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Disparity in Social Capital: From a Time Series Data of Social Networking Service

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Abstract： In this paper, using data of actual Social Networking Service, we examine the disparity in social capital as a network. As for the absolute level of social capital (the total number of friends), the disparity appears large, but if we compare with the whole network size, it is relatively small disparity. But when we focus on the mediation role among people, the disparity is found more clearly. Such a mediation role is critical for searching reliable and new information. Hence such a disparity in social capital becomes obvious in the planning and carrying out new project.

Keywords: Disparity, Social Capital, Social Networking Service

Introduction

Social capital is one of most important factors for collective action including mass production and self governance. Social capital is defined by three factors, Trust, Norm and Network. Trust and Norm prevent people from free-riding and deceptive actions. Through the network, people share information (that is sometimes used for detecting free-riders) and get new information (with which people can find a new way, for example job-change).

In Japan, Social Networking Services become popular recently. For example, Mixi is the largest Social Networking Service Provider in Japan, it has a membership about 15,680,000 (September 30 in 2008). In addition to this, there are many other major Social Networking Service Providers, i.e. GREE, Mobage, Yubitoma, Myspace, Yahoo!Days and so on. In Social Networking Service, “Diary” and “Community” (of hobby) are main contents. So, the service is mainly used for individual entertainment.

Such an entertainment use is a major one, but now another use of Social Networking Services is emerging. That is a use for activating the local region. One example is

"Hyokomu" that is a regional Social Networking Service in Hyogo Prefecture. One important feature of Hyokomu is virtual Mall with which people know many local shops and exchange information about them. Of course, people can buy goods and services at the virtual shop and can go to the real shop. In addition to this, people gather local information, i.e volunteer activities, hobby club activities, and so on. The platform "OpenSNP" that is used in Hyokomu and other local Social network service got award of "NIKEI Local Area Informatization Grand Prize 2008." This fact shows the importance and possibility of Social Network Service in local regions.

In functions of Social Networking Service, distinctive feature is that people can limit flow of information to their friends. The friendship is created by "request" and "approval" that is e-mailed in Social Networking Services. In the Profile, the list of friends is displayed.

Information is the origin of power in the modern society. For example, in collective decisions in the group, the amount of information of other group members is critical. If someone knows more information about others, he or she can make appropriate opinions. This includes the possibility that he or she induces the group to increase his or her private benefits. This implies that, in the group, the more information someone has, the more power of collective decision he or she has.

From the traditional theory, we can see that the origin of power is property rights of scarcity recourses. In production, because of the scarcity capital, the owner of capital has more power of decision in production than the owner of labor that is less scarcity and more exchangeable than capital. From this point of view, the "information" and "networks as a cannel of information" are new topics we have to examine in detail. The increasing attention to network as social capital is understood in this context.

The regional Social Networking Service is filling the key role for activation of the region now. There is a possibility that the relationship with friends in Social Networking Service is critical role for the activation.

From more general meaning, structure of relationship with friends is an interesting topic. From Granovetter (1974), good information for getting-job and job-changing frequently comes from one's friends who are not so familiar. This implies that some friends who is a little far away is important and so structure of relationship with friends is important. But, in real society, it is difficult to perceive the structure of the relationship with friends. On the other hand, using data of Social Networking Service, we can perceive the structure of relationship with friends.

In the following section we show the data and basic statistics. In section 3, we present the notion that is used for capturing the structure of relationship with friends. In section 4, we show some implications. Finally we conclude.

Data

Data is obtained from Social Network Service that carries business now. We have the all data about "friendship" from its foundation. The period is about 2.5 years. At the end of the period, there are 742 members. There are 1013 relations with friends. This Social Networking Service is general one with which a lot of people enjoys exchanging personal information and information about hobby in it. The change of total number of memberships and friend relationships are shown in Figure 1 and 2.

