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The Process of Community's Coping Capacity Development in the Sumida Ward, Tokyo – A Case Study of Rainfall Harvesting Movement

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Synopsis

The rainwater harvesting movement in the Sumida Ward, Tokyo helps local community to reduce water related risks, and also to fill up required water supply for the community. In this paper, we will try to show how this movement diffuses in the community and how this diffusion process reflected in social network system helps the community to cope with disaster related risks. This is assumed to be a process where a community shifts from one structural situation to another. A survey design is proposed for future empirical study, which is considered as juxtaposition of Vitae System Model and social networks approach to understand the coping capacity of the people.

Keywords: coping capacity, disaster risk management, Vitae System, social networks

1. Introduction

Coping is defined as the characteristics of individuals or groups in terms of their capacity to anticipate, cope with, resist and recover from the impacts of hazards (Blaikie et al., 1994). Using and enhancing this capacity is a better alternative while fighting with various disaster risks. In the context of integrated disaster risk management, it is accordingly inevitable to understand this process of coping mechanism. We consider coping mechanism is a process of structural change developed by social networks among the members of that particular structural unit. An innovative idea or technology, devolved by a local community to fight with various disaster risks, is such a reflection of this coping mechanism in our present study. Our study aims to understand the process of diffusion of innovation reflected in the personal networks of adopters as well as in the whole system networks and also to find out the factors that influence this process. We have taken the rainwater harvesting practice by the local community of Sumida city, Tokyo as our case study.

2. Problem Description

2.1 Disaster risks in the Sumida Ward, Tokyo

Sumida Ward (*Sumida-ku*) is located in the eastern part of Tokyo. It has a population of 225,935 persons (as of December, 2001).Being a part of the Tokyo (Metropolitan) City, the Sumida Ward is confronted by various disaster and environmental risks in the course of urbanization. The major disaster risks that have been faced by the Sumida city are as follows:

Situation – 1 (Water Scarcity): Water supply in the Tokyo City largely depends on constructing dams in the upstream region of the Tone and Tame Rivers. Until quite recently the numbers of dams have increased to meet up the continuously-growing water requirements of Tokyo population. But the shade of resorting to this commonly used countermeasure by utilizing a huge amount of money, manpower and money, instead of securing adequate water for the city was that it forced displacement of people and devastation of vast areas of farmland in the upstream region. Moreover, the dams have gradually been loosing water storage capacity due to continuous silt deposition. Thus, the process will ultimately bring regional imbalance and environmental insecurity among the communities of the city, even if, the city of Tokyo and its surrounding regions still need adequate water to sustain.

Situation – 2 (Flood): The city has more than two billion cub.ic meters of rainfall every year. Rainwater is directed to the sewage system and released into rivers. Consequently, the flow exceeds the river system, resulting in floods. Floods challenge this modern mega-city and may paralyze the efficient transport system, safe drinking water, performing daily activities etc.

Situation –3 (Water and environmental contamination): Since the vast lands of the city area have been covered by asphalt, it is a reason of hindrance for groundwater recharging. In 70's when Japan was enjoying unprecedented economic growth, factories and buildings pumped up groundwater from deep wells excessively disregarding nature's water circulation. Consequently, shallow wells dried up resulting in subsidence, for example- part of Sumida Ward sank by 3.5m at the deepest.

