

Doctoral Dissertation

博士学位論文

A STUDY OF THE RELATIONSHIP BETWEEN GOVERNMENTAL  
AND NON-GOVERNMENTAL DISASTER PREVENTION

地域防災に関する行政と住民の連携方策に関する研究

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A Study of the Relationship between Governmental and  
Non-Governmental Disaster Prevention

by

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## 博士論文の要旨

地域防災力の向上に際しては、防災行政の対応力の強化はもとより、防災行政と地域住民との連携強化や協力体制の構築なども重要な意味をもつと考えられる。しかし、地域防災力の向上に際しては、当該地域における種々の実情によって採るべき方策の在り方も異なってくるはずであり、無論、ある地域において有効性が認められた方策が、他の諸地域においても普遍的に有効である保証などは何処にも無いはずである。とりわけ検討対象が先進国なのか開発途上国なのかによっても、そこで取り得る方策の内情は大きく異なることが想定される。したがって、このような課題の検討にあたっては、まず第一義的には、当該地域において防災力向上を図るうえで解決すべき根源的課題は何なのかを明確化するプロセスが特に必要となると考えられる。

このような観点から、消防を事例として各地域の実情を概観してみるならば、ある種の特徴的な傾向を読み取ることができる。例えば、その先進国の事例として日本の消防の現況を概観してみるならば、地域住民の有志（ボランティア）からなる「消防団」は一定の法的根拠が付与されており、「常備消防」とともに公設消防の一翼を担うべき位置づけとなっている。日本国内では、このような「常備消防」と「消防団」との円滑な連携のもと、大規模震災時の同時多発火災などではない限り、火災は短時間で消し止められる場合が多く、十分な消防力が効果を発揮し得る体制にあると言えよう。

一方、開発途上国の諸地域では、このような高度な消防体制を有する場合は必ずしも多くはないのが実情である。公設消防設備を喫緊に整えることもまた困難であるという実情のなか、このような地域においては、既存の地域リソースを最大限に有効活用しつつ地域防災力の向上を図ることが喫緊に行い得る方策と言えよう。

無論、日本における地域防災力の向上に際しても、問題点や課題が存在しない訳ではない。地域コミュニティの弱体化が、地域消防力のみならずあらゆる地域的活動場面において負の影響をもたらすとして指摘されて久しく、とりわけ防災や消防に関して言えば、行政による高度な防災体制への依存意識が地域住民の当事者感覚の失墜をもたらしているとの指摘もある。伊勢湾台風を契機に整備された日本の災害対策基本法は、決定的に不足していた国内の防災インフラ整備を格段に推し進め、制定以前では数千人オーダーであった死者数を、制定後においては（阪神淡路大震災、東日本大震災の発生年を除いては）百人程度にまで低減させたことは事実であり、日本における防災上の課題は、如何にして地域住民自身の当事者意識を備え付けるかといった、いわゆる地域コミュニティの活性化といった課題へと範囲を拡大しつつあると言えよう。

以上を踏まえるならば、地域防災力向上のためには、まず、当該地域において解決すべき喫緊の課題は何なのかを把握するプロセスはどの対象地域においても必須であることは言うまでもなく、また、その課題への対処方策についても対象地域の実情に応じて異なって然るべきであることは明らかであろう。とりわけ上述のように、先進諸国と開発途上国における実情の違いは、行政と地域住民との関係性に着目することによって特に明白となる側面も少なくないと考えられる。

このような認識のもと、本研究では、とりわけ行政と地域住民との関係性のあり方に焦点をあて、地域防災力の向上のための方策について、開発途上国と先進国との対比のもとで検討を行うものとする。検討対象の事例として火災を取り上げ、開発途上国における検討対象地域の事例としてタイ・バンコクを、先進国における検討対象地域の事例として日本を取り上げることとする。

検討の結果、得られた主な結論は以下の通りである。

まず、開発途上国のひとつでもあるタイ・バンコクでの検討では、地域消防力向上のための根源的課題を把握すべく行ったヒアリングおよびアンケート調査により、以下のような点が明らかと

