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Empirical analysis of internal social media and product innovation: Focusing on SNS and social capital

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**Empirical Analysis of Internal Social Media and Product Innovation:
Focusing on SNS and Social Capital**

Abstract

Recently social media such as Blog and SNS has been introducing by many firms for means of sharing information inside the firm, in particular to promote product and process innovation. This paper attempts to examine the relationship between social media and product innovation, and research questions are summarized as follows: (i) whether social capital influences the use of social media; (ii) whether social media promotes product innovation; and (iii) whether the effect of social media on product innovation is different in the manufacturing and service industry. The analysis clarifies that social capital in the firm is indispensable for the effective use of social media. Managerial attitudes toward innovation and social media are requirements for firms to promote product innovation. Managers thus should make an effort to raise social capital and nurture reciprocal culture for SNS use inside the firm. The paper finds that social media for product innovation is more important in the service industry than manufacturing. Social media makes it easy to obtain customers' information and share it among related sections, because social media enables to expand channels to make contact directly with the customer in the service industry.

JEL codes O32, M15

Keywords Social Media, Product Innovation, Social Capital, Ordered Probit Regression

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I. INTRODUCTION

1.1. Social media and innovation

In accordance with rapid transformation of the Information Society, it becomes difficult for firms to adjust themselves to the market trends, in particular, it is much more difficult in the areas of innovation and R&D, since changes in of consumers' attitudes become much faster. Firms have to mobilize all managerial resources, information and networks to adjust these changes and then to achieve innovations. In so doing, firms have two channels: open and in-house innovation processes. We discussed the former in Idota *et al.* (2010a); Idota *et al.* (2010b), and this paper focuses on the latter focusing on how firms collect, accumulate, and integrate information on customers' needs as well as technology and ideas which are owned by each employee or the section of firm, because sharing and integrating of employee's knowledge and ideas are important for innovation. As the size of firms expands, however, information related to innovation owned by each section is difficult to be shared by face-to-face basis. Therefore a knowledge management system is required. The number of firms comes to use ICT (Information and Communication Technology) as a communications tool in the knowledge management system. Recently social media such as Blog and SNS has been introduced and used by many firms in order to achieve product innovation. Kaplan and Haenlein (2010) define social media as “a group of Internet-based applications build on the ideological and technological foundations of Web 2.0, which allows the creation and exchange of user-generated content.” That is, it can be said that social media is a generic name of technology that enables individual employee to send, respond and share knowledge and information each other using the Web. Social media thus activates communications among employees, connects them all over organizational sections, and promotes sharing information and creating new ideas, which increases the productivity of firms and innovation (Lang, 2005).

Social media is a technology that supports member's sending information on the telecommunication network, and other members' responding to it openly. The firm comes to cause new ideas because member's information and knowledge are shared and used with an unspecified member beyond the section, and consequentially, comes to solve the problem of the organization easily. That is, it supports the organizational knowledge creation for the innovation. However, it is necessary to embed social capital like trust and the reciprocity between members in order that social media is used for the knowledge management. Information is not exchanged openly if there is no social

capital between members. On the other hand, in “Communication use trend investigation“ of the Ministry of Public Management, Home Affairs, Posts and Telecommunications, the service industry of the availability of social media tends to be higher than that of manufacturing in Japan. It is thought that social media is easily used for the knowledge management and product innovation in the service industry and the service industry evaluates the importance compared with manufacturing.

1.2. Definition of Blog and SNS

Blog (short form of “Web log”) is an online service with a diary creation function. It includes mini blog such as Twitter. On the other hand, SNS (Social Network Service / Social Network Site, hereinafter SNS) is also a service that constructs social network on online. Boyd and Ellison (2008) define SNS as “web-based services that allow individuals to (i) construct a public or semi-public profile within a bounded system, (ii) articulate a list of other users with whom they share a connection, and (iii) view and traverse their list of connections and those made by others within the system.” In firms, a Blog is used to send and share Information for their work. Managers send messages to their employees by SNS, and it functions as a bulletin board similar to an administration report, an in-house rule, and news of one's death information, etc. The members who take charge of the same job must share specific information such as the daily report, the project, the information about customers, and the technical intelligence using SNS.

SNS thus can be used for activating in-house communications. The employees participate freely in SNS and various kinds of information are transmitted via SNS with their self-responsibility. The employee can make constructed and participate in this community. The members who take charge of the same field can mutually exchange on and information not only on sales and the technology but also on common themes like hobbies, preferences, circumstance, the residential areas, alma maters, etc. The employees can form interpersonal relationships via communications with other member of other sections without being restricted in their current position and place.