2.2 Rainwater harvesting– an initiative

Perceiving the risks, Murase, a sanitary officer in the 'Sumida City Office' and a local leader also, came up with an answer i.e., the practice of rainwater harvesting. With the help of other colleagues in the community, he organized a group called 'Raindrop' to spread the rainwater harvesting practice. Their notion is that instead of discharging the rainwater into the sewage, rain can be caught where it drops and thus storing rainwater at household level and in community level small dams can contribute like a big dam in total. The 'mini dam' (tank) is easy to set up and not huge money is required. The stored water can be used for washing, cleaning purpose as well as drinking water in the emergency and also for fire fighting. On the one hand, it reduces water caring costs, provides a self-sufficient community, and on the other hand it helps the community members to mingle with each other and thus they can share their ideas and feelings. As a whole, it contributes to the enhancement of awareness among the community members about the importance of effective water management. The rainwater harvesting in the Sumida Ward is not restricted only at the household level, but it has been practiced also at community level. The form of community level water recycling practice is named 'Rojison'. 'Roji' means street and 'Son' corresponds to "Respect" in Japanese language, thus it means the object of roadside respect. . Rojison as a physical object has served as a symbol of encouraging community level water harvesting practice. It is also a symbol of neighborhood safety and protection Rainwater is collected in an underground tank, with rainfall water transferred from roofs of nearby houses. The water thus stored on-site can be pumped up with a hand pump. Above all, 'Rojison' serves a as public place where the community members can share their ideas, problems and interests.

2.3 Adoption of rainwater harvesting

The idea of rainwater recycling first came into practice in 1982 when the "Raindrop' group requested the *sumo* (wrestlers') association to use the rooftop water of local *sumo* stadium for non drinking purpose. Though initially the idea was rejected by the *sumo* association, yet the 'Group Raindrop' was success to implement their plan by sanctioning it as a rule through the Tokyo Metropolitan Authority. Since then all the newly constructed public and private buildings have come under the rainwater recycling system. To date, 180 tanks have been installed and the entire facilities through the city now hold a volume of 10000 cubic meters of water. More than 19 Rojison have been built and used by the communities in Sumida Ward, Tokyo. Now, Sumida Ward can store 3500 tons of rainwater caught on the roofs of large building like the Kokugikan (*Sumo* hall) and the Edo-Tokyo Museum in Ryojoku. About 70% of the Kokugikan (*Sumo* Wrestling Arena) today use only rainwater. Other large buildings like Sumida city hall have also been equipped with basement rainwater tanks. To promote this practice among the community, various workshops have been organized; plumbers, engineers, architects have been trained to construct rainwater recycling tanks. Social links have been established with various national and international organizations that are also practicing rainwater recycling.

3. Vitae System Model and Coping Mechanism

3.1 Vitae System Model

Vitae System Model developed by Okada and extended by Misra and Okada (2005) argues that the process of reducing disaster vulnerability should be dovetailed into the very process of community

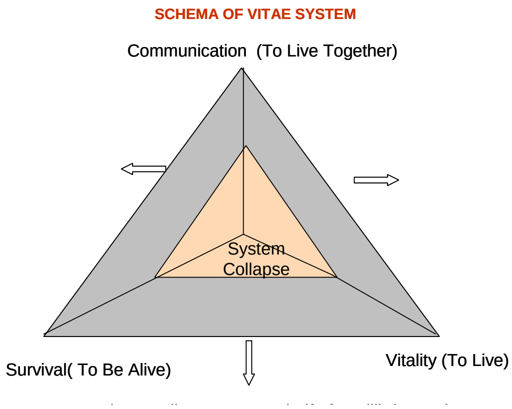

Fig. 1 Vitae system model (source: Okada and Misra),

development. The scope of the perspective is centered around holistic viewpoint that any community has three vital or generic components viz, 'Survival', 'Vitality' and 'Communication'. 'Survival' implies 'to become alive ', 'Vitality' implies 'to live lively' and 'communication' corresponds 'to live together'. For a community to become disaster resilient, the development of the community must address the coordinated quality of these three components viz, 'Quality of Survival' (QUS), 'Quality of Vitality' (QUV), and 'Quality of Communication' (QUC). Excessive inadequacy of any of the components could result in the collapse of the system. Though securing the 'Quality of Survival' is considered one of the prime objectives, yet a balance growth of all three components is essential for a resilient system moving along towards a desirable development (Fig. 1).