なった。すなわち、公設消防の他に、地域住民の自主的活動としてのボランティア消防団が存在しているものの、これらの中に連携関係は一切存在せず、むしろ長年に渡り軋轢が生じている状況にあり、消防活動の効率化に大きな支障をきたす状況にあることが把握された。無論、公設消防インフラの増強が必須である状況には変わらないものの、整備の完了には多くの時間と費用を要することもまた事実である。このため、より現実的かつ喫緊の地域消防力向上策としては、既存の地域リソースを最大限に有効活用すべく、公設消防とボランティア消防団との連携体制の構築により地域消防力の効率化を図ることが想定された。これを現実化すべく、本研究では、公設消防とボランティア消防団との連携体制の構築によって生じ得る地域消防力の向上の程度をビジュアルに示した「Regional Fire Fighting Validity Map」を試作・提唱しつつ、具体的に公設消防とボランティア消防団との連携に向けたワークショップを双方参加のもとで実践し、結果として双方が連携にむけて極めて前向きに歩み始めるという成功を見るに至った。長年に渡る公設消防とボランティア消防との軋轢の解消に成功した取り組みは、バンコクの消防史上、本事例が初めてであり、今後に於ける本取組みの他地域への普及が期待される状況となっている。

一方、先進国のひとつである日本での検討では、以下のような知見を得るに至った。高度に発展した公設消防を備える日本においては、地域消防力の更なる向上のためには地域コミュニティの活性化が不可欠であるとの指摘は従来にも多く行われてきたものの、その実現化に際しては、地域住民個々の利他的なふるまいの重要性を指摘（自分のことだけではなく地域や他人のことも真剣に考えましょう、といった類の指摘）するに留まるものが多くを占める現状にあった。これに対して本研究では、このような地域消防力を活性化させるための地域住民個々の協力的な行動（ex 周辺他者への消防活動の勧め、等）は、必ずしも利他的な動機付けのみに依らずとも、延焼リスク特性の正しい理解を促すことで利己的動機付けに訴えかけることによってさえも十分に喚起され得ることを確認した。このことは、地域消防力向上のためのコミュニティの活性化方策の検討にあたっては、必ずしも住民個々の奉仕心や慈善意識のみに依らずとも、個々の延焼リスク認識を適正化するための方策を検討するという、言わば基本的かつ本質的な検討によっても十分に達成し得るという点において、新たな知見をもたらすものと言えよう。



## ABSTRACT

Generally, in order to improve a regional safety for disasters and accidents, indispensable strategies are not only a reinforcement of the governmental ability, but also a strengthening of the cooperative relationship between government and non-government which means volunteers, residents and so on. Needless to say, the effective strategy should be varied depending on the actual situation in the subject area, because there is no guarantee that some strategies or countermeasures based on the common-sense values of one subject area will be of universal application for all other regions. Especially, such an effective strategy will also differ according to whether the subject area is in the developed country or in the developing country. Consequently, the process to make clear about what the fundamental problems are in the subject area must be an essential for examination of such solutions as above.

If I tried to overview the actual situation of various places about firefighting as an example, then I can find some distinctive tendencies. If I overviewed the recent Japanese situation for firefighting as an example, it may be said that there is a highly-developed fire fighting system which can extinguish a fire immediately except for a large number of simultaneous fires in a huge earthquake. It may be said that there is an effect of a smooth cooperative relationship between governmental and non-governmental fire fighting. In the Japanese system, it is worth specially mentioning that the voluntary fire fighting plays a part in the official fire fighting on a legal basis.

On the other hand, it is unusual for most developing countries to have such a highly-developed fire fighting system. It ought to be important for such most developing countries to make full use of the existing community resources, because it is impossible to reinforce immediately the governmental infrastructures.

Needless to say, even if in Japan, it is not that there are not problems at all. It has been long since some researchers said a weakness of a community leads to an undesirable situation not only in fire protection, but also in every respect. Regarding to the disaster prevention or regional fire fighting validity, it has been pointed out that a resident who depends overly on an existing highly-developed disaster prevention system tends to lack a consciousness of the parties concerned. It is true that the Basic Act on Disaster Control Measures which was triggered by “Isewan Typhoon” had promoted the remarkable infrastructure improvements for disaster prevention, and also had succeeded in decreasing the number of victims per year by natural disasters from several thousands to about hundreds. Therefore, it can be also said that the subject of the current Japanese disaster prevention issue is expanding to a reinvigoration of a community such as how to revitalize a consciousness of the parties concerned, after establishment of the Basic Act on Disaster Control Measures in Japan.