In sum, SNS is “a tool in which it is assumed to be a main purpose that the person ties to other persons,” and Blog is “a tool in which the simplification and the chain of the information sending are assumed to be a main purpose.” SNS that has the function of Blog appears and their differences become vague in recent years.

1.3. Objectives of empirical analysis

According to Schumpeter (1934, p. 47), innovation was defined by “carrying out new combinations.” It contains the following five elements: (i) introduction of a new product; (ii) introduction of a new method of production; (iii) opening of a new market; (iv) acquisition of the new source of supply of raw materials or intermediate products; and (v) carrying out of the new organization. This paper confines the analysis only to the first category; introduction of a new product. The reasons are as follows. The authors have been engaging in ICT use and innovation. In our previous papers (Idota *et al.*, 2010a; 2010b) obtained the following results. “The design management system (included CAD/CAM)” became positively significant in product innovation of Japanese firms. Regarding open innovation, “CTI (Computer Telephony Integration)” and “SCM (Supply Chain Management)” became positively significant. ICT is thus an important tool for product innovation. In particular, both CTI and SCM are sources of outside information which enhances open innovation, since the former is useful to construct database based on customers’ opinions and the latter integrates information from production and marketing sides. Accordingly, the manufacturing firms must understand the concept of open innovation. This paper focuses on the role of social media in these areas of innovation. Moreover, fewer results were obtained so far, except Yoshida and Minetaki (2008), for example. This paper, therefore, examines fully importance of social media for product innovation.

This paper thus analyzes three points: (i) how social capital relates to the promotion of utilization of social media; (ii) whether social media promotes product innovation and (iii) how the effect of use of social media for product innovation is different in the manufacturing and service industry.

The database of Institute of Socioeconomic Strategic Research, Kansai University is used for this paper. This survey was conducted by the Web questionnaire on Japanese firms in January, 2009. It has 3,000 respondents. Based on this survey data, the above points are analyzed.

II. SITUATION OF SOCIAL MEDIA IN JAPAN

2.1. Users of public social media

Impress R&D Internet Media Research Institutes surveyed 3,293 samples for the public Internet users in April 2010, and reports that 54.7% of respondents use Blog and

21.3% of them use SNS. The use of social media increases in Japan as shown in Figure 1, in which top eight of registration SNS of the Internet is indicated. Mixi, GREE, and Mobage Town are examples of Japanese original SNSs. For example, mixi launched on Feb 2004 became the most popular and famous Japanese SNS, and the number of its users exceeds 21.9 million (as of Oct 31, 2010), and has been expanding as a communication infrastructure. GREE and Mobage Town are other examples of SNS and online game sites.

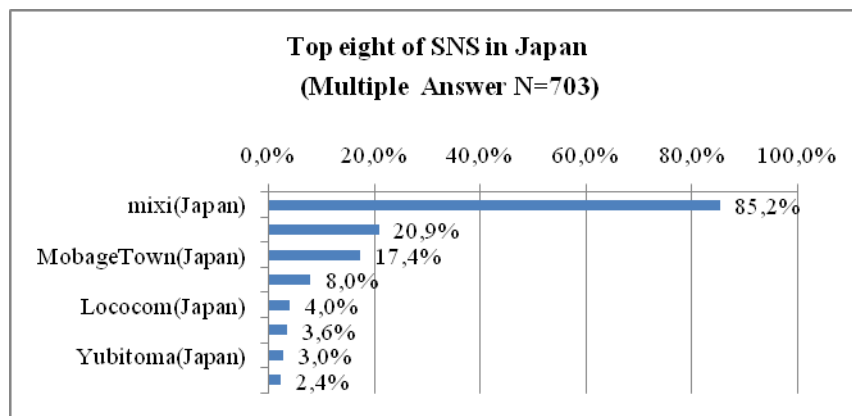


Figure1. Top eight of SNS in Japan

Source: Impress R&D Internet Media Research Institutes (2010), p.199, modified by Authors.