3.2 Sumida crisis-turned chance development in the light of 'Vitae' system

The Sumida water related crisis shows quite factually that inappropriate managing of water resources was leading towards increased vulnerability to and degraded coping capacity with and environmental risks by damaging three components of the community as described in the 'Vitae' system model. The threats towards the 'Quality of Survival' (QUS) include such hazards as water scarcity, flood, fire etc. Similarly, such environmental hazards like degradation of water quality due to inadequate sewers and lack of awareness of proper waste disposal and recycling, all are classifiable as threats to QUS. Moreover this old community in Sumida Ward has been confronted by social threats such as potential displacement of people to outside if some large-scale urban redevelopment project is straightforwardly introduced. Notably all of this could have worked as survival risks to the community but some people were creative and imaginative enough to turn it otherwise. The Rojison mini-facility actually was an innovation which came out of this kind of drive.

On the other hand, meeting the challenge to upgrade the 'Quality of Vitality' (QUV) by both economically and socially vitalizing this community has long been an important concern for both local people and the Sumida Ward Government. At community level what people can lead and change for this purpose is limited but effective if gradually conducted on a modest scale. For instance, efforts to improve the quality of neighborhood life in terms of amenity, aesthetics, and amusement are typical measures for achieving the purpose. In fact the "Rojison" community monument has exactly served for this kind of purpose. People gathered around it, small children joyfully played with water tapped from the facility, and thus it has been regarded as a "neighborhood forum."

All of this forced both local people, local government officials and concerned specialists to find out an adequate balance between what can be governed at their neighborhood community level and what not, which means that the latter agenda should be communicate with people living outside and more area-wide administrative bodies. Knowing this, it was quite natural and reasonable for them to take on the challenge towards the 'Quality of Communication' (QUC). A noteworthy success in this line of challenge was that the spirits and thoughts of what has been symbolized by the "Rojison" facility has spread and become well accepted in other neighboring Wards. Though it was not actualized in the form of "Rojison" facility, the movement also exerted an immense impact on the rest of the neighborhood community yet within the same ward or on its neighboring areas, such that new buildings and offices have started to implement water recycling practices (as mandated by the newly introduced ward-level regulation.).

Two more points need to be made in this regard.

i) It probably helped trigger pro and con public debates about emerging limits to the conventional approach to develop water resources in the Tokyo Metropolitan Region, and resultant needs for shifting toward some more distributive and networked utilization system.

ii) Nation-wide and cross-country-wide social networks of people (citizens, government officials, NGOs, specialists, etc.) have been constantly extending to advocate, promote and share rainwater harvesting knowledge and technology.

This is an encouraging example of upgraded QUC which promoted dissemination and collaboration far beyond the community area.

3.3 Rainwater harvesting as an integrated approach

Now, it better to review the above points derived from application of the Vitae System Model and to turn up our focus to the most essential point of what the Vitae System Model prescribes. That is, any thing that is modeled as a living body must be coordinated and integrated in terms of the above three cardinal functions. This is particularly the case with modeling the process of its coping capacity being challenged and likely to become either upgraded or degraded.

How does the rainwater practice in the Sumida Ward help the community to fill up the quality of structural components by using their own local resources and capacities? The rainwater harvesting movements guided the community into maintaining and enhancing its structural requirements through a balance development or progress of its various components. This functional integration process may be explained as follows: reducing flood risk, recharging ground water, in-situ water storage which resulted in the improvement and maintenance of the 'Quality of Survival'.

Similarly "Rojison" served as an instrument for the social and economic vitalization of the community. Being a "neighborhood forum", it provided the community a physical sphere to gather around, share their ideas and values, use water tapped from the facility for watering plants, cleanings cars and public places. It rendered the openings to improve the quality of neighborhood life in terms of amenity, aesthetics which are elements of the 'Quality of Vitality".

In a due course, the spirits and thoughts that has been symbolized by the "Rojison" facility has spread in other neighboring wards. Implementation of water harvesting practices in the new buildings and offices

