 has the number of clicks more than phase 2, the effectiveness of phase 1 is lower than phase 2. The conversion rate of phase 2 performs that the revenue of this phase is better than another. Besides, Fig. 4 shows that the average influencer efficiency of phase 2 is also better than phase 1.
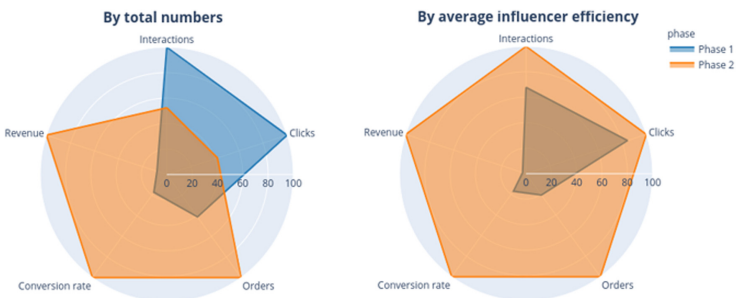

Fig. 4. The average influencer efficiency

The ADVO system can manage a small influencer marketing campaign which runs in a local market. The influencers detected by this system work effectively, they can approach more target customers and get the reality revenue. Besides, the ADVO system gives dash-boards of the campaign to report its status in real time. It can visualize the working of users on the posts of influencers, the revenue got by each influencer. The tracing of consumer behaviors when they interact with influencers helps the brand to construct its homophily which is the brand-lovers' community.

6 Conclusion and Future Work

In this paper, the architecture of ADVO system, which is a management system for influencer marketing on a social network, is proposed. This architecture includes three main functions: *AdvoSights* - social listening and analyzing the users' behaviors on a social network to detect emerging influencers, *AdvoBiz* – establishing commerce activities of the brand, and *AdvoFair* - building an advocate community of the brand. The ADVO system is a foundation supporting the businesses to manage their commerce activities through an influencer marketing campaign. The system can detect potential influencers for a brand based on the measures: amplification factors to measure the virality of information, the passion point of a user with the brand, and the ability about content creation. It also extracts the visual report for the campaign in real time. The ADVO system has been tested on real-world influencer marketing campaigns and got positive experimental results from the customers.

However, the current ADVO system only manages a small marketing campaign in a local market. In the next step, this system will be scaled up to manage the larger campaigns which have more users and higher frequency of interactions in the duration time of campaigns. In the future, some methods for increasing the attraction and influence of users will be researched. Those methods will escalate the effectiveness of influencers in the marketing campaign. Besides, the study of tracing the change of consumer behaviors supports the businesses to enlarge their market. Through the management system, our customers can track activities on the social network and build a useful plan of marketing campaigns.

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