2.2. Business use

According to the above survey, 24.2% of responding firms among 1,900 samples already established Blog in 2010, and its number increases by 2.2% compared with 2009 (Figure 2). In 2010, 9.3% of firms established SNS. This is 1% increase compared with 2009 (Figure 3). Figure 4 shows purposes of business SNS and “Enclosure of Existing User” (51.1%), “Research & Marketing Research” (50.6%), “Spread of information by word of mouth” (43.8%), “Information exchange (external)” (34.7%), “Information exchange (internal)” (33.0%), “Appointment” (32.4%), and “Others” (8.5%).

SNS ties not only firms with customers but also ties among employees, and as a result, the number of SNS business users thus increases and firms make use of SNS for various purposes.

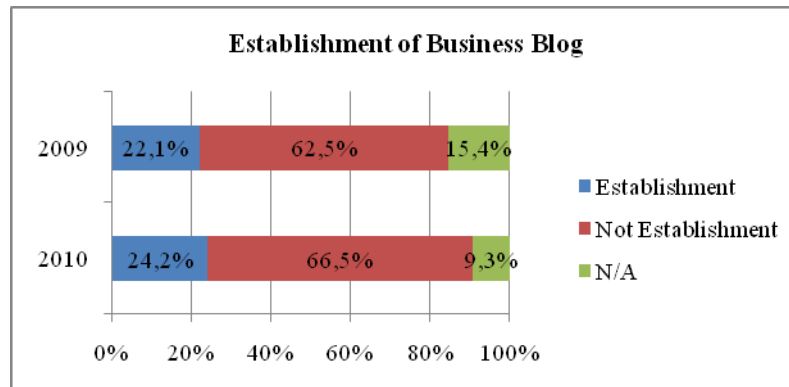


Figure 2. Establishment of Business Blog

Source: Impress R&D Internet Media Research Institutes (2010), p. 252

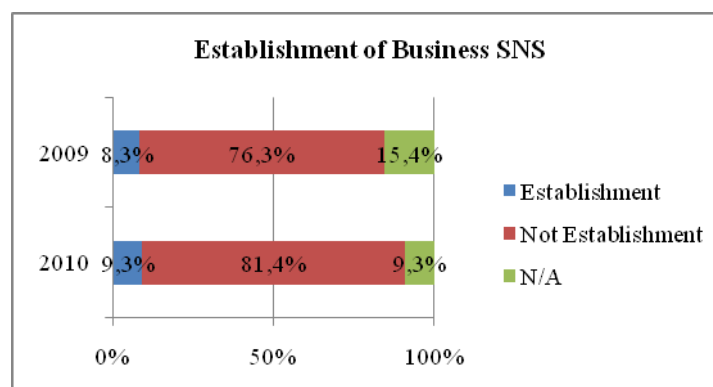


Figure 3. Establishment of Business SNS

Source: Impress R&D Internet Media Research Institutes (2010), p.251

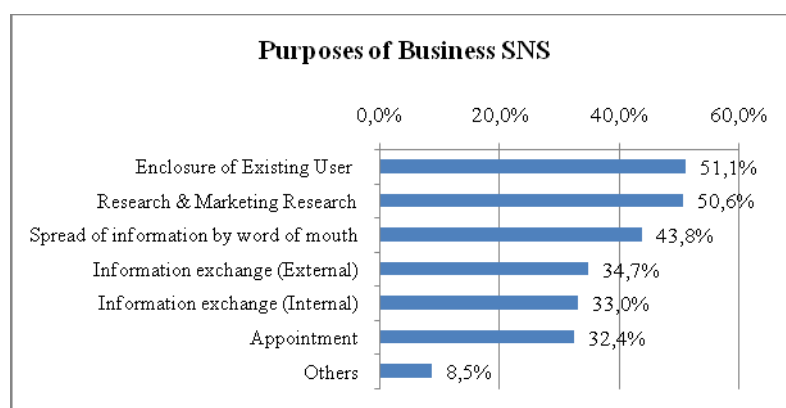


Figure 4. Purposes of Business SNS

Source: Impress R&D Internet Media Research Institutes (2010), p.251

2.3. Examples of Business SNS in Japanese Firms

The advanced two cases of business SNS in Japanese firms are introduced as follows (MIC (Ministry of Internal Affairs and Communications), 2005).