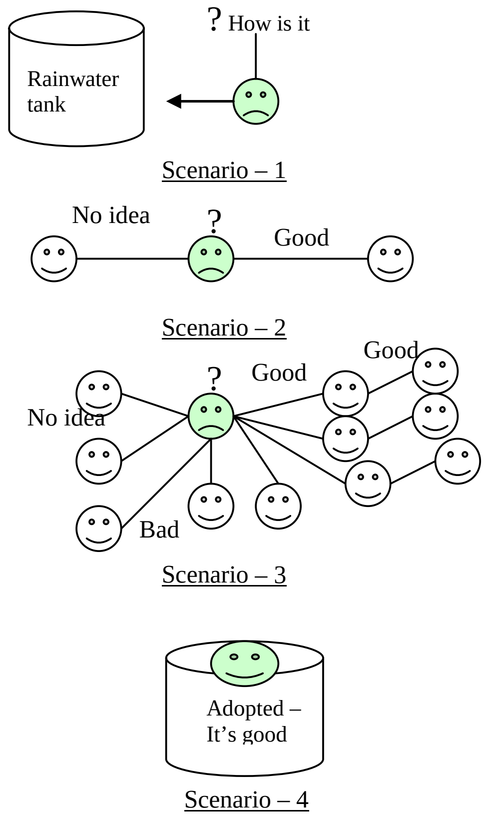

Fig. 2 Getting information from others helps an individual to take decision by about an innovative idea

exemplifies the sprits communicated within the same ward or its neighboring areas. The social networks have been established between communities, government officials, NGOs, specialists etc. at nation and international level to advocate, encourage and uphold the idea of rainwater harvesting knowledge and technology. This is a stirring example of upgraded 'Quality of Communication'.

3.4 Rainwater harvesting – 'a stock of knowledge' or technology

We now turn our discussion to highlight on the aspect of "innovation" made through the above mentioned community movement symbolized by rainwater harvesting.

A technology is a design for instrumental action that reduces the uncertainty in the cause-effect relationship involved in achieving a desired outcome (Rogers, 1983). It is argued by the scholars (Rogers, 1983) that a technology has two components viz., hardware and software. Hardware consists of tools that embody technology as a material and physical object; and software includes the knowledge base for the tool. Thus, we consider the rainwater harvesting is a ‘stock of knowledge’ or a technology. It is knowledge in a sense that by performing the above mentioned function, it may help the local community to maintain their structural components such as QUS, QUV and QUC. The rainwater recycling is thus a means for the community for its structural change. This structural change is on the other hand an outcome of the coping mechanism of the local community in a scenario where the rainwater recycling is a tool or a stock of knowledge. Rainwater harvesting may help the community to shift from one structural position to another, or it helps the community to maintain their structural components as well as to reduce future risks.

4. Diffusion of rainwater harvesting and social networks

Community’s coping mechanism is a result of the process of adoption of rainwater tank (mini dam) as well as the practice of community water harvesting like ‘Rojison’ in the Sumida Ward. As evidenced in the previous discussions based on the Vitae System Model, the community is considered to become more resilient as people increasingly adopt this innovative idea. To understanding of this knowledge and technology as an innovation process is necessary to conceptualize the coping mechanism of the community. The diffusion of knowledge and technology is defined as the process by which a few members of a social system initially adopt an innovation, then over the time more individuals adopt until all members adopt the new idea (Ryan and Gross, 1943; Rogers, 1983; Valente, 1995). Here, we, consider the diffusion of knowledge and technology or the adoption of rainwater harvesting by the community members as the change in coping capacity.

An innovation is defined as an idea, practices, or objects that are perceived as new by an individual or other unit of adoption (Rogers, 1983). This newness aspect contains a degree of uncertainty. The “Newness” aspect of an innovation may be expressed in terms of knowledge, persuasion, or decision to adopt. So, in a diffusion process, the degree of uncertainty can be reduced by obtaining information or observing the adoption behavior of others. In Fig – 2, we have shown how we interpret an individual takes decision about the adoption of an innovation. For example, in the first scenario (Fig.2), seeing the rainwater tank, an individual person becomes curious about that, but he or she is unable to take decision because he or she does not have any information on that aspect. The figure shows that in the following process, he/she starts to gather information from his/her peer group or neighbors. Relying on others information and observing others’ behavior, he/she comes to his/her decision and adopts the new idea. Sharing information by the members of a social system in such a way that it creates a chain of network that helps the members of the system to take a collective decision about the new idea. Modeling this network pattern within this network frame is instrumental to understand the pattern of the diffusion process or the process of changing coping capacity.