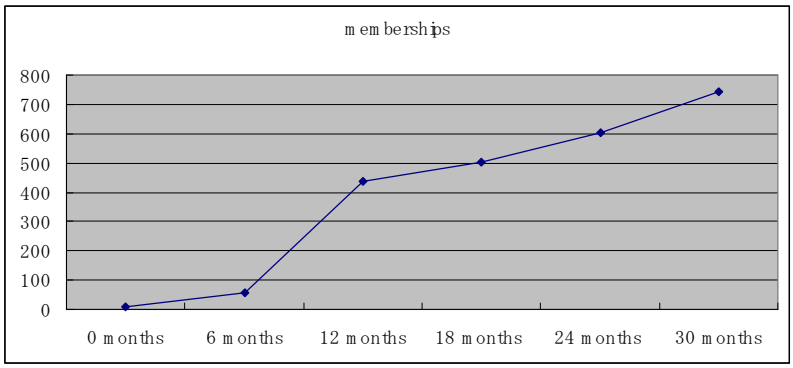

Figure 1

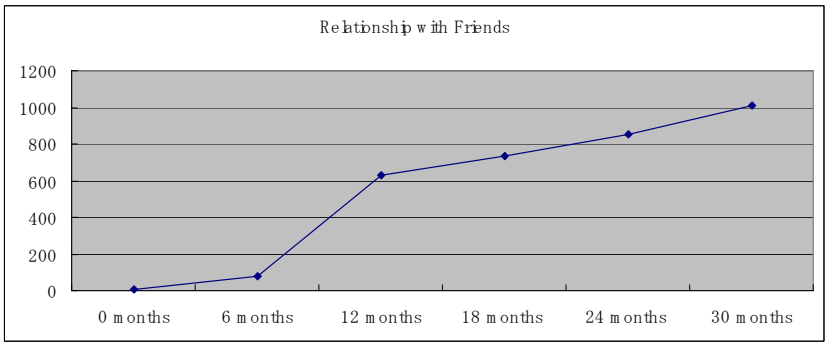

Figure 2

The change of average friend relationship is shown in Figure 3.

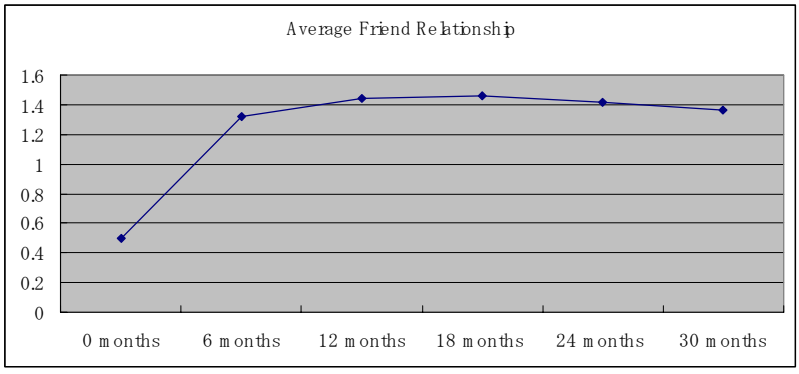

Figure 3

Of course, the number of friendships corresponds to the "Degree" in the standard

network analysis. If the network size increases, then the pool of potential friends also increases. If there is N member in a group, the potential friends is N-1. Hence average friendship is standardized further by dividing N-1. This standardized notion is "density" in the standard network analysis. The change of density is shown in Figure 4.

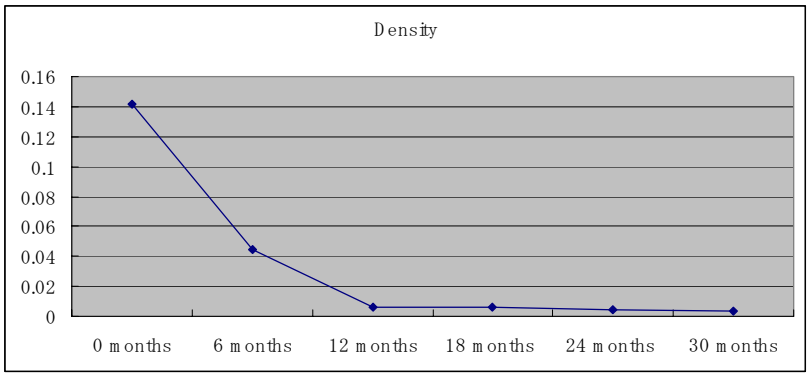

Figure 4

With these graphs, in our data, the membership increase steadily, but the average number of friend relationship is around 1.4. Hence, in contrast with the expansion of group size, the communication level within the group is stable at relatively low level.

Centrality

The relationship with friends is channel of information. The amount of information is the critical factor in the group. Hence the amount of relationship with friends is the proxy of power in the Social Network. In addition to this, the amount is not important at absolute level but it is important at relative level. This is because someone has more power against others from the advantage of more information.

