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Analysis and empirical study on influence factors of enterprise microblog marketing effect

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ABSTRACT

The article applies the diffusion status of "repost information cascade" to measure the marketing effect of enterprise Microblog. Integrating social network information diffusion and dissemination dynamics theory, the author selects variables from three aspects of Microblog characteristics, enterprise node characteristics, repost node heterogeneity as influence factors to build the influence factor model of information cascade diffusion effect and verify the model assumption on the basis of the actual data collected in Sina Microblog. The study finds that both Microblog additional information and enterprise node characteristics have significant influence on the accumulated Microblog repost number; acceptance-type Hub node has more significant influence on information diffusion speed, while diffusion-type Hub nodes can help extend the information dissemination scale.

Key Words—enterprise Microblog, Microblog marketing, information cascade, social network, information dissemination.

INTRODUCTION

"Microblog marketing" refers to the Internet marketing behavior that enterprises or organizations take Microblog as a medium and conduct information dissemination, sharing and interaction.

The studies on Microblog marketing in macro perspective mainly explore the Microblog marketing patterns[1], future development trend[2] and value prospect[3];most of which are qualitative description, lacking quantitative analysis.

Based on micro perspective, scholars mainly start with Microblog information dissemination model, study how to obtain the maximization of information effect and marketing effect, and mainly study the optimization of information dissemination. In regard to evaluation of the influence of nodes, scholars apply different methods to measure the influence of nodes. Some focus on the sort algorithm for the influence of FollowerNum [4], some take into overall consideration the user preference, interaction between nodes and dissemination capacity [5].With regard to evaluation of information quality, some scholars put forward a mutually enforced learning framework to predict content quality and user reputation [6],some scholars employ nDCG algorithm to evaluate and sort the Twitter information quality [7].

Thus, both overseas and domestic scholars agree that the key of Microblog marketing lies in realizing the maximization of information diffusion effect; however, quantitative study on this is insufficient, and there is a lack of comprehensive classification of influencing factors of information diffusion.

The article innovatively selects the repost information cascade diffusion status formed by Microblog posting of enterprises as the key to present Microblog marketing effect, applies multiple regressions, variance analysis and other quantitative analysis means, which make up for the deficiency of the previous studies， and collects large-sample actual data for demonstration, combining the theory with the practice and being pretty convincing with

practical promotion value.

II.BUILDING INFLUENCE MODEL OF KEY FACTORS ON ENTERPRISE MICROBLOG MARKETING EFFECT

The article applies the diffusion effect of "repost information cascade" to measure the Microblog marketing effect, builds Microblog information dissemination model and analyzes the information cascade diffusion effect and its influence factors.

Dependent variable –the measurement index of information diffusion effect:
Studies at home and abroad are taken for reference, and two indexes of dissemination scale and dissemination speed [4,5,8] are used for measuring the diffusion effect of repost information cascade.

Independent variable – influence factors:
As for the influence factors, the study takes the classic BASS diffusion model for reference:
(1) Microblog factors: Two factors are included. Additional information: consider whether image/ video, URL, @ others and #topic# are covered; PostTime: including the time factor with a day as a cycle according to the activity routines of Sina Microblog users.
(2)Enterprise node characteristics Enterprise node characteristics indicate influence of enterprise nodes in the social network, including factor: node FollowerNum.
(3)Repost node characteristics and their acceptance behavior. The acceptance behavior of the intermediate nodes in the diffusion path of a Microblog posting can influence the overall diffusion through stimulating the acceptance behavior of the subsequent nodes. The study defines hub nodes as nodes with many social relation chains; it ranks all the repost users of a certain Microblog posting according to their FriendNum and FollowerNum, uses the setting of critical value by existing studies, and defines two types of hub nodes: acceptance-type hub: nodes whose FriendNum ranks top 20% among all the repost users; dissemination-type hub: nodes whose FollowerNum ranks top 20% among all the repost users.