A social network is the pattern of friendship, advice, communication or support which exists among the members of a social system (Knoke and Kuklinski, 1982; Burt and Minor, 1983; Wellman 1988; Valente, 1996). How do social networks influence diffusion? Becker (1970) mentioned the association between socio-metric location or social network and diffusion of innovation in at least three ways. First, interpersonal communications provide the network individual with information that he/she might otherwise have missed. Second, the knowledge that others have considered and/or introduced, and the concept being transmitted provide this individual with legitimating and support. Finally, location in the network of interpersonal relations exposes the individual to deliberate influence attempts concerning acceptance or disapproval of the innovation.

5. Threshold model of diffusion of innovation

5.1 Threshold model of diffusion of innovation

In the beginning of social network approach of diffusion in innovation study, a significant number of researchers tried to focus on opinion leader i.e., to count the number of times an individual was nominated as a network partner and to correlate this variable with innovativeness as measured by an individual’s time of adoption of the innovation under study (Valente, 1996). Opinion leader was theorized to be a significant influence on the rate of adoption. In a diffusion process, all the individuals do not necessarily adopt the innovation at the same time;

rather it is adopted by a person or group of individuals in the beginning and later on, other members of the community follow them. An individual engages in a behavior based on the proportion of people in the social system already engaged in the behavior (Granovetter, 1982). Thus, an individual, while adopting the new idea, observes the behavior of the members of his/her own community, which helps him/her to reduce uncertainty accompanied with the newness aspect of a technology or innovation. Therefore, an individual's adoption behavior is a function of the behaviors of others in a group. This approach of diffusion of innovation was postulated by Granovetter (1978). Focusing on the structural approach, Granovetter introduced the threshold model of collective behavior. A collective threshold behavior is the proportion of adopters in a system prior to an individual's adoption. Individuals who are very innovative, have adopted the innovative idea or technology when none or very few of its network members adopt. It recognizes an individual with a low threshold, whereas, a high threshold person adopts the innovation when a majority of his network members adopted the innovation. Granovetters (1983) postulates the threshold is the proportion of adopters in the social system needed for an individual to adopt an innovation. Valente (1996) argued that the problem of this collective behavior threshold is that the individual may not be able to accurately observe the behavior of others in a social system and thus he/she relies much on his/her personal network for taking a decision on adoption of the innovation. Since the innovation contains uncertainty, it encourages individuals to discuss with others who have already adopted and have some experience (Becker, 1970). As a result, the adoption threshold must be measured in terms of direct communication links with others in contrast to collective behavior threshold (Valente, 1996).

Personal network is the set of direct ties that an individual has within a social system (Wellman, 1988). In the course of diffusion of innovation, more and more people adopt the innovation and as a result the proportion of adopters in an individulas's personal network generally increases. But this process depends on the structure of the system. Fig. 3 shows this process of adoption in an individual's personal network.

Exposure is the proportion of adopters in an individual's personal network at a given time. Since adoption threshold is the proportion of adopters in an individual's personal network, an individual is thus very innovative if none of his/her personal network members adopted the innovation at the time of his/her adoption, i.e., he/she is a very radical person as well as a low threshold individual. On the contrary, an individual is considered as very conservative if all the members of his/her personal network adopted the innovation before he/she adopted (Fig.4). But, a person's degree of innovativeness depends not only at the personal level, but also at the system level. A person may be very innovative in respect of his/her personal networks, but not so innovative in respect of the whole system and vis-a–vis. Therefore, the degree of innovativeness should be judged both in respect of personal network as well as system network.

