

LEVERAGING SOCIAL MEDIA METRICS IN IMPROVING SOCIAL MEDIA PERFORMANCE.....

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1 LEVERAGING SOCIAL MEDIA METRICS IN IMPROVING SOCIAL MEDIA PERFORMANCES THROUGH ORGANIC REACH: A DATA MINING APPROACH

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1
Abstract: *This paper identified the relevance of several publication's characteristics of each publication in reaching more people through organic strategy using Support Vector Machines. Before finding the relevance of several inputs, 10 potential models were examined. Based on the results of 10 models examination, we found that Comments, Likes and Shares have smallest error. However, those variables represent the customer engagements, instead of reaching more people. In the other side, Lifetime total organic reach is the best model compares to other models, therefore lifetime total organic reach was selected as a model. Furthermore, page total likes were found as the most relevance input in reaching more people through organic reach. The next most relevance inputs were followed by Type, month, day and hour of publication. Eventually, we come up with a managerial implication on how to publish a post in order to reach more people through organic reach.*

Keywords: *social media, data mining, organic reach, Facebook pages, Rapidminer*

JEL Classification: *M1, M3*

3 1. INTRODUCTION

The importance of social media is becoming more popular today and many company's decision makers put more efforts in searching best strategies to leverage their presents in social media such, YouTube, Facebook, and Twitter (Kaplan and

6
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Haenlein, 2010). Through leveraging social media, companies can build possibility in communicating with thousand or millions of consumers in promoting products and services (Kietzmann et al., 2011). On the other hand, a research in UK shows that more than a quarter of B2B SMEs currently adopt social media in achieve brand objective³, especially in reaching new potential customer (Michaelidou et al., 2011). Many companies soon noticed the opportunities of internet-based social networks in affecting customer's decision and combining social media strategies to benefit their company (Moro et al., 2016). However, the challenges that many enterprises face is even they understand the urgent of evolving in social media they don't really understand how to make it effectively and measureable (Hanna et al., 2011).

Since introducing products and services through social media is cheaper and it is known as an acceptable way to market products and services at particular target market (Kirtiř and Karahan, 2011), more and more companies put more efforts in understanding the performance of their company's social media especially on finding the most efficient way in promoting their products and services. In other words, effective leveraging social media could help SMEs in financial way. In fact, several studies put more focus on analyzing interaction, prediction and the efficiency of using social media advertisement (e.g. Handayani and Lisdianingrum, 2011) rather than identifying factors that affect the succeed of promoting social media in organic strategies that offer almost zero cost.

In the beginning 2018, Indonesia has 132.7 Million internet users and around 130 Million of the users is active in using social media Facebook (Wearesocial, 2018). This phenomenon offers huge opportunities in reaching new customer through online advertising, especially in targeting Indonesian market. Advertisements strategy through Facebook page generally divided into paid advertisement and organic advertisement.

Data mining offers overwhelming methods for generating predictive insight through leveraging raw data (Turban et al., 2011). Data mining is proved as a helpful tool in using to analyze huge, flexible, and complex social media data (Barbier and Liu, 2011). Nevertheless, recent studies only focus in investigating the reactive interaction based on different source of social group data. In this research we focus on identifying factors related in building SMEs brand through fans Page Company in using organic strategies. The factors relevance are identified by using Support Vector Machine weighting and in order to determine the best prediction model, we also provide 14 potential testing model. The selected model then used to analyze the importance of inputs in determining the best strategies publishing each post in Company Facebook pages.