The theoretical model is as follows:

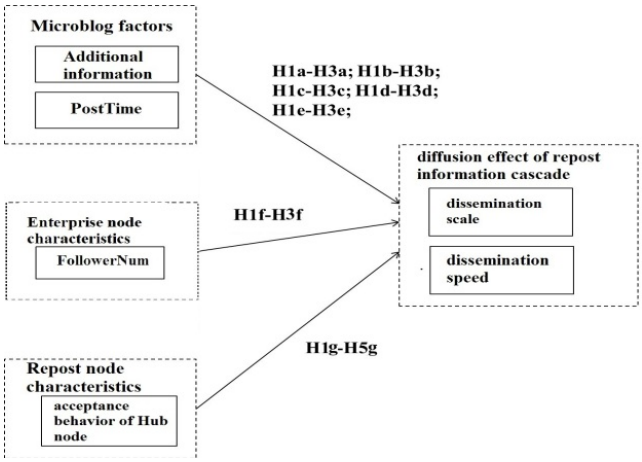

Figure 1：Influence factor model of repost information cascade diffusion effect

III.RESEARCH HYPOTHESIS

3.1 Influence of Microblog factors on diffusion effect of repost information cascade

H1a: Compared with Microblog postings in plain text, Microblog postings including image/ video have a larger RepostNum.
H2a: Compared with Microblog postings in plain text, Microblog postings including image/ video are more likely to be reposted in a short time.
H3a: Compared with Microblog postings in plain text, the information cascade formed by Microblog postings including image/ video are more likely to survive for a longer time.
H1b: The Microblog posting with URL has larger RepostNum than that of plain text.
H2b: The Microblog posting with URL is more likely to be reposted in a short time than that of plain text.
H3b: The Microblog posting with URL is more likely to have a long-life information cascade than that of plain text.
H1c: The Microblog posting with @ has more repost times.
H2c: The Microblog posting with @ is more likely to be reposted in a short time.
H3c: The Microblog posting with image or video is more likely to have a long-life information cascade.

H1d: The Microblog posting with # has a larger RepostNum.
H2d: The Microblog posting with # is more likely to be reposted in a short time.
H3d: The Microblog posting with # is more likely to have a long-life information cascade.
H1e: The RepostNum will be increased when the Microblog is posted in an active time.
H2e: The Microblog posted in an active time will be more likely to be reposted in a short time.
H3e: The Microblog posted in an active time is more likely to have a long-life information cascade.

3.2 The influence of enterprise node characteristics on the diffusion of repost cascade
H1f: There is a positive correlation between FollowerNumof enterprise nodes and RepostNum.
H2f: The FollowerNum of enterprise nodes will influence the dissemination speed. The more the FollowerNum, the more easily the Microblog will be reposted in a short time.
H3f: The FollowerNumof enterprise nodes will influence the survival probability of repost cascade. The more the FollowerNum, the longer the information cascade will exist.

3.3 The influence of the heterogeneity of repost nodes and the acceptancebehavior on the diffusion of repost cascade
H1g: The reposting of Hub node occurs in the early stage of information cascade diffusion.
H2g: The reposting of Hub node is favorable for accelerating the dissemination of information cascade.
H3g: The reposting of Hub node is favorable for enlarging the dissemination of information cascade.
H4g: Acceptance-type hub has a greater influence than diffusion-type hub on the diffusion speed of information cascade.
H5g: Diffusion-type hub has greater influence than acceptance-typehub on the diffusion scale of information cascade.

IVDATA ANALYSIS
It analyzes the influence of Microblog factors and enterprise node characteristics on the RepostNum in the method of multiple linear regression and on the repost speed in the methods of survival analysis and linear-regression analysis; and the influence of hub nodes on RepostNum and repost speed in the methods of variance analysis and regression analysis.

4.1 The influences of Microblog factors and enterprise node characteristics on the RepostNum
4.1.1 Model variable setting
The variables of regression model are set as follows:
Dependent variable: RepostNum – the repost times during the observation period. The logarithm transformation (logRepostNum) is performed to increase the fitting degree of the model.

Independent variable:
(1) Microblog factors:
- Additional information:

➢ Six indexes: “Include img or not (IncludeImg)”, “include URL or not (IncludeURL)”, “include @ or not (Include@)”and“include # or not (Include#)”
➢ The representations of dummy variables are set. When it takes 1, the index will be “yes”.
- Time point of posting:

➢ PostTime: It is divided into four phases based on the activeness of posting in 24 hours: rest at night (19:00-24:00), on and off work (8:00-10:00, 17:00-19:00), working (10:00-17:00) and sleeping (0:00-8:00). The dummy variable areas are divided based on the four periods of time.
(2) Characteristics of enterprise nodes:FollowerNum

RESULTS AND DISCUSSION

4.1.2 Result of data analysis
The result of significance test indicates that the general Sig. (significance level) of the model is 0.00, less than 0.05. Thus the regression model is effective.Table 1 refers to the regression coefficient of the model. The two-tailed test shows that except the Sig. of PostTime is greater than 0.05,the Sig. of rest variables is less than 0.05. And it can be seen from the standardized regression coefficient of Beta column that hypotheses of H1a, H1b, H1c, H1d andH1fare varified. However, hypotheses of H1fis false.