It follows from what has been said thus far that the process to make clear about what the fundamental problems are in the subject area must be an essential for each place, and that the effective countermeasure ought to be varied depending on the actual situation of the subject area. Especially, I may say that the differences in disaster prevention issues between the developing countries and the developed countries ought to become clear by focusing on the relationship between government and non-government.

As mentioned-above, in this study, focusing on a fire fighting as an examination case, I would consider the differences on the fundamental problems and effective countermeasure for regional fire fighting validity between developing countries and developed countries. I would take the case of Thailand as a developing country, and also take the case of Japan as a developed country.

In summary, the following results were obtained:

Firstly, regarding to the investigation on Bangkok, Thailand, as a case study of a developing country, the following were grasped by some investigations. Namely, even though there are some voluntary firefighting groups in each district in addition to the governmental fire fighting, so far from existing a cooperative relationship, there are many conflicts between them. And such conflicts hinder the improvement of the efficiency of the comprehensive regional fire fighting. There is no doubt about the necessity of the further infrastructure improvements for disaster prevention. However it is also true that such further infrastructure improvements take a long time and a lot of cost. Therefore, it was considered that the most practical countermeasure would be an improvement of the efficiency of the regional fire fighting by an establishment of the cooperative relationship between the governmental and volunteer fire fighters which was a typical case of the existing community resources. In order to put this countermeasure into practice, in this study, I have proposed the Regional Fire Fighting Validity Map which can show the actual situation and the effect of the establishment of the cooperative relationship between them, and also held several workshops in which both members were attended. As a result, this practical approach succeeded in achievement the above purpose. I heard that nobody succeeded in establishment of such a cooperative relationship between them in the past. Therefore, this ought to be the first case in Thailand history. Moreover, the spread of this strategy to the other districts is expected in the future.

Secondly, regarding to the investigation in Japan, as a case study of a developed country, the following were grasped by some investigations. It has been long since some researchers emphasized the importance of a reinvigoration of a community for the further improvement of the regional fire fighting validity, and these researchers also emphasized only the importance of the altruistic or charitable behavior for an achievement of the reinvigoration of a community. In contrast, it was found from the results in this study that a person who had understood deeply the existence of the fire risk which spread from its neighborhood, had a basic tendency to have a motivation to awaken a neighbor's activity for a regional fire spread risk reduction. Especially, it is quite interesting that such a basic tendency can be explained as not only an altruistic motive but also a selfish motive. Furthermore, I made some contents in order to promote such a motivation, and verified its usefulness. In this sense, practical use of this strategy is expected in the future.

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# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND

Although training activity is by far the most important thing in strengthening the community in disaster prevention, the relationship and cooperation between local government and residents should not be overlooked. Lack of relationship between each party can lead to the unsuccessful preparation for disaster prevention.

I wanted to investigate the relationship between local government and residents in disaster prevention activity problems and to improve the abilities and relationship between local government and residents in the disaster preparedness mitigation. I could define the disaster prevention activity by two parts. There are governmental officers and non-governmental officers who means that volunteers and residents. There are many regions that official disaster fighting ability is not enough in the world and I would evaluate the balance on the relationship of government and residents.

First of all, the balance situation between government officers and non-government officers have been a good relationship. I would think about disaster prevention system in the world. For example, fire fighter, volunteer and people know how to cooperate and manage in case of disaster situation in developed countries. Secondary, it called unbalance system. There have lacking of non-official abilities to prevent their own communities. Because government has enough abilities to protect their residents, they can take care of their people for everything. On the other hand, most residents feel happy and safe but residents will not recognize to help themselves. They always think that the government has to help them as a duty. For example, some residents did not evacuate because they did wait for announcement

from the government. Therefore, the costs of damage in properties and lives were higher than we expected.

Finally, there have lacking of official ability. It happened on disaster situation cases in some developed countries in the past. The government did not have enough effective means to take care of people when disaster occurred. Residents had to help themselves. However, this situation is happening in some developing countries. Therefore, I had considered on investigating disaster situation cases because I can guess that in the past, within developing countries, there are many problems happened as same as in developed countries. Nevertheless, I have figured out the relationship between local government and residents in disaster prevention activity problems with the key point of solution in this project.