10

Table 1. Features from arranged data set

No	Features	Type of data set
1	Comments	Numeric
2	Likes	Numeric
3	Shares	Numeric
4	Type	Text (Video, Photo, Status, Link)
5	Post Message	Text
6	Posted date	Text
7	Permanent Link	Link
8	Post ID	Unique Code
9	Page Total Likes	Numeric
10	Total Engagements	Numeric
11	Post Day	Text (Sunday....., Saturday)
12	Post Hour	Text (01,02,.....,24)
13	Post Month	Text (January,....., December)
14	Lifetime Post Total Reach	Numeric
15	Lifetime Post organic reach	Numeric
16	Lifetime Post Total Impressions	Numeric
17	Lifetime Post Organic Impressions	Numeric
18	Lifetime Engaged Users	Numeric
19	Lifetime Post Consumers	Numeric
20	Lifetime Post Consumptions	Numeric
21	Lifetime Post Impressions by people who have liked your Page	Numeric
22	Lifetime Post reach by people who like your Page	Numeric
23	Lifetime People who have liked your Page and engaged with your post	Numeric

Extracted from https://www.facebook.com/#!/insights/?referrer=page_insights_tab_button

In this research we use a small educational company data (table 1) which focus on promoting study to Taiwan. The data was generated by company's Facebook pages that consist in 215 post published from June 2016 to April 2018. Thus, this published data set was feed in to data mining software (Rapidminer) as an input.

The purposes of this research as follows:

- To find the best model (label) that predicts the impact using factors related or characteristics by comparing the differences between predicted value and real metrics value
- To analyze the insight generated by the best model and weighting the input including how the input affects each published post in helping manager selects the best decision
- To identify the factors that affect company pages based on lifetime post total organic reach by assessing weighting input and others factors that may be related.
- To create a managerial implication map in helping manager make a decision.

2. LITERATURE REVIEW

In order to keep closer with their users, several universities in Malaysia use Facebook pages as their online platform (Ayu and Abrizah, 2011). In addition, Facebook also offers open source data for admin of a Facebook pages. This metrics provide a valuable insights in measuring Facebook pages performance (Bonsón and Ratkai, 2013). In facts, many companies are not really understand on how to use and measure the metrics (Hanna et al., 2011). Therefore, in this research, data mining technique was used in identifying Facebook pages factors that could help stake holder in determining best decision.

Data mining offers powerful technique in dealing with big, complex, and rapidly changing information (Barbier and Liu, 2011). Data Mining has a good ability for finding precious patterns and hidden knowledge in social networks (Gupta et al., 2014).

Support Vector Machines (SVM) was first developed by Cortes & Vapnik (1995). The idea is to find optimal separating hyper plane in two distances by optimizing difference among distances' closest values. The concept described in fig. 1. The dots put in the dash line are called support vectors, then the line between dash lines is called separating hyper plane. SVM is able to control capacity and changeable in setting up decision implementation makes it very useful and wide-functional on machine learning (Cortes and Vapnik, 1995). Therefore, SVM has showed very important role in many issues of data mining field (Mangasarian, 2001).

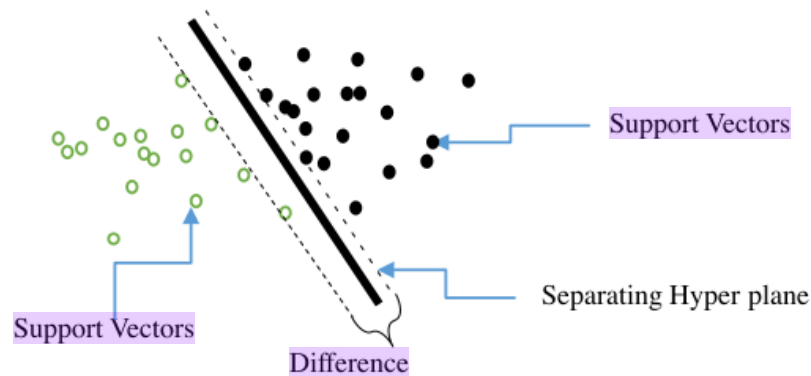


Fig.1 Support Vector Machine

3. METHODOLOGY AND DATA

The data set was taken from Facebook pages metrics provided by Facebook through admin page. The data consist of two years posts published of Educational Company from Indonesia. The Company mainly works for promoting study to Taiwan. All the posts were published from June 2016 to April 2017. As a result, the data accumulated consist of 215 posts published. Table 1 shows all of the features arranged in the data set. All of the data was generated from the company's Facebook page from June 2016 to April 2018. The company's Facebook pages generated 23 features related with page performance metrics, however only some features will be taken. Then the selected features are divided in to two parts. The first part is treated as input features and the second part is used to be modeled.