(1) Case of NTT East

NTT East is a telecommunications company in the eastern Japan. It introduced the internal SNS named “Saty,” and currently over 1,000 employees use this system. The most important target of SNS is “Redesign of corporate culture.” Other specific reasons of usages are summarized as follows: (i) constructing database and visualizing internal human network; (ii) promoting information communication; (iii) nurturing mutual assistance spirits in the whole sections of the firm. SNS aims at distributing their knowledge and sharing information mutually through the firm-wide. And it can visualize overall internal human relationship. Moreover, what is the most important is that employees are asked not to use this system compulsorily, but voluntarily. Each employee can decide whether he/she uses it or not and how to use it for his/her business work. NTT East encourages employees to participate in this SNS under the slogan such that “reaction is the most important incentive.” In addition, the firm also targets SNS to nurture employees via online to think and behave for company as a whole.

(2) Case of Monteru, Inc.

Monteru, Inc. is a confectionery company in Tokyo. It has SNS named “Sweets Explorations” (<http://sns.monteru.co.jp/>). Before introducing SNS, there were few opinions and comments directly from the users, and then the firm decided to obtain opinions directly from users via a communication space. 840 users registered as of December 2005. Four junior employees were engaged in these correspondence works, and this appointment was for their education. As a result, their ability to obtain opinions through conversations with users and their feeling of participation in such project voluntarily was enhanced greatly. They understand soon how to become the friend of the new members, and update information every day. The core members came to accumulate experience of SNS, and expand this to other staffs. In addition, other purposes of this system are to obtain ideas of products innovation and user information

in general.

Form the above examples, SNS can surely connect employees inside of firms and customers outside by activating communications. SNS is thus expected to create new corporate culture based on reciprocity, organizational knowledge, and innovation, and in what follows we will examine empirically how much firms utilize SNS for these purpose.

III. RESULTS OF ANALYSIS

3.1. Summary of statistics

Let us summarize the data-set shown in Tables 1-3. Regarding the size of firms, the number of employee over 200 is 2,117 (70.6%), and thus the majority of respondents affiliate in the large-sized firms. Regarding industry, 798 firms (26.2%) belong to the manufacturing, while 1,646 (54.9%) to the service industry (see Table 1). Table 2 shows firms' social media, social capital, and attitudes toward innovation. "Degree of social media use compared with three years ago" is 3.44 point on the average in the Likert five scale. All social capital factors are lager point on the average. Successful for creating new products in this tree years is 3.03 point on the average. In attitudes toward innovation factors, "Managers express understanding when collaborating beyond divisions" is the highest on the average. Effects of social media express Knowledge management for an innovation. In effects of social media, "Speed of information gathering per employee" is high on the average (Table 3).

Table 1. Summary Statistics

		Freq.	%
The number of employees	Less than 10	174	5.8%
	10-49	218	7.3%
	50-99	166	5.5%
	100-199	325	10.8%
	200-499	410	13.7%
	500-999	368	12.3%
	over 1,000	1,339	44.6%
Industries	Agriculture, forestry and fisheries industry and mining	12	0.4%
	Construction	136	4.5%
	Manufacturing	798	26.6%
	Service industry	1,646	54.9%
	Medical treatment & welfare	111	3.7%
	School and educational industry	116	3.9%

Public office	115	3.8%
Others	66	2.2%

Source: Authors

Table 2. Summary Statistics

		Freq.	Min	Max	Avg.	Std. Dev.
The situation of social media use	Degree of social media use compared with three years ago	3,000	1	5	3.44	1.075
	Degree to exchange information on awareness and impression concerning customer by using social media	3,000	1	5	3.05	1.208
	Degree of trust in colleague	3,000	1	5	3.66	.865
	Degree of atmosphere that consults colleague easily	3,000	1	5	3.60	.959
Innovation	Successful for creating new products in this tree years	2,996	1	5	3.03	.934
Attitudes toward innovation	Degree of atmosphere and tendency for employee's originality and idea to tie to development of products and services	2,998	1	5	3.18	.992
	Creating new products and services with the networks outside company	2,997	1	5	3.05	1.047
	Human resource support to make new products and services efficiently	2,996	1	5	3.06	1.048
	Managers express understanding when collaborating beyond divisions	2,994	1	5	3.26	1.029
	Speed of decision-making	2,994	1	5	2.87	1.115

Source: Authors

Table 3. Effect of social media

		Freq.	Min	Max	Avg.	Std. Dev.
Effect of Blog	Speed of information gathering per employee	2,066	1	5	3.31	.766
	Time until knowledge is used to work	2,066	1	5	3.33	.733
Effect of SNS	Speed of information gathering per employee	1,856	1	5	3.36	.775
	Time until knowledge is used to work	1,856	1	5	3.28	.730

Source: Authors

3.2. Role of SNS for efficiency of business and social capital

This paper uses SNS as an example of social media, since the difference in the effect of SNS and Blog was hardly recognized from this data set. Based on this survey data, ordered probit analysis is applied. At first, the roles of SNS such that it can promote information and knowledge sharing for the business process are examined, and in order to analyze the effect of social capital in this process, it is also added in explanatory

variables.