5.2 Adopter categorization

Classical diffusion of innovation study classified adopters based on innovativeness as measured by

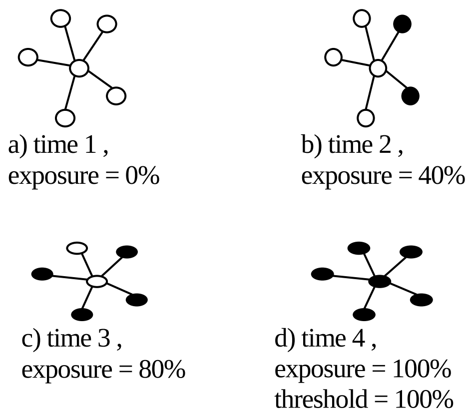

Fig. 3 Showing exposure and threshold in personal network (source: Valente, 1996)

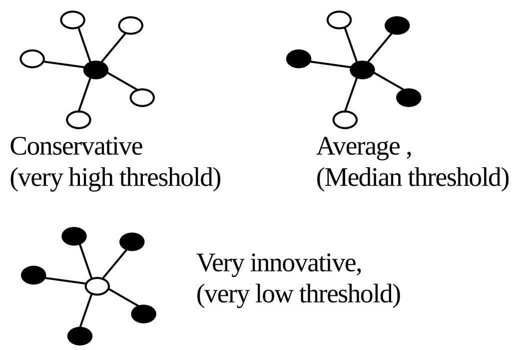

Fig. 4 Degree of innovative in personal network

time-of-adoption (Rogers, 1983). Adopters are classified as 1) early adopters, 2) early majority, 3) late majority, and 4) laggards. Early adopters are individuals whose time-of-adoption is greater than one standard deviation earlier than the average time-of-adoption. Early and Late majorities are individuals whose time-of-adoption is bounded by one standard deviation earlier and later than the average. Laggards are those individuals who adopted later than one standard deviation from the mean. Valentine (1996) classified personal network threshold adopters by partitioning the network thresholds distribution in the same manner describe for time-of-adoption adopter categories. Low network threshold individuals have personal network thresholds one standard deviation lower than the average threshold. Low and high network threshold individuals have personal network thresholds bounded by one standard deviation less than and greater than average. High network threshold individuals have personal network thresholds one standard deviation greater than average (The average threshold is the mean threshold for the community). Adopter categorization is created to compare early adopters with later adopters to determine difference in their social and personal characteristics, communication behavior and opinion leadership.

5.3 External influence

Two possible external sources of influence on adoption of innovations are cosmopolitan actions and communication media. A cosmopolitan individual is oriented to the world outside of his/her local social system and relates his/her local social system to the larger environment by providing links to outside information (Valente, 1996). Cosmopolitan actions and media consumption provide individuals with earlier awareness of an innovation (Becker, 1970). External influence may have different impacts on the diffusion of innovations in the personal networks and system level. Role of external influence on adoption of innovation needs to be clarified when one considers thresholds relative to the social system and personal networks (Valente, 1996). This dual classification permits specification of how external and interpersonal influence flow through the system and govern the diffusion of innovations.

6. A proposed survey design

6.1 Required data

Empirical analysis of the personal network threshold model requires data collected on – 1) time of Adoption, 2) individual attributes 3) social network ties , 3) external influence.

6.2 Survey design

It is quite comprehensible that using the threshold model of the Sumida rainwater harvesting diffusion process will provide us with a give us a picture to understand the coping capacity of the community. Here, we propose a preliminary idea of conducting the empirical survey in the Sumida Ward. For our study, we plan to take a neighborhood of the Sumida Ward. For the statistical analysis to be meaningful, the sample size needs to be large enough. One idea is to cover the whole or a lesser population the survey area, which may be identical to this neighborhood or much smaller. In this regard, it is required to mention that the survey area community should be practically a closed group so that the ties among the community members are present.

6.3 Time of adoption

The information about time of innovation will be collected by asking people to recall their time of adoption rainwater of a recycling tank, and if possible, the month and year of adoption specified. This information will help us to categorize the adopters both at personal level and system level.