## **1.2 OBJECTIVE TO STUDY**

Generally, in order to improve a regional safety for disasters and accidents, indispensable strategies are not only a reinforcement of the governmental ability, but also a strengthening of the cooperative relationship between government and non-government that means volunteers, residents and so on. Needless to say, for practical purposes, the effective strategy should be different depending on the actual situation in the subject area. As a matter of course, there is no guarantee that some strategies or countermeasures based on the common-sense values of one subject area will be of universal application for all other regions. In other words, community based disaster prevention is one of the effective ways to build the cooperative relationship between government and non-government for disaster prevention activity.

Accordingly, it seems that the process to make clear about what the fundamental problems are in the subject area is essential for examination of such solutions as above. For

example, if I tried to overview the recent Japanese situation for fire fighting from the above point of view, it may be said that there is a highly-developed fire fighting system which can extinguish a fire immediately except for a large number of simultaneous fires in a huge earthquake. It considered that there is an effect of a smooth cooperative relationship between governmental and non-governmental fire fighting. In the Japanese system, it is worth specially mentioning that the voluntary fire fighting plays a part in the official fire fighting on a legal basis. On the other hand, it is unusual for most developing countries to have such a highly developed fire fighting system. Therefore, an improvement of the regional fire fighting validity ought to be one of the most crucial topics today. However, it ought to be true that it is impossible to reinforce immediately the governmental infrastructures. Therefore, it ought to be important for such most developing countries to make full use of the community resources such as regional volunteers or residents activities.

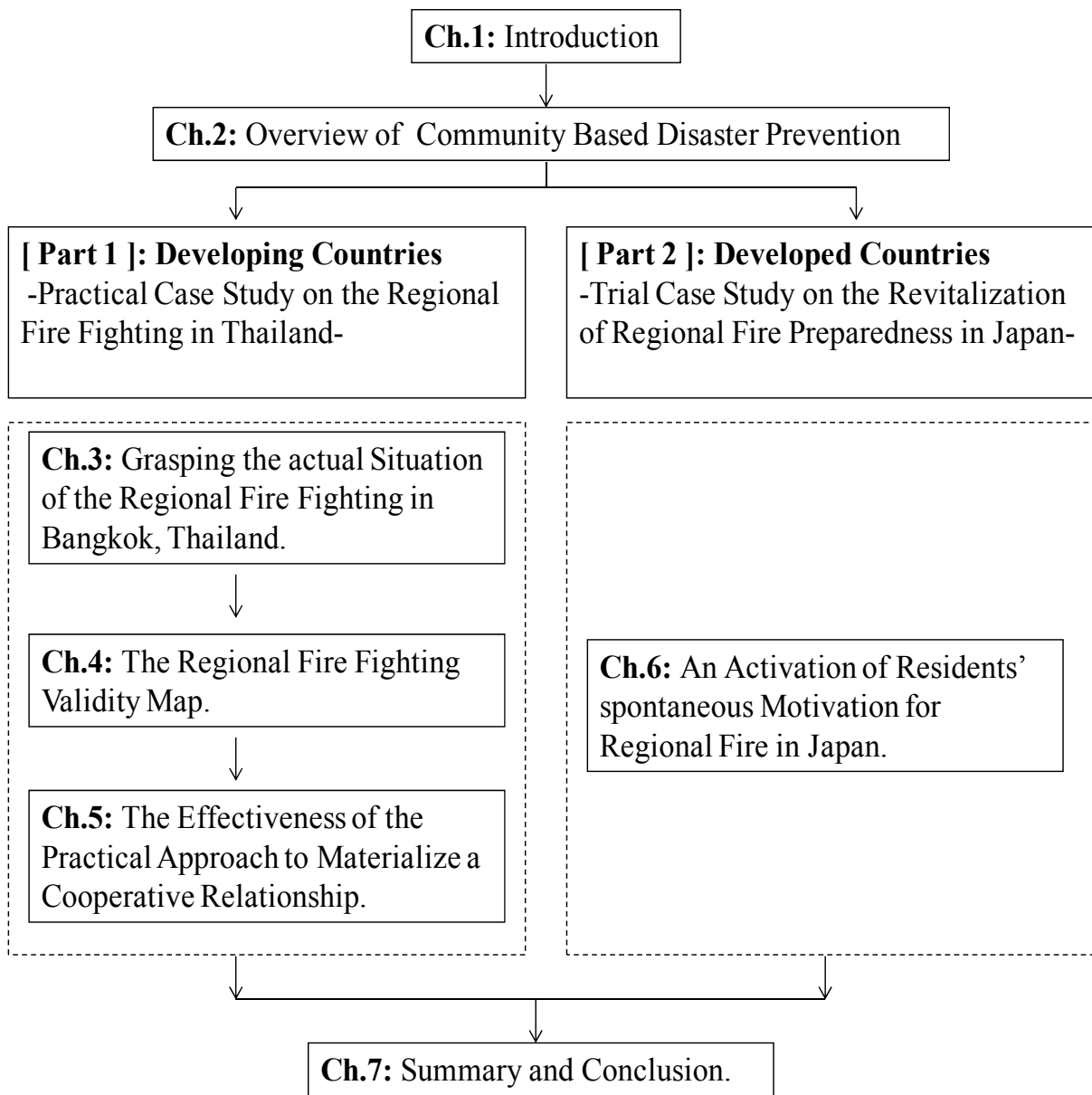
Of course, even in Japan, it is not that there are no problems at all. It is clear that a weakness of a community leads to an undesirable situation not only in fire protection, but also in every aspect. However, it has been long since they said residents (especially in urban area) had a tendency to depend hardly on the above highly-developed fire fighting system, and the reinvigoration of the regional disaster prevention abilities had become a current problem to be solved.