Since hour consist of 24 hours, it was grouped into 5 major groups. The first hour group is ranged from 00.01-05.00 am; second hour group is ranged from 05.01-10.00 am; third hour group is ranged from 10.01-15.00 pm; fourth hour group is ranged from 15.01-20.00, and 20.01-24.00 is the last group.

Table2. List of input Features

Feature	Description
Page Total Likes	Total People who have liked the company's Facebook page
Post Day	the day when The post was published
Post Month	the month when The post was published
Post Hour	the hour when The post was published
Type	Type of the posts

Adapted from Moro et al (2016)

3
As Posted, Permanent link, Post ID, Post Message are text unique data, then these features are considered as possible future research. To understand those text data, text mining probably possible to be applied. Type, Post Day, Post Hour, Post Month, Page Total likes are treated as input features (Moro et al.,2016). Detail of these input features is described at table 2. Post day consist of from Sunday to Saturday, Post month consist of from January to December, Post hour consist of from 00.01-24.00, type consist of photo, status, link and video.

The second part of data is grouped as several potential model. These potential model will be analyzed in order to determine the best predictive model using Support Vector Machine. These potential model are described in table 3. These models was divided into 2 major group such engagement variables and visualizations variable. Comments, Likes, and Shares were engagement variables and the rest was treated as visualization variables.

3
Table 3. List of outputs features to be modeled

No	8 Output features	Descriptions
1	Lifetime Post Total Reach	The number of people who had Company Page post enter their screen (Unique Users)
2	Lifetime Post organic reach	The number of people who had company Page post enter their screen through unpaid distribution. (Unique Users)
3	Lifetime Post Total Impressions	The number of times company Page post entered a person's screen (Total Count)
4	Lifetime Post Organic Impressions	The number of times company Page posts entered a person's screen through unpaid distribution. (Total Count)
5	Lifetime Engaged Users	The number of unique people who engaged in certain ways with company Page post (Unique Users)
6	Lifetime Post Consumers	The number of people who clicked anywhere in company page post. (Unique Users)
7	Lifetime Post Consumptions	The number of clicks anywhere in company page post. (Total Count)
8	Lifetime Post Impressions by people who have liked your Page	The number of impressions of company Page post to people who have liked Page. (Total Count)
9	Lifetime Post reach by people who like your Page	The number of people who saw company Page post because they've liked the Page (Unique Users)
10	Lifetime People who have liked your Page and engaged with your post	The number of people who have liked company Page and clicked anywhere in the posts. (Unique Users)
11	Comments	Total Comments in the post
12	Likes	Total likes in the post

No	Output features	Descriptions
13	Shares	Total shares in the post

Extracted from https://www.facebook.com/#/insights/?referrer=page_insights_tab_button

Data Mining is a sequence of extracting information from various perspective into useful insight or knowledge (KS and Kamath, 2017). In doing Data Mining process, Rapidminer data Analytic was used. In order to select the best model among 13 models in table 3, Support Vector Machine was run and 5 input features was feed into the system as input variables to. Detail flow is described in Fig. 1. In preparing the 215 rows of raw data from Company Facebook pages, 15 outliers were removed and Z-transformation was used to normalize all of the features. Furthermore, one feature with less Mean Absolute Deviation (MAD) is selected to be a model in order to analyze factors that affected Facebook page performance. After finished selecting best model, then Support Vector Machine Weight was run in determining the most influential factors among 5 inputs. After obtaining the weight of the inputs with respect to model, the weights were analyzed in order to identify others possibility strategies that may be useful in supporting company' Facebook page reach more people through organic way. The others likelihood might be related with particular factors, such Indonesian cultural, recent phenomenon etc.