(1) Estimation I: SNS and speed of business works

In Table 4 and 5, the estimations of effects of introducing SNS are taken as dependent variables such as “Speed of information gathering per employee,” and “Time until knowledge is used to work,” respectively. On the other hand, as for explanatory variables, questions regarding social media use are those including “Degree of social media use compared with three years ago,” and “Degree to exchange information on awareness and impression concerning customer by using social media”, which indicates a quantitative factor of increase of the usage frequency and a qualitative factor of sharing awareness concerning the customer needs. As for social capital, “Degree of trust in colleague” and “Degree of atmosphere that consults colleague easily” are selected. In addition, firms’ attributes such as the size of firms are also taken explanatory variables.

Table 4. Effect of SNS: Speed of information gathering per employee

					Number of obs =	1,856
					LR chi2(7) =	380.67
					Prob>chi2 =	0.000
					Pseudo R2 =	0.0911
					Log likelihood =	-1898.44
Effect of SNS: Speed of information gathering per employee	Coef.	Std. Err.	z-value	p-value	Marginal Effect	
Size of firms	-0.02001	0.014004	-1.43	0.153	-0.00191	
Degree of social media use compared with three years ago	0.191204	0.02777	6.89	0.000 ***	0.018287	
Degree to exchange information on awareness and impression concerning customer by using social media	0.161835	0.024836	6.52	0.000 ***	0.015478	
Degree of trust in colleague	0.23707	0.039261	6.04	0.000 ***	0.022674	
Degree of atmosphere that consults colleague easily	0.138789	0.035516	3.91	0.000 ***	0.013274	
/cut1	0.127676	0.154127				
/cut2	0.832995	0.145809				
/cut3	2.747827	0.154184				
/cut4	4.120861	0.167007				

Note: ***, **, and * indicate the significant at the 1, 5, and 10 % level, respectively.

Source: Authors

Both estimations indicate that an increase in speed of business works via SNS with supplemented by social capital are proved. Therefore, in order to raise efficiency of business process, SNS is effective only in the case where it is supported by suitable

social capital. Accordingly it can be said that social capital should nurture and SNS should be promoted in the firm to make more effect to use SNS.

Table 5. Effect of SNS: Time until knowledge is used to work

						Number of obs =	1,856
						LR chi2(7) =	329.54
						Prob>chi2 =	0.000
						Pseudo R2 =	0.0833
						Log likelihood =	-1813.11
Effect of SNS: Time until knowledge is used to work	Coef.	Std. Err.	z-value	p-value		Marginal Effect	
Size of firms	0.000662	0.014205	0.05	0.963		4.87E-05	
Degree of social media use compared with three years ago	0.161069	0.028015	5.75	0.000	***	0.011839	
Degree to exchange information on awareness and impression concerning customer by using social media	0.165849	0.025231	6.57	0.000	***	0.01219	
Degree of trust in colleague	0.211571	0.039637	5.34	0.000	***	0.015551	
Degree of atmosphere that consults colleague easily	0.134402	0.036006	3.73	0.000	***	0.009879	
/cut1	-0.03538	0.157197					
/cut2	0.814523	0.146836					
/cut3	2.841237	0.156156					
/cut4	4.181317	0.170331					

Note: ***, **, and * indicate the significant at the 1, 5, and 10 % level, respectively.

Source: Authors

(2) Estimation II: SNS and product innovation

These estimations examine whether social media promotes product innovation. Tables 6 and 7 select the following outcome of the introducing social media as dependent variable, namely “Whether firm is successful in product innovation in the recent three years.” As for the selection of explanatory variables in these estimations, ideas are as follows: for successful product innovation, atmosphere is required such that employee can freely demonstrate originality and propose new ideas which would result in product innovation. The firm should also establish the systems such as arranging necessary number of human resources and prompt decision-making process. Moreover, the collaboration beyond the divisions inside as well as outside of firm is necessary. From these reasons, therefore, managerial attitudes toward innovation including as “Degree of atmosphere and tendency for employee's originality and idea to connect with the development of products and services,” “Creating new products and services with the networks outside company,” “Human resource support to make new products and services efficiently,” “Managers express understanding when collaborating beyond

divisions,” and “Speed of decision-making,” are included in the explanatory variables. In addition to these, above effects of SNS use used in Table 4 and 5 are also included as contributions of SNS to product innovation, that is Table 6 and 7 include “Effect of SNS: Speed of information gathering per employee” and “Effect of SNS: Time until knowledge is used to work,” respectively.