According to the above, it is clear that the countermeasures to be done in a moment should be different depending on the actual situation in each area. In addition, it is also clearly that the process to make clear about what the fundamental problems are in the subject area is essential. Therefore, in this study, focusing on a fire fighting as an examination case, I would consider the differences on the fundamental problems and effective countermeasure between developing countries and developed countries. I would take the case of Thailand as a developing country, and also take the case of Japan as a developed country.

### 1.3 OUTLINE OF STUDY

This research concluded with seven chapters (cf. **Fig. 1.1**). However, I divided the content into two parts after the Overview in chapter 2, which reviewed the results of previous research paper in community based disaster prevention. After that, I would start with part 1 described about the developing countries (Practical case study on the regional fire fighting in Thailand) which composed of chapter 3 to chapter 5. Chapter 3 presented grasping the actual situation of the regional fire fighting in Bangkok, Thailand. Moreover, chapter 4 presented the regional fire fighting validity map to make a regional fire fighting validity map and simulation in order to improve some regional fire fighting validity, indispensable strategies are not only a reinforcement of the governmental fire fighting ability, but also a strengthening of the cooperative relationship between governmental and non-governmental fire fighting ability. Additionally, chapter 5 presented the effectiveness of the practical approach to materialize a cooperative relationship to do workshop between governmental and non-governmental fire fighting. Based on the result of questionnaire in the past, was into practice in the light of the facts, to verify the effect of this practical approach on an establishment of a cooperative relationship between the voluntary fire fighter and the governmental fire fighter in Bangkok. After completed with part 1, I would move forward to part 2, which explaining the developed countries in chapter 6, which is a trial case study on the revitalization of regional fire preparedness in Japan. However, this section would present the activation of resident's spontaneous motivation for regional fire in Japan to comparable with part 1. Finally, chapter 7 summarizes the thesis and the conclusions of this study.





**Fig 1.1 Outline of Study**

## **CHAPTER 2**

### **OVERVIEW OF COMMUNITY BASED DISASTER PREVENTION**

According to outline this research studies, community based disaster prevention is the strengthening of the valuable strategy to cooperative relationship between government and non-government to achieve better outcomes in disaster prevention. In this chapter, I would introduce three parts. First part was of the role of disaster prevention. Second part, the general disaster prevention was basic of disaster risk communication and communities. After detailed description of these two parts, disaster fire prevention would present in this chapter research to point out the community based disaster prevention in fire situation.

#### **2.1 THE ROLE OF DISASTER PREVENTION**

Community based disaster prevention is the significance to prevent the natural disasters in the globalization. Natural disasters could occur not only in developed countries but also in developing countries as well. Therefore, disaster prevention is the role of importance of the mutual aid in times of crisis. I would introduce the role of disaster prevention for three parts. First part, disaster prevention in globalization had proposed to understand what disaster effected this world. The next content would present developed countries in disaster prevention. On the third content developing countries in disaster prevention would be offered. After finished the role of disaster prevention, I would move forward to understanding the basic of disaster risk communication in the next step.