Table 1 Regression coefficient (dependent variable: RepostNum of log)

Model	Standardized Coefficients	t	Sig.
	Beta		
(Constant)		38.217	.000
IncludeImg	.136	178.040	.000
IncludeURL	.002	.509	.011
Include#	.034	8.516	.035
Include@	.007	1.890	.013
PostTime	**.001**	**.212**	**.832**
FollowerNum	.197	24.015	.000

4.2 Influence of Microblog factors and enterprise node characteristics on repost speed

4.2.1 Influence of Microblog & enterprise node elements on first repost time

1. Setting of model variable

Dependent variable: FirstRepostTime, the time interval between the posting of the Microblog and the first repost. Logarithmic transformation is required.

Independent variable: the same as chapter4.1.1

2. Result of data analysis

The result of significance test indicates that, the F-statistics of the model is 139.642 and the general Sig. of the model is 0.00, <0.05, thus the regression model is effective.

Table 2 refers to the regression coefficient of the model. The two-tailed test shows that the Sig. of FollowerNum, Include#, IncludeImg, and PostTime of enterprise nodes is less than 0.05, which indicates that the hypotheses of H2a, H2d, H2e and H2f are verified; the symbol of Beta signifies that the above variables have negative correlation relation with first repost time. Besides, the Sig. of the variables including IncludeURL, Include@ is greater than 0.05, which indicates that hypotheses of H2b and H2c are false.

Table 2 Regression coefficient (dependent variable: First Repost Time of log)

Model	Standardized Coefficients	t	Sig.
	Beta		
(Constant)		-4.358	.000
FollowerNum	-.166	-4.391	.006
IncludeURL	**.007**	**.445**	**.656**
Include@	**.014**	**.966**	**.334**
Include#	-.071	-19.480	.000
IncludeImg	-.159	-16.662	.000
PostTime	-.009	.617	**.044**

4.2.2 Influence of Microblog factors and enterprise node characteristics on the survival probability of information cascade

This section uses cox proportional hazard model to model for the survival condition of reposted information cascade.

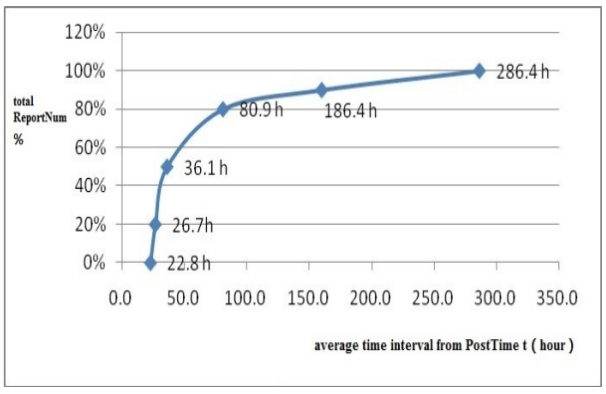

Figure 2Diffusion process – time distribution curve of information cascade of enterprise Microblog

Figure 2 shows the Microblog diffusion process- time distribution curve. According to the statistics, 50% of the enterprise Microblog postings are reposted for the first time within 1.8 minutes, and 80% of the enterprise Microblog postings are reposted for the first time within nine minutes, which verifies that Microblog repost has strong timeliness. However, the life circle of most information cascade is not long and the average time is 286.4

hours only.

1. Selection of time scale

Take the average time of sample Microblog postings in different diffusion stages as the observation time of survival analysis, namely, the average time taken by first repost (26.7h), average time for 30% of RepostNum (36.1h), average time for 50% of RepostNum (80.9h), average time for 80% of RepostNum (186.4h) and average time for 100% of RepostNum (286.4h).

2. Setting of variable

Dependent variable: survival condition of reposted information cascade at different observation time.
Independent variable: the same as chapter4.1.1

3. Result of data analysis

The general Sig. of the model is 0.000, < 0.05. Thus the model is effective.

The regression coefficient of the model is shown in Table 3. The Sig. of IncludeImg, IncludeURL, Include@, Include#, PostTime of enterprise node is less than 0.05, which indicates that the above variables have large influence on the survival probability of information cascade when the Sig. is less than 0.05, and the symbol of coefficient B signifies that the above variables have negative correlation relation with survival risk, thus hypotheses of H3a, H3b, H3c, H3d and H3fare verified. However, the Sig. of PostTime is greater than 0.05, which indicates that the hypotheses of H3eisfalse. The value expB represents the influence of various variables.