Hence we have to examine the dispersion of the number of friendship relations. With Figure 5, we can see the maximum number of friend relationships increases. The high number is contrast with the low stable level of average number of friend relationships. 1

In order to examine disparity in friend relationships, more appropriate notion is "centrality" in standard network analysis. This notion is defined as follows: The number of friendship relations of member i is expressed by $D(i)$. Let * be the member who has the maximum number of friendship relations. The total number of group member is N. Given this notation, the Group Degree Centrality is defined as follows:

1 Unfortunately, in our data, there is no data about cancellation of friend relationship. But generally, such a cancellation is not so frequent in Social Networking Service. Hence we consider that the essential property is reflected in our data.

$$C_D = \frac{\sum_{i=1}^{N}(D(*) - D(i))}{(N-1)(N-2)}$$

The numerator is the sum of difference between the maximum number of friendship relations and each agent's number. The denominator is the theoretical maximum number of the aggregation. Hence this is standardized index. The transition of this index is shown in Figure 6.

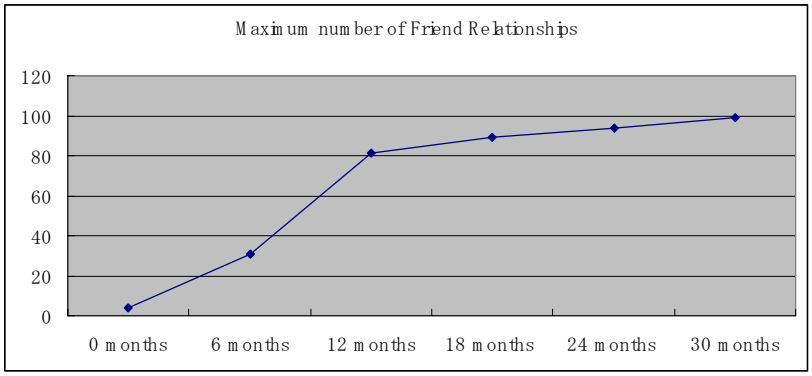

Figure 5

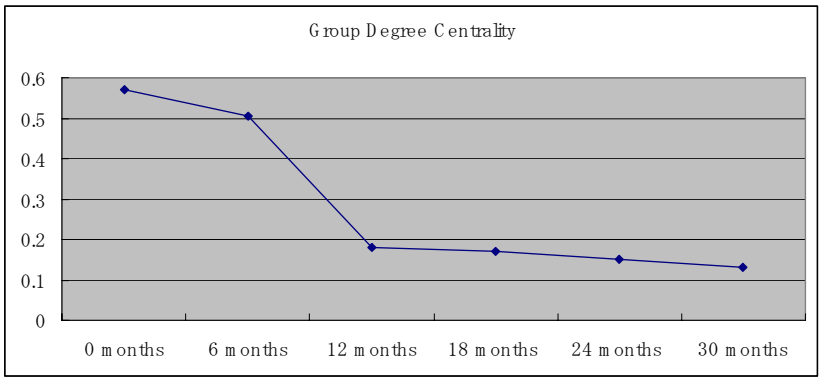

Figure 6

By Figure 5 and 6, in contrast with increase in the maximum value, the group index decreases. Hence the aggregate level, the centrality is not so strong. But this decrease in the index comes from the standardization. The number of friend relationships for each member (degree) is the notion that is defined locally. Hence, the speed of increase in the number of friend relationships for each member is slower than the speed of increase in the number of whole members (more exactly, the maximum number of friendship relations).

In order to take account of the global effect of increase in the total number of members, we calculate Group Betweenness Centrality. "Betweeness" is the notion that captures the bridging role between two agents. Roughly speaking, in the chain of friendship relations, if two agents i and j cannot be linked without someone k, the agent k has the property of

betweenness. Given an agent k, all paths of two agents except k are taken account of. Hence if the total number of members increases, the combination of two agents also increases. This betweenness index is aggregated and standardized with the same way of Group Degree Centrality. Consequently, Group Betweenness Centrality is constructed. This index focuses on mediation role and captures the global effect of increase in the total number of members. The transition of Group Betweenness Centrality is shown in Figure 7.