Table 6. The relationship between product Innovation and effect of SNS; Speed of information gathering

					Number of obs =	1,856
					LR chi2(7) =	944.12
					Prob>chi2 =	0.000
					Pseudo R2 =	0.1901
					Log likelihood =	-2011.7215
Product Innovation	Coef.	Std. Err.	z-value	p-value	Marginal Effect	
Size of firms	0.0032568	0.0138772	0.23	0.814	0.0001408	
Degree of atmosphere and tendency for employee's originality and idea to tie to development of products and services	0.1723093	0.0347683	4.96	0.000 ***	0.0074492	
Creating new products and services with the networks outside company	0.1701659	0.0313892	5.42	0.000 ***	0.0073566	
Human resource support to make new products and services efficiently	0.3132976	0.0305232	10.26	0.000 ***	0.0135444	
Managers express understanding when collaborating beyond divisions	0.1887593	0.0321733	5.87	0.000 ***	0.0081604	
Speed of decision-making	0.1925671	0.027118	7.10	0.000 ***	0.008325	
Effect of SNS: Speed of information gathering per employee	0.1903912	0.0357631	5.32	0.000 ***	0.0082309	
/cut1	1.865778	0.1583114				
/cut2	2.922201	0.1596827				
/cut3	4.592972	0.1725937				
/cut4	5.974943	0.1922811				

Note: ***, **, and * indicate the significant at the 1, 5, and 10 % level, respectively.

Source: Authors

Let us summarize these estimation results of the relationship between product innovation and SNS use. As results, both effects of SNS and attitudes toward innovation factors become significant for both models. In case of product innovation, the marginal effect of “Human resource support to make new products and services efficiently,” “Managers express understanding when collaborating beyond divisions,” “Speed of decision-making,” and “effect of SNS” is large. From this result, it follows:

- (i) human resource support is the most important for product innovation
- (ii) Encouragement of collaboration inside the firm and decision-making promptly are

(iii) SNS use is also necessary for product innovation.

It can be said that SNS is indispensable for the product innovation as well as the attitudes toward innovation.

Table 7. The relationship between product Innovation and effect of SNS; Time until knowledge is used to work

					Number of obs =	1,856
					LR chi2(7) =	944.67
					Prob>chi2 =	0.000
					Pseudo R2 =	0.1902
					Log likelihood =	-2011.4495
Product Innovation	Coef.	Std. Err.	z-value	p-value		Marginal Effect
Size of firms	0.0007605	0.0138796	0.05	0.956		0.0000329
Degree of atmosphere and tendency for employee's originality and idea to tie to development of products and services	0.1691925	0.0347912	4.86	0.000	***	0.007312
Creating new products and services with the networks outside company	0.1683914	0.0314076	5.36	0.000	***	0.0072774
Human resource support to make new products and services efficiently	0.3137148	0.0305215	10.28	0.000	***	0.0135579
Managers express understanding when collaborating beyond divisions	0.1931653	0.0320666	6.02	0.000	***	0.0083481
Speed of decision-making	0.1881304	0.0271744	6.92	0.000	***	0.0081305
Effect of SNS: Time until knowledge is used to work	0.2063329	0.0383984	5.37	0.000	***	0.0089171
/cut1	1.87583	0.1589528				
/cut2	2.932086	0.1603039				
/cut3	4.603526	0.1732376				
/cut4	5.985654	0.1929083				

Note: ***, **, and * indicate the significant at the 1, 5, and 10 % level, respectively.

Source: Authors

3.3. Effects of SNS in the different industries

Next we examine whether the same results can be obtained in the different industries. This data is divided into the manufacturing and service industry. Tables 8-9 show the result of the manufacturing, while Tables 10-11 those of the service industry.