### **2.1.1 Disaster Prevention in Globalization**

As I had mentioned in previous, natural disasters would happen not only in developed countries but also in developing countries. Recently, there are many regions affected from natural disasters, for example, storms, earthquakes, floods and many hazards. These disasters destroy about 296,818 in 2011. However, the human life impacts by disaster types during 2000 and 2009, were 78,087 deaths in an annual average. Recently, the high percentage of people killed by natural disasters that effected America region was about 75.93 % in 2010. The annual average of high percentage of people killed by natural disasters by region between 2000 and 2009, was Asia region about 84.55 % (CRED, 2010). Therefore, the damage caused by disasters has been rising in the last two decades (EM-DAT, 2010). Most floods and storms occurred as usual in all regions but earthquakes caused the deadliest disasters in the past decade. About 60 percent of the dead victims were caused by earthquake (UNISDR, 2010). However, floods and tropical typhoons are the result of the climate change which can lead to the increasing in damages in the Future. The rises of global temperature and sea level average will affect and increase the risk of inundation by floodwaters in the cities' delta areas (IPCC, 2007). Moreover, natural disasters are also the majority of economics losses in developed countries and the impact of disasters in developing countries in terms of live and livelihoods (Malloch, 2004). Therefore, primary aim of disaster prevention management is to strengthen the society such as residents, livelihoods, governmental administration, and natural environment. To establish disaster prevention, all stakeholders need to work together and be aware of their respective roles and responsibilities (DRR, 2008). According to this report, most countries did not concern about this notification report as well as in the developing countries because those governments always have conflicts with economical problem and lack of structural countermeasures to protect natural disasters. On the other hand, developed countries have prepared structural countermeasures

against raising various kind of disaster but still some problems have occurred with non-structural countermeasures to understand actual saving life (Katada et al, 2011). I would propose developed countries on disaster prevention afterwards.

### **2.1.2 Developed Countries in Disaster Prevention**

Unless developed countries have prepared structural countermeasures against raising vary disaster in present. There were several tremendous disasters attacking Japan in the past, Isewan typhoon killed nearly 6,000 Japanese people in 1959 and The Great Hanshin (Kobe) Earthquake caused 6,400 victims died. As a result, there were 40,000 died in natural disasters during the 15- year period between 1945 and 1959. On the other hand, the fatal human were 5,000 died during the 35- year period between 1960 and 1994 before The Great Hanshin Earthquake occurred. Japanese government had been successful to reduce the disaster damage reduction after the World War II. Japanese government has converted the policy disaster prevention by focusing in the disaster countermeasures basic and various disaster management related laws (Cabinet, 2005) and using software strategy for developed disaster activities such as evacuation planning, flooding hazard map (MLIT, 2003). Flood hazard maps have been an essential in aiming to help local people and aware of the vulnerability with their own regions. Therefore, Japanese will act the role of disaster prevention activities to evacuate with becoming inundation area. The characteristics of inundation risk in the causal structure has four categories 1) Hazard caused by flood characteristics. 2) Exposure imply to environmental resources such as society 3) Damage is loss not only properties but also human life and social resilience 4) Effective disaster recovery (Sato, 2006). According to disaster prevention policy changing, Japanese government has determined the disaster reduction targets to reduce numbers of deaths with disasters to less than 100 died, which to “Zero risk level “in a long term (Cabinet, 2005). However, achieve zero risk result become to

ascertain for residents. But there is a low expectation for risk zero with natural disasters (Nakayachi, 2002). According to the soft countermeasures, several researchers have been launched these strategies since a past decade. For example, Professor Toshitaka Katada provided evacuation behaviors of frail elderly and the aged in river flood disaster (Katada et al, 2002) solution. Weakness of evacuation activities such as the elderly and aged have pointed out with action plan in flooding situation. Disaster risk governance strategies proposed and developed with a cooperative between technology and social network (Nagasaka, 2008). Moreover, the collaboration between multi-agents based evacuation simulation system was used the crossroad game to rescue activities with the residents in Nagata Ward, Kobe (Okada et al, 2007). Therefore, many strategies come out to prevent the disaster in developed countries but a weakness of a community lead to unpleasant in disaster prevention activity. It is necessary to encourage residents to improve and cooperate to reach the high possibility of saving life. On the other hand, developing countries also have problem in disaster prevention. Nevertheless, I would present this content in the latter.