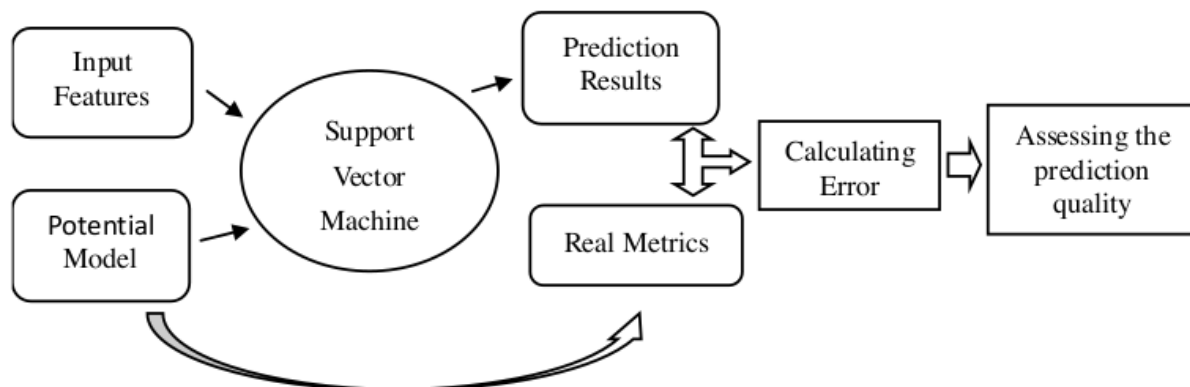


Fig. 1. Data Mining Procedure

4. RESULTS AND DISCUSSIONS

As explained in section 3, five inputs were used to predict the performance of 13 potential model describe at table 3. Z-transform was used to guarantee the 5

inputs are normal distributed. In order to get better prediction results, 15 outliers were deleted and the rest were treated as building model. Using SVM, the data was split in 2 parts, 80% as a train data and rest 20% as a test data. To guarantee the test data can represent the whole data characteristics, stratified sampling was performed. After processing the 13 models using 5 inputs, we measured the assessment results by calculating the error using Mean Absolute Deviation (MAD), which is widely method used to evaluate the regression prediction performance (Sharpe, 1971). The results are shown in Table 4.

Results on Table 4 shows that engagements metrics have a better accuracy than visualizations. This results are contradict with previous research that conducted by Moro et al (2016). The difference results generally caused by different target customer. In this research, the data is from a SMEs educational company from Indonesia whose target customers are mainly students. In this case, customer engagements are important because the company is promoting the way to study in Taiwan. Customers always have many questions related how and when the registration is opened.

Although Comments, Likes, and Shares have smallest MAD value (table 4), these interactions metrics only show engagements or interactive communications between customer and company. The number of comments, Likes and Shares don't show the number of new target customer reach by each post published. On the other hand, comments may contains positive or negative feedback and still be a potential area to research more (e.g., Gerolimos, 2011). Life time total organic reach is the best visualization model proved by its small error difference compared to others visualization models. This result is aligned with the research goal to identify and build organic posting strategy to reach more customer through organic strategy. Thus, we use Life Time Post Organic Reach as a model to identify factors that can affect the successful of organic promoting using company Facebook Pages.