Table 3 Coefficient of cox regression model

	B	SE	Wald	df	Sig.	Exp(B)
FriendNum	-.505	.045	9.578	1	.002	1.100
IncludeURL	-.145	.037	15.159	1	.000	.865
Include@	-.310	.040	58.596	1	.000	.734
Include#	-.202	.040	25.648	1	.000	1.223
IncludeImg	-.580	.042	190.154	1	.000	1.287
PostTime	**-.003**	**.031**	**.008**	**1**	**.929**	**.997**

4.3 Influence of repost behavior of Hub node on repost speed and RepostNum

4.3.1 Difference of Hub node and non-hub node on repost time

Investigate the difference of two kinds of nodes on repost time first, and measure the repost time of one Microblog posting according to the sequence percentage of one repost behavior among all repost behaviors. It can be obtained through the analyses of means that the first 32.7% of all repost behaviors are the repost behaviors of acceptance-type hub on average, first 46.8% are those of diffusion-type hub and 52.3% are those of non-hub node. Thus, it can be seen that the repost behaviors of two kinds of hub nodes are in the early stage of whole diffusion process and the repost behavior of acceptance-type hub is earlier than that of diffusion-typehub. Then use multi-factor analysis of variance to further investigate whether there is a big time-taking difference between these two kinds of hub nodes. The result shows that the significance level (Sig.) of two kinds of hubs is less than 0.05, thus there exists a big difference on time taking of hub node and non-hub node.

To sum up, hypothesis H1g gets verified.

4.3.2 Analysis on influence of repost behavior of Hub nodes on repost speed

Further use Multiple Linear Regression (MLR) to analyze the influence of two types of hub nodes on diffusion speed. According to Diffusion Life Cycle Curve in figure 2, the paper focuses on the time of the former 50% repost behaviors. In addition, due to the segmented investigation in terms of time, we just build models based on the enterprise Microblog postings which have been reposted for more than 50 times in order to avoid the error caused by smaller RepostNum.

Construct three regression models according to the different diffusion timeframes. The dependent variables are respectively the time difference from posting to RepostNum of 10%, 30% and 50%, and the independent variables are the quantity of two types of hub nodes among the repost users at the corresponding time. Through variance analysis on the regression model of three different diffusion time (RepostNum at $t_{10\%}$, $t_{30\%}$, $t_{50\%}$), the result shows that the overall significance level (sig.) of three models is less than 0.05%, indicating that, at different timeframes of reaching up to the RepostNum of 10%, 30% and 50%, the number of accepted hubs will influence the time of realizing the RepostNum. Also, seeing from the symbols of standardized regression coefficients, there is negative correlation between the number of hubs and the corresponding time. That is to say, the repost behaviors of hubs will accelerate the diffusion speed of information cascade, and the hypothesis H2g is verified.

With regard to the degree of fitting R^2 of regression model, $t_{10\%}$ model has the best degree of fitting, thus it can be seen that, the shorter time away from the posting of Microblog, the better interpretation for the diffusion of information cascade by the acceptance of hub nodes. Besides, the regression coefficient of acceptance-type hub is significantly greater than that of diffusion-type hub, which indicates that the acceptance -type hub has stronger ability in receiving new information because of more repost links, and then it has more remarkable influence on the diffusion rate of information. Hence hypothesis H4g is verified.

Table 4 Coefficients of regression model in different timeframes

Timeframe	Diffusion-type hub		Acceptance-type hub		Adjusted R^2
	Standardlised coefficient	Sig	Standardlised coefficient	Sig	
$t_{10\%}$	-.145	.000	-.245	.000	.653
$t_{30\%}$	-.104	.001	-196	.000	.423
$t_{50\%}$	-.017	.005	-.031	.000	.312

4.3.3 Influence of repost behavior of hub nodes on RepostNum

Analyze the influence of two types of hub nodes on RepostNum with Multiple Linear Regression (MLR), with RepostNum as dependent variable, and with the quantity of two types of hub nodes among repost users at corresponding time as the independent variables. Construct four models with the RepostNum of 10%, 30%, 50% and 80% respectively as the dependent variables.