### **2.1.3 Developing Countries in Disaster Prevention**

Developing countries are the most affected by Natural disasters in the world. The costs of damage always occur with life and livelihoods. Recently as a decade ago, people in developing countries are extraordinarily vulnerable to natural disasters because most of developing countries live in vulnerable regions. Not only high-risk area but also the vulnerability of social communities, particularly poor countries are in Asia and Africa (Info resources, 2009). Most of developing countries have lacked structural countermeasures and assistance of governmental abilities. For example, some provinces in northern and central of Thailand had been inundation because of monsoons in this seasonal heavy rain. The flooding problems were not only enough structural countermeasures in flood disasters but also causing

by human failures (Thammasarod, 2011). There have happened still many problems in developing countries. Even though, main problems are concerned with natural disaster. Meanwhile, the cooperative of human resources in developing countries to control the disaster, are still complicated problems. Nonetheless, Not only natural disaster problems should control, but also complicated problems with human communication, should concern to make clearly communicate with communities without human problems. These cases have most often occurred during natural disasters in developing countries. One of human problems have mentioned above. It was basic of disaster risk communication and communities in the next content. I would propose it following this.

## **2.2 BASIC OF DISASTER RISK COMMUNICATION AND COMMUNITIES**

After the role of disaster prevention was described in previous content, I would like to present basic of disaster risk communication and communities in this content. There were composed of three contents. First content, I would propose the perceptive of effective risk communication. After that, I would explore that risk communication and communities in disaster prevention. The latter in this content would present the role of risk communication and communities in governmental and non-governmental. After completed this section, I would like to introduce a disaster fire prevention that pointed out the community based on disaster prevention in fire situation.

### **2.2.1 Effective Risk Communication**

Since I have mentioned that not only natural disasters occur, but also the effective risk communication is still the problem to be concern in communities in disaster prevention. However, risk also could define as the possibility of the natural impact would happen and influence to citizens (Groth, 1991). There have two meaning also defined of risk communication (National Research Council, 1983). The first is that an interactive process of exchange of information and opinion among individuals, groups, and organizations. The second is that discussion about risk types and level about methods for managing risks. Therefore, risk communication was a direct way of communication for understanding with the public. The role of communication provided by acquaintance's communicator between senders and receivers. The risk communication would have the translation, elucidation and simplification with communicators. However, the model of risk communication had changed to be two way processing as interactive between public and communicators (Bradbury, 1994). The model of risk communications have been developed to a new approach to residents with new technical terms, for example, knowledge, listening, implementing, training, practical, evaluation with each skills to the public (Douglas, 1986&Slovic, 1987). Therefore, the risk communicators were not only the transmitter but also receiver in the present (Meeker, 1991). Because risk communications strategies must be focus to understand how the public concern, apperceive and respond to sensation, notion, affection with people. Particularly, disasters risk information that was perceptive and influence towards behavioral change with making decision sense to public .For instance, the risk information and communication must be the technological risk communication in hazard risk information (Covello, 1988). Many residents always concern the natural and the technological risk to affect population, and control the risk (Sandman, 1987). However, the language of information and communication should also provide with social trust because social trust was socially based with a rational basis (Earle &

George, 1995). One of social trust strategies proposed to communicate to people in this research, was “hope”. Nonetheless, effective risk communication in community is the one of strategies to control and prevent the disaster situation although human cannot stop natural disaster. Therefore, residents should understand risk communication and communities in disaster prevention. Then I would propose it in the next content.

### **2.2.2 Risk Communication and Communities in Disaster Prevention**

After residents understand the effective risk communication, they also need to know how to communicate with their communities in disaster prevention. Communications are variety of way to impart with communities. Afterward, risk communications has been the essential strategies in disaster risk preparedness. There were many risk communications way to communicate in disaster to communities because risk communication can directly aware of social vulnerability in disaster preparedness. The local communities have to play a role of ability to prevent disasters. On the other hand, the individuality of flood disaster in Japan can cause an economic loss but the fatal human is reducing. Because the structural countermeasures can protect the residents and some people may ignore of preparedness disaster .People always believe after the greater flood disaster happen, it will not occur near future (Motoyoshi, 2006). This situation has supported in natural disaster research that residents have trouble to comprehend with natural disaster risks (Slovic et al, 1974). Even though, tsunami recently attacked some northern part of Japan on March 11, 2011. There were enormous of the number of human casualties in many prefectures. However, a small coastal town in Iwate Prefecture, Almost all the elementary and junior high school children of Kamaishi survive the tsunami. It was not a miracle but it was disaster education by using risk communication in disaster preparedness. Professor Toshitaka Katada inculcates a culture of disaster awareness by including knowledge and practice. This project proposes to make the