Table 4. Results of Prediction Model Performance

Model (Y)	MAD	Source
Comment	0.077625	Engagements
LIKE	0.323548	Engagements
SHARE	0.32521	Engagements
Lifetime Post organic reach	0.337446	Visualizations
Lifetime Post Total Reach	0.338373	Visualizations
Lifetime Post Total Impressions	0.364931	Visualizations
Lifetime Post Organic Impressions	0.374777	Visualizations

Model (Y)	MAD	Source
Lifetime Post Consumptions	0.409569	Visualizations
Lifetime Post Consumers	0.426844	Visualizations
Lifetime engaged users	0.434556	Visualizations
Lifetime Post reach by people who like your Page	0.462771	Visualizations
Lifetime People who have liked your Page and engaged with your post	0.471702	Visualizations
Total Engagements	0.504792	Visualizations
Lifetime Post Impressions by people who have liked your Page	0.522502	Visualizations

Source: Results Computed

In order to understand the weight of five inputs and to identify the factors related in doing organic promotion through Facebook company pages, SVM Weight was performed. The five inputs were feed into the system and respect to the model of Lifetime post Organic Reach. The results of SVM Weight is ranged between 0 and 1. The range explain the importance among the inputs respect to the label. The results shows (table 5) that page likes have a major contribution than type, month, day and hour. Page total likes holds a very important rule to support the organic reach. This event is caused by the rule of Facebook. Whoever liked a page will automatically be a follower and see the publications in their feed (Facebook dashboard). Thus, whenever the company page post a publications, the publications will always appear in its follower feed. Therefore, the first strategy to have better organic viewer is to have more follower in company pages

Table 5. Results of SVM Weight

Attributes	Weight
PAGE TOTAL LIKES	1
Type	0.704
Month	0.385
Day	0.072
Hour	0

Type of publications occupies second most important position (table 5). There are four types of publications such as link, photo, status and video (table 6). The research results show that, in term of type, link appear as the most important factors in supporting organic reach performance. Since this company is educational company and their focusing is to promote study in Taiwan, link post usually aimed

to announce scholarship results or others information related to requirements to study in Taiwan. That's why, link post sometimes is the most post awaited than others and when it is published, more people will start to discuss, share and eventually reach more people.

In this case, even though link shows the most important factor to support the organic reach, it doesn't suggest the manager to simply post link publications alone, but to mix with pictures and link is better. The reasons are the importance of link is 1 (table 6), and picture is 0.86. The difference is quite close compared to video the contribution only 0.23. The other reason is picture also contain a special meaning that described particular purpose (Hum et al., 2011.) and easily understood by customer. This results are also supported by Malhotra (2013). He found that post picture usually can communicate effectively in delivering special message. Thus, to get more customer from organic reach, focusing publications on combination of link and picture is the best.

Table 6. Results of Type SVM Weighting

Attributes	Weight
Type = Link	1
Type = Photo	0.860989
Type = Video	0.231214
Type = Status	0

The third most important factor that affect the organic performance is month. The research show that (table 7), publications published in March reach more people than another months. The reason is the registration date to apply Taiwan scholarship in late march. Usually, company page get more engagements and reach more people at this month. This insight could be implemented in doing product or service promotion. Since more people watch out the page during March, then putting promotion in March will be better than other months.

Table 7. Results of Month SVM Weighting

Attributes	Weight
Month = March	1
Month = September	0.98632
Month = January	0.884519
Month = June	0.632139

Month = August	0.561879
Month = November	0.54282
Month = October	0.417293
Month = February	0.416405
Month = July	0.366241
Month = April	0.2921
Month = December	0

September occupied the second most important month in supporting organic reach. During September Company pages usually post some guidelines and related information regarding how to apply scholarship in Taiwan. Therefore, in September more questions usually come to company's table work. Eventually, since March and September is registration time to apply study to Taiwan either with or without scholarship, promote special products or services would perform much better. This information also can be used to determine the time of special event such as group discussion time, promotion via video call, or even offering discount for special products.