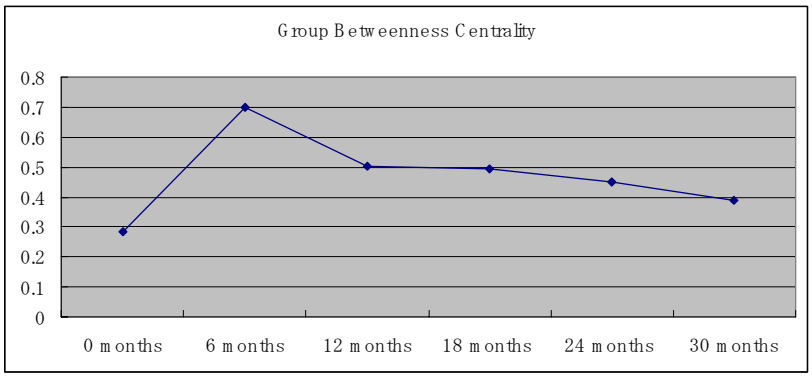

Figure 7

In Figure 7, we can confirm that Group Betweenness Centrality does not decrease so much in contrast to Group Degree Centrality.

Implications

From Figure 3 and 5, the difference between average number of friend relationship and maximum number of it increases steadily, that is about 100 relations at the end of period. But this absolute disparity is relatively small against the expansion of the total number of members. This fact is proved by the index of Group Degree Centrality (Figure 6).

This implies that even if someone has more direct information, the whole situation within the group become more complex. So the advantage of individual increase in the direct information is relatively low. In the collective decision making in the group, such direct information is important. But the effect of the disparity of friend relationships is limited.

On the other hand, the disparity of role of mediator is more striking. From Figure 7, the Group Betweenness Centrality keeps relatively high level even at the end of period. To get reliable new information from someone, introduction by reliable person (that is friend) is important. Hence the high Group Betweenness Centrality implies that for such an introduction, some persons are important role. In other words, there is critical disparity in this meaning. Figure 8 shows the whole networks at the end of period. We can confirm that

some members play a hub of network. This structure is the origin of the disparity of social capital as mediation.

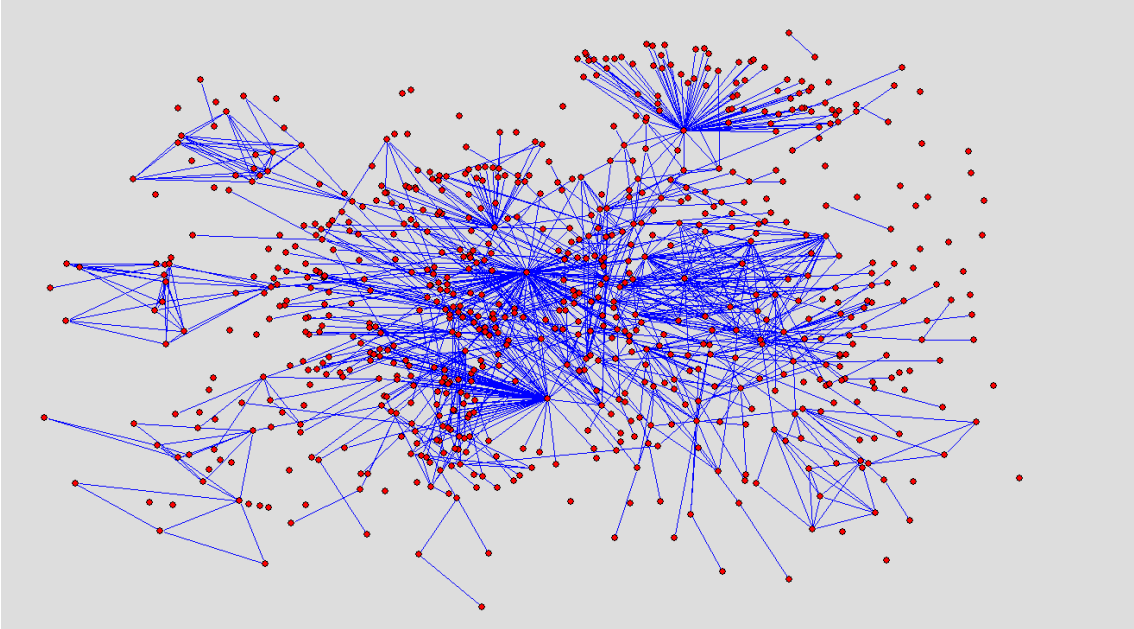

Figure 8

Conclusion

In this paper, using data of actual Social Networking Service, we examine the disparity in social capital as a network. As for the absolute level of social capital (the total number of friends), the disparity appears large, but if we compare with the whole network size, it is relatively small disparity. But when we focus on the mediation role among members, the disparity is more obvious. Such a mediation role is critical for searching reliable and new information. Hence, in a real world, such a disparity is realized in the planning and carrying out new project or finding new jobs. This is interpreted that potential "weak ties" effect is concentrated to a few members.

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