6.4 Individual attributes

Individual's personal attributes are very much concerned with time of adoption. The degree of innovativeness depends on personal characters of the adopters (Coleman et al, 1957). Considering this, we are planning to collect the data by individuals attributes such as age, sex, occupation, income, education level, the frequency of attending workshops organized by the 'Raindrop Group', etc. . To find out the individual motive of rainwater adoption, we also intend to categorize the individuals by relying on the structural components of the 'Vitae' system. We propose to categorize the individuals motives into three orientation viz survival orientation, vitality orientation and communication orientation. To capture this phenomenon, the individual will be asked to answer the following question (one example):

How would you rank the importance of these characteristics in using the rainwater recycling? -

a) It helps to deal with any water related disaster risk (QUS)

b) It reduces the water utility expenditure (QUV)

c) I have adopted it or will adopt it as because my friend/neighbor requested or advised (QUC)

The following response patterns in ranking will be classified as follows: - Survival oriented – abc, acb; Vitality oriented – bca, bac; and Communication oriented- cba, cab.

The classification of the individual according to their orientation will give us a better picture about the process of diffusion. Arguing over this point, we here presented one hypothetical scenario (Fig. 5) that shows the co-relation between individual's orientation and time of adoption of a rainwater tank. We assume that a group of individuals adopt the rainwater recycling at different periods of time and each of them has one's own orientation for the adoption. Fig. 5 shows a hypothetical distribution of the adopters both at the personal level (personal networks) and system level (collective networks) in correlation with the adopter's orientation. A hypothetical figure of the diffusion process of a rainwater tank shows that in the case of personal network the majority of the very early adopters are communication oriented, yet at system level the majority of the early adopters are survival oriented. So in this way, the intention of the adopters in the initial phase can be determined by correlating their time of adoption and orientation. It may help illustrate that what factors or orientations play crucial role in the diffusion process. For example, the hypothetical figure shows that at the system level, initially the adopters were vitality oriented, but as the process progressed, the adopters became much more communication oriented. We may work with such a scenario that can predict that at the system level in the initial stage the survival factors plays a more crucial role than others , but in a later stage of diffusion process, maintaining quality of communication or the communicative motive of the individuals with the others serves as the major factor of diffusion of innovation. In this way, the

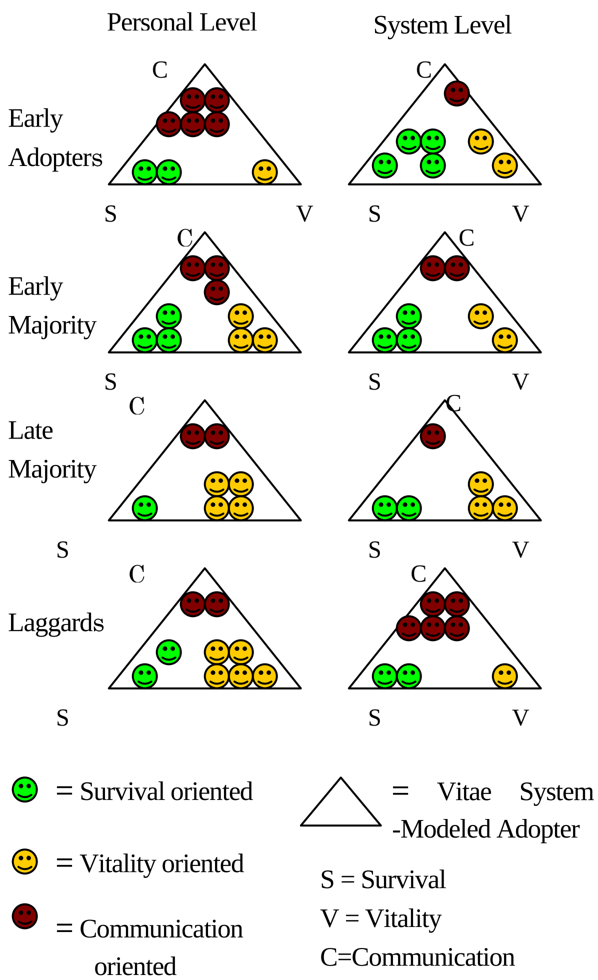

Fig. 5 A Hypothetical relation between individuals' orientation and time of adoption

categorization of individual attributes in three orientations will enable us to judge or understand the various aspects of diffusion processes. For the sake of our discussion, we have only shown and discussed single hypothetical scenario developed from the correlation between classification of the orientation of the individuals and the time of adoption.