Table 8. Results of day SVM Weighting

Day	Weight
Day = 2 (Tuesday)	1
Day = 3 (Wednesday)	0.9179
Day = 4 (Thursday)	0.5381
Day = 7 (Sunday)	0.2921
Day = 1 (Monday)	0.2602
Day = 6 (Saturday)	0.1429
Day = 5 (Friday)	0

Since Sunday and Friday is pray day for Muslim and Christian people, there is less people reached in these days and the contributions of these day is less compared to Tuesday and Wednesday. The results is different with previous research, which Friday is the most relevant day (Moro et al., 2016). The different

results are caused by local cultural in Indonesia. There are more 80% of Indonesian populations are holding Muslim and Christian religion. Since Friday is Muslim pray day, therefore the result is confirmed by putting Friday as the least important day in reaching people through Facebook pages.

Table 9. Results of Hour SVM Weighting

Attributes	Weight
Hour calculation = 4 th	1
Hour calculation = 2 nd	0.976203
Hour calculation = 5 th	0.700454
Hour calculation = 3 rd	0.430723
Hour calculation = first	0

As hours have least contribution to page performance, some researcher don't put more efforts in digging and explore more knowledge inside it (e.g. Moro et al., 2016). In this research, even though the contribution is least, the extraction was still studied. Since target customers of this company are students and normally school finished at 15.00, we divided hours into five groups (section 3). One of important contribution in this paper is found that there are time difference between post published in page and post published date extracted from admin page. The time differences were caused by time different zone. Post published in company page has 15 hour difference to time published extracted from admin page. Therefore, there are different day and time post between data extracted from Facebook and data from admin page. If researcher only use the date extracted from Facebook page the results will be bias. Thus, time adjusting has to do before running the research.

The results show that, group 4th has major contribution to the organic performance. Group 4th is range from 15.01-20.00 pm. It means, publications that published at around 15.01-20.00 pm has more contribution than group 1st (00.01-05.00 am), group 2nd (05.01-10.00 am), group 3rd (10.01-15.00 pm) and group 5th (20.01-24.00pm). The reasons behind are the target customers. Since the target customer are students which normally will be at school around 08.00-14.00, the post published would be better after that time.

5. MANAGERIAL IMPLICATION

7

This research focus on identifying strategy to reach more people through organic way. Several previous research focus on relationship and prediction only

(e.g. Moro et al., 2016), but in order to assist Small and Medium Size Enterprises (SMEs) which has limitation in financial way, organic reach strategy is one of the most useful technique. Organic reach strategy means company doesn't need to pay money in promoting their product or services through Facebook. Thus, based on data mining technique, several strategy were identified.

In this case, the data was taken from a Small Company Facebook pages which is promoting study in Taiwan either with scholarship or without scholarship. Using Support Vector Machine Weight, then total page likes of the company pages were found the most important factors in supporting organic reach. Then, followed by type of post, which is link is the most relevant post and picture is in the second position. Since the difference of relevance between link and picture is pretty similar, then we suggest to combine the picture and link in generating more organic reach.

Month occupied the third position after page total likes and type of publications. March and September have a greater contribution than another months. For weekday, Tuesday and Wednesday have more relevance than other weekday and the last factor is hour. Hours have least contribution compared to page total likes, type of publications, month post, and weekday post published. In this paper, we also prove that, page total likes is the most important factor that contribute best to reach people through organic reach, this result is different with previous research which type has a greatest relevance (Moro et al., 2016). The research that conducted by Moro was combination between paid reach and organic reach, therefore the research results also different.

Finally, this research come up with a decision map on what strategy should the company apply when published a post on their company Facebook pages (figure 2).