In both cases, factors related to attitudes toward innovation including “Degree of atmosphere and tendency for employee's originality and idea to tie to development of products and services,” “Creating new products and services with the networks outside company,” “Human resource support to make new products and services efficiently,”

“Managers express understanding when collaborating beyond divisions,” and “Speed of decision-making.” In addition to these, above effects of SNS use used in Table 8-9 and 5 are also included as contributions of SNS to product innovation, that is, Table 8 and 10, Table 9 and 11 include “Effect of SNS: Speed of information gathering per employee” and “Effect of SNS: Time until knowledge is used to work,” respectively.

(1) Estimation III: Manufacturing industry

Estimation results are shown in Table 8 and 9. Except Size of firms, all variable are found to be significant in two models.

Table 8. The relationship between product Innovation and effect of SNS; Speed of information gathering; manufacturing

						Number of obs =	471
						LR chi2(7) =	314.8
						Prob>chi2 =	0.000
						Pseudo R2 =	0.2331
						Log likelihood =	-
							517.89481
Product Innovation	Coef.	Std. Err.	z-value	p-value		Marginal Effect	
Size of firms	-0.0133202	0.0290373	-0.46	0.646			-
Degree of atmosphere and tendency for employee's originality and idea to tie to development of products and services	0.2326792	0.0764257	3.04	0.002	***	0.0121171	0.0006937
Creating new products and services with the networks outside company	0.1560769	0.0675202	2.31	0.021	**	0.0081279	
Human resource support to make new products and services efficiently	0.3839561	0.065541	5.86	0.000	***	0.0199951	
Managers express understanding when collaborating beyond divisions	0.2184251	0.0656431	3.33	0.001	***	0.0113748	
Speed of decision-making	0.2388998	0.0560419	4.26	0.000	***	0.0124411	
Effect of SNS: Speed of information gathering per employee	0.1660439	0.0693306	2.39	0.017	**	0.008647	
/cut1	2.192201	0.3132006					
/cut2	3.332537	0.3227732					
/cut3	4.725625	0.3447421					
/cut4	6.307879	0.3807861					

Note: ***, **, and * indicate the significant at the 1, 5, and 10 % level, respectively.

Source: Authors

Table 9. The relationship between product Innovation and effect of SNS; Time until knowledge is used to work; manufacturing

					Number of obs =	471
					LR chi2(7) =	313.5
					Prob>chi2 =	0.000
					Pseudo R2 =	0.2321
					Log likelihood =	-518.54665
Product Innovation	Coef.	Std. Err.	z-value	p-value	Marginal Effect	
Size of firms	-0.0143093	0.0290917	-0.49	0.623	0.0007496	
Degree of atmosphere and tendency for employee's originality and idea to tie to development of products and services	0.2182658	0.0763926	2.86	0.004 ***	0.0114345	
Creating new products and services with the networks outside company	0.1625038	0.0674099	2.41	0.016 **	0.0085133	
Human resource support to make new products and services efficiently	0.3776465	0.0659018	5.73	0.000 ***	0.0197842	
Managers express understanding when collaborating beyond divisions	0.23176	0.0650995	3.56	0.000 ***	0.0121415	
Speed of decision-making	0.2379786	0.0561941	4.23	0.000 ***	0.0124673	
Effect of SNS: Time until knowledge is used to work	0.1641845	0.0779442	2.11	0.035 **	0.0086013	
/cut1	2.163037	0.3164319				
/cut2	3.303342	0.3260898				
/cut3	4.696982	0.348085				
/cut4	6.275623	0.3835531				

Note: ***, **, and * indicate the significant at the 1, 5, and 10 % level, respectively.

Source: Authors

(2) Estimation IV: Service industry

Table 10. The relationship between product Innovation and effect of SNS; Speed of information gathering; service industry

					Number of obs =	1,050
					LR chi2(7) =	548.66
					Prob>chi2 =	0.000
					Pseudo R2 =	0.1931
					Log likelihood =	-1146.5194
Product Innovation	Coef.	Std. Err.	z-value	p-value	Marginal Effect	
Size of firms	0.016453	0.0185838	0.89	0.376	0.0006486	
Degree of atmosphere and tendency for employee's originality and idea to tie to development of products and services	0.1034841	0.0453758	2.28	0.023	**	0.0040798
Creating new products and services with the networks outside company	0.1952154	0.041517	4.70	0.000	***	0.0076962
Human resource support to make new products and services efficiently	0.3135281	0.0404571	7.75	0.000	***	0.0123606
Managers express understanding when collaborating beyond divisions	0.1569121	0.0421707	3.72	0.000	***	0.0061861
Speed of decision-making	0.2567353	0.0355061	7.23	0.000	***	0.0101216
Effect of SNS: Speed of information gathering per employee	0.2236928	0.0485797	4.60	0.000	***	0.0088189
/cut1	2.037519	0.2150054				
/cut2	3.15429	0.2169655				
/cut3	4.762882	0.2335412				
/cut4	6.18921	0.2632836				

Note: ***, **, and * indicate the significant at the 1, 5, and 10 % level, respectively.