6.5 Social network ties

The importance of social network ties has already been mentioned above in this paper. Direct ties i.e. personal networks among the individuals as well as the indirect ties among the individuals likewise system networks are the reflection of individuals' behavioral pattern. However, ties between individuals in a social network are not commonly homogonous. The pattern of network among the members in a system varies

Table 1 Proposed survey design for social network ties

Concepts	Variables	Survey design
Quality of survival	Water requirements (physical infrastructure)	Whom (3 persons) does he (the respondent) often turn for advice and suggestion in water/ infrastructure related problem?
Quality of vitality	Efficient water utility	Whom (3 persons) does he (the respondent) think most effectively used the water recycling or handled water problem?
Quality of communication	Friendship (social interaction)	Who (3 persons) are the friends in this neighborhood, whom he (the respondent) saw or interact most often socially?

according to the changes of the nature of ties. An individual likes to develop tie with others in various contexts. The changes in the nature of ties also influence the pattern of social networks in a community. Therefore, we categorize the informal ties among the members in a system into three aspects based on the three structural components of the 'Vitae' system. Table-1 shows the three different network ties and proposed a survey design accordingly.

The significance of categorization of social network ties is not only restricted to understanding the correlation between the nature of ties and network patterns. It also gives an idea how the opinion leaders are changing with the changing nature of ties. It. may be the individuals who are nominated as opinion leaders in the case of 'survival' tie, but in the case of other two cases such as vitality and communication ties, other individuals may possibly be identified as opinion leaders. It also helps us to find out the relation between opinion leaders in various social ties and their individual attributes or orientation. Thus it raises a question that is there any relation between diffusion of innovation and the present condition of community structure? Our tentative answer is: yes, quite likely, and the clue is to make use of the 'vitae' structure. With this in mind, our proposed survey is expected to address the following questions:

a) How does an individual seek social ties to maintain their structural components?

b) How his /her adoption decision depends on his/her location in a social structure, the designed survey can answer these questions?

7. Conclusions

In the above discussions we have focused on the Rainwater Harvesting movements in Sumida Ward, and illustrated how effectively and positively the movements impacted the community and other external areas. It has been shown that this entire process can be interpreted as an innovation process with the symbolic technology of rainwater harvesting being diffused and disseminated. A point is made that the Vitae System Model is useful in describing and modeling the integration process of three cardinal functions which are considered to characterize the coping capacity of a community or social system of our focus.

We have also referred to the importance of understanding the ongoing structural change and that of addressing a community's coping capacity development. The proposed social network approach helps us systematically study the behavioral nature of a community through analysis of social network patterns .It is also mentioned that in our study, instead of considering an actor as monogamous node, we considered it as a dynamic unite of a social structure. Putting individual's attributes, motives, behavioral action and ability into the light of the 'Vitae System' structure, our study has suggested a prospective analytical method to model a more dynamic nature of the social network To understand a community's coping mechanism, it is necessary to understand these dynamic components of an actor, instead of simply considered as a static node of a holistic structural pattern. Our future work will include an empirical survey actually conducted in Sumida city based on the above mentioned proposed study design, and then examine if we can derive meaningful policy implications.

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東京都墨田区におけるコミュニティの取り組み能力開発のプロセスに関する研究
– 雨水活用運動をケーススタディとして

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要　旨

東京都墨田区における雨水活用運動によって、雨水を集め、内水排除対策、渇水対策等に寄与することを目的としている。本研究は、このようなミニ技術の普及伝播のプロセスに着目し、これを技術革新過程とみなすとともに、社会的ネットワークの変容が災害リスクへの取り組み能力にも影響し、ひいては社会的ネットワークの構造が変化するという見方でモデル分析する。実証的研究を行うために社会調査を設計する必要に触れるとともに、生命体システムの諸機能の具体的な特定や社会的ネットワークと地域の災害リスクへの取り組み能力の変化との具体的な意味づけについても議論する。

キーワード：取り組み能力，災害のリスク管理，生命体システム，社会的ネットワーク