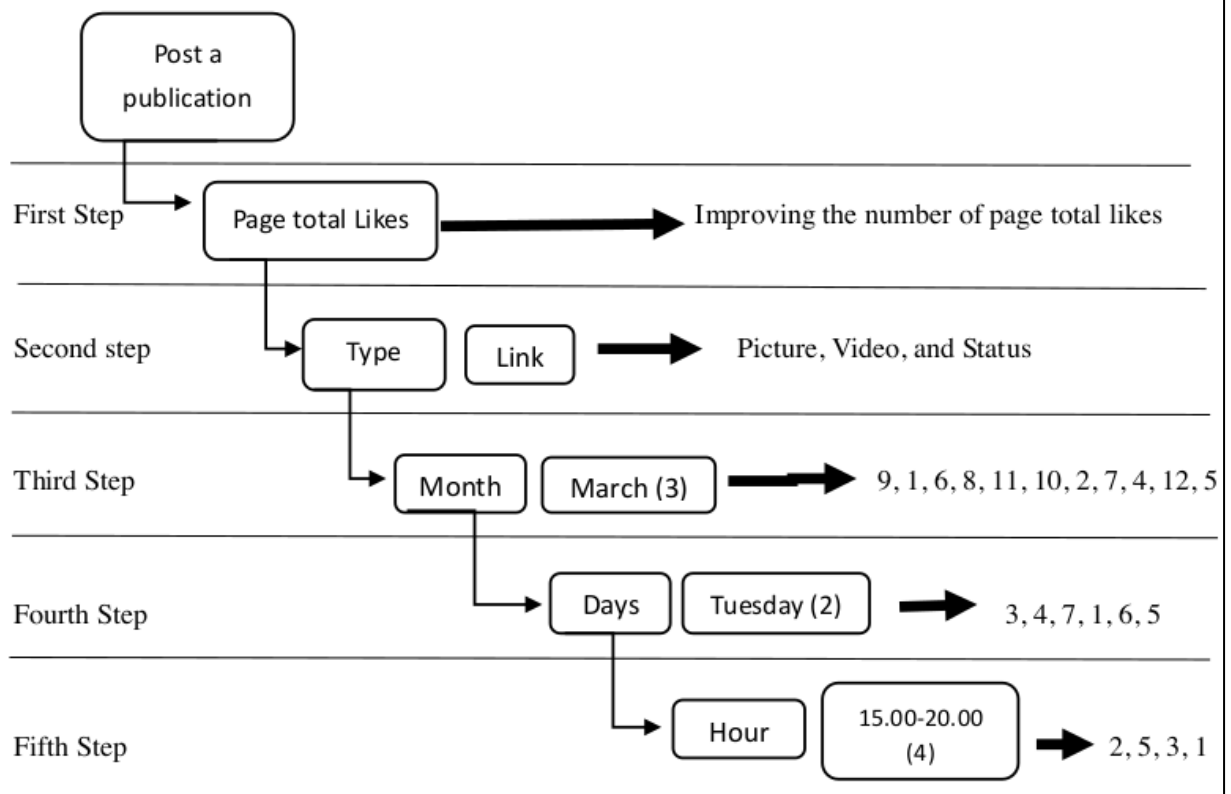


Fig. 2. Publication strategy (Managerial Implication)

6. CONCLUSION

4

The main goal of this research is to identify factors that affect Facebook pages performance through organic reach and provide a managerial implication in publishing a publication. Organic reach strategy is a strategy to reach more people in Facebook through organic strategies or in other words to run free promotions via Facebook without pay any advertisement fee. Support Vector Machine was used in modelling each performance of 13 potential models using five inputs generated from one company Facebook pages from Indonesia. In order to get the weight of each variable inputs, Support Vector Machine Weight was performed.

Based on this research, Comments, likes, and share have the smallest error than the other potential models. Moreover, comments, like and share are engagements variable, so in reaching more people, lifetime total organic reach was selected as the best model. we found that total page likes is the most important

factor that affect the company page performance in reaching more people through Facebook. Type of publications take the second most important factors that affect the organic Facebook reach then followed by month in third position, day in fourth position and hour in last position. Eventually, ¹ promote and reach more new potential customer through Facebook page, we come up with managerial implication on whether to post a publications in Facebook page (fig 2). Analyzing on how customer engage such, comments, like and share would be a future research. Understanding customer comments using text mining method potentially benefit to company in.

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