According to the variance analysis results of four regression models, the overall significance level of all models (Sig.) is all less than 0.05, thus the regression model is effective. From figure 5 which shows the regression coefficient and testing results of significance, adjusted R^2 is more than 0.8 in terms of the degree of fitting of models, indicating a good degree of fitting. Through two-tail t-test, the sig. of diffusion-type hub and acceptance-type hub are all less than 0.05, indicating that, the number of hubs will have an influence on the current RepostNum on the different stages of information diffusion. Also, there is a positive correlation between the number of hubs and RepostNum from the symbols of regression coefficients, namely, the acceptance of hubs is beneficial to expand the diffusion range of information cascade. Hence hypothesis H3g is verified.

In addition, the regression coefficient of diffusion-type hub is significantly greater than that of acceptance-type hub, thus it can be seen that diffusion-type hub has a strong information dissemination capacity due to its numerous followers, and then it is more beneficial to expand the diffusion range of information cascade. Hence hypothesis H5g is verified.

Table 5 Coefficients of regression model in different timeframes

Time Frame	Diffusion-type hub		Acceptance-type hub		Adjusted R^2
	Standardlised coefficient	Sig	Standardlised coefficient	Sig	
$t_{10\%}$	.766	.000	.113	.000	.864
$t_{30\%}$	.758	.000	.162	.000	.826
$t_{50\%}$	.648	.000	.303	.000	.889
$t_{80\%}$	.883	.000	.433	.000	.893

CONCLUSION

1) Influence of Microblog factors and characteristics of enterprise nodes on RepostNum

The additional information in Microblog factors and characteristics of enterprise nodes will remarkably influence the accumulated RepostNum of Microblog postings, and also have a positive correlation with it.

There is no significant correlation between PostTimein Microblog factors and accumulated RepostNum. The dissemination of Microblog postings may be delayed sometimes, and the posted information in inactive period (such as midnight) does not signify no reposting. Once there is subsequent reposting, the influence of original PostTime on the total ReportNum might be weakened.

2) Influence of Microblog factors and characteristics of enterprise nodes on repost speed

Among Microblog factors, apart from three variables of whether it contains URL, whether @ others and , other variables can have marked influence on FirstRepostTime (speed) and there is a negative correlation between the former and the latter. As the reposting users tend to be active users, whose behaviors may be out of impulsiveness,

and who may not have time or may be lazy to open URL for further reading, whether there is URL has a limited effect on them; while @ others is a relatively passive strategy, only the objects being @ have a certain influence and also reposting the Microblog information can promote the secondary diffusion of Microblog postings.

3) Influence of influence factors on RepostNum and repost speed

In terms of the influence of regression coefficients on RepostNum and first repost time, the IncludeImg was influenced the most, then Include#. Thus the different strategies on mode of representation of organization content have big different promotion for the diffusion. IncludeImg and Include# are the best methods for the Microblog diffusion, while Include URL and Include@ come second.

According to the regression coefficients of the two regression equations of RepostNum and RepostTime, the regression coefficients representing the characteristic variables of enterprise nodes are obviously higher than the variables of additional information of Microblog, thus FollowerNum are the most persuasive indicators for interpreting the diffusion effect of Microblog.

4) Influence of acceptance of hub nodes on repost speed and RepostNum

Reposting of hub nodes can accelerate the information dissemination; the regression coefficient of acceptance-type hub nodes is significantly greater than that of diffusion-type hub nodes, and the reason is that, acceptance-type hub nodes have more repost links and have stronger ability in receiving information. Hence acceptance-type hub nodes have a more significant influence on speed of information dissemination.

Reposting of hub nodes is beneficial to expand the scope of information diffusion; the regression coefficient of diffusion-type hub nodes is obviously greater than acceptance-type hub nodes, and the reason is that diffusion-type hub nodes have numerous followers, and have a stronger ability in information dissemination, thus it is more beneficial to expand the scope of information dissemination.

VI STRATEGY AND PROPOSAL

(1) Effectively organize the Microblog content through additional information, and increase the readability of Microblog.
(2) Reasonably choose RepostTime.The rest at night (20:00 – 24:00) and on and off work(8:00 – 9:00 & 16:00 – 18:00) are the peak hours for users to browse Microblog, so we can make full use of the period to post Microblog.
(3) Promote the secondary diffusion by virtue of reposting behaviors of hub nodes. On the one hand, enterprises can attract more hub nodes to become followers through continuous optimization of content and operation, and then increase the reposting probability of hub nodes. On the other hand, they can specially @ some hub nodes to increase the exposure of Microblog to hub nodes.

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