Source:

Authors

Table 11. The relationship between product Innovation and effect of SNS; Time until knowledge is used to work; service industry

					Number of obs =	1,050
					LR chi2(7) =	546.6
					Prob>chi2 =	0.000
					Pseudo R2 =	0.1923
					Log likelihood =	-1147.5499
Product Innovation	Coef.	Std. Err.	z-value	p-value	Marginal Effect	
Size of firms	0.0130485	0.0185557	0.70	0.482	0.0005188	
Degree of atmosphere and tendency for employee's originality and idea to tie to development of products and services	0.1022119	0.0454062	2.25	0.024	**	0.0040638
Creating new products and services with the networks outside company	0.1924343	0.0415606	4.63	0.000	***	0.0076509
Human resource support to make new products and services efficiently	0.3196859	0.0403759	7.92	0.000	***	0.0127103
Managers express understanding when collaborating beyond divisions	0.1622279	0.0420463	3.86	0.000	***	0.00645
Speed of decision-making	0.2505662	0.0355681	7.04	0.000	***	0.0099622
Effect of SNS: Time until knowledge is used to work	0.224139	0.0512233	4.38	0.000	***	0.0089115
/cut1	2.012977	0.2154049				
/cut2	3.12736	0.2169618				
/cut3	4.734606	0.2333958				
/cut4	6.157677	0.2629523				

Note: ***, **, and * indicate the significant at the 1, 5, and 10 % level, respectively.

Source: Authors

(3) Result of estimation

In order to answer the question whether SNS has larger effect to product innovation in the manufacturing or service industry, let us compare marginal effects in estimations, since they are common significant variables in both industries. It turns out that all attitudes toward innovation factors of the manufacturing are larger than those of service industries. However, the service industries in effects of SNS are larger than those of manufacturing. Thus, it can be said the follows;

- (i) attitudes toward innovation and effective SNS use are important for the manufacturing and service industry for product innovation
- (ii) attitudes toward innovation is more important for the manufacturing
- (iii) effective SNS use is more important for the service industry.

IV. CONCLUSIONS

The purpose of the paper to identify social media use to affect product innovation. Recently social media has introduced and used by many firms in order to enhance sharing information among employees and other sections, which also achieve more product innovation. This paper discusses three points: (i) whether social capital influence the use of social media; (ii) whether social media promotes product innovation; and (iii) how the effects of social media use in order to achieve product innovation are different in the manufacturing and service industry.

Regarding the first and second point, it can be clarified that SNS promotes product innovation and social capital must be necessary for effective use of SNS.

In addition to attitudes toward innovation, social media uses to promote product innovation. The information sharing is promoted and organizational knowledge is created by SNS. However, if the employees themselves do not understand the target of the firm nor they collaborate with each other, SNS is not used for the organizational knowledge creation that causes product innovation, even if the manager forces its use. If social capital is not well empowered in the firm, the member cannot send and receive information and the idea, because others do not trust. Managers should make an effort to enforce social capital and reciprocal culture for SNS use inside the firm.

Finally, the service industry of the effect of SNS on product innovation was higher than manufacturing of it. One of the advantages of SNS is to share awareness to the customer needs. There are many chances that the service industry contacts directly with the customer and the consumer, compared with manufacturing. Therefore, it is easy for the service industry to perceive users' needs, to develop new products suitable for their needs, and to supply them to the market. On the other hand, the manufacturing industry needs to take more time for this process, and the manufacturing industry is likely dilatory in sharing the awareness of needs and making new products suitable for needs.

In this paper, however, the followings are not able to be clarified

- (i) In the firm that social media are used, what factors make social capital rich?;
- (ii) What functions of social media are useful for the innovation?;
- (iii) What information shared by Social media is useful for the innovation?;
- (iv) What features of the other members who do the collaboration on Social media is useful for the innovation?;
- (v) Why is the effect of SNS of the service industry higher than that of manufacturing?;
- (vi) Is SNS use effective also for the process innovation?

These are research topics in the future.

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