knowledge your own through actual practice and do not believe too much faith in hazard maps. The decision making of situation based on the latest scientific knowledge through your viewpoints (Katada et al, 2005). Therefore, risk communications for disaster preparedness have been a part of disaster education to communicate the fact and the technological disaster for survival citizens. Moreover, the multicultural societies and differential cultures are being raised disaster risk communication to be complex perception (Clerveaux et al, 2007). The models of disaster communication tools provided to communicate a simple way to access with disaster education. The Tsunami Scenario Simulation Model (TSSM) and the Disaster Awareness Game (DAG) proposed as strategies for effective communication of disaster information and risk reduction in the Caribbean region (Clerveaux et al, 2008). On the other hand, there have been report that cause of Kindergarten through high school fire increase between 2003 and 2005 in US. The causes for school structure fires were suspicious (32%), cooking (29%), and heating (9%) because most children were not reliable a risk of fire (NFIRS, 2007). Moreover, they lack of instructor to give a lesson to know the source of ignition. For this problem, it would concern with risk communication for disaster preparedness lacking between instructors and children in School. Generally, children behaviors always intend to play with dangerous things following their ages. Additional, in case of fire, most people ignore fire alarms when a fire occurs. However, the basic problems were that people failed to respond and delay to respond the fire alarm signal (Proulx, 1999). Therefore, having improved the fire alarm signal warning, occupant response, increased the voice communication messages, staff-warden instruction, training, fire drill and a well-fire safety plan (Proulx, 2000), are necessities of changing human behavior in fire. On the other hand, there had been recently the questionnaire survey to search the students who studied in a classroom in Gunma University, would evacuate or not when caught the fire alarm signal. The most of percentage are that the student would evacuate immediately because of needing

information and shying to be crowd person on their friends. Even though, human being was the importance of role in risk communication in this case but I would support that resident should be own responsibilities to risk events. According to content above, it was risk communication and communities in disaster prevention. On the other hand, the role of risk communication and communities in governmental and non-governmental was considerable as basic of disaster risk communication and communities in next content.

### **2.2.3 The Role of Risk Communication and Communities in Government and**

#### **Non-government**

This content proposed how to importance of the role of risk communication and communities in governmental and non-governmental disaster risk field. Communication message could transmit from government and non-government to citizens. Other words, it was normally accepted that the national government with shared responsibility with, was the main responsibilities for managing disasters (Andjelkovic, 2001). One of the roles of government ought to communicate with local residents. Since early times, the risk communication with communities in governmental role was an important because risk communication became an essential evaluating what the public wanted. It was certain to be a risk communication with a good solution. Not only the information but also the solution as well (Frederick, 1987). Risk communication had issued and become importance of part the governmental policy process because a variety of different information could make a different way to do for people (Kunreuther, 2003). In the recently decades, government has an original data on risks. However, credible sources of risk information have decreased by causing of influenced by stakeholder, biased information, bureaucratic role, lied, presented half-truths, mismanaged disaster activities, and incapable knowledge. Moreover, official

government and experts always have conflicted when they issued the important risk information to public (Covello et al., 1998). For example, it was important to present the public in hazard risk information by a scientist or a group of experts (James, 1987). Therefore, government needs to share and participate with communities. However, opening risk information such as flooding hazard map is unhelpful to landowners who have properties priceless declined. Nowadays, Japanese can easily gather risk information via various media, for example, web site, telephone, and television. On the hand, sometimes many widely information can make people to take over action as well (Seo, 2006). The role of risk communication and communities in government and non-government should be value partners to support the public actions, messaging information, and controlling rumor which always located around a crisis event. However, in case of negotiating public controversies, a neutral party was an importance of role to speak for the group to develop and reliable channels of communication directly to community such as a face-to-face meeting (Reynolds, 2002). Successful in disaster prevention between government and residents, one of the key role is the risk communication to public or stakeholders. The public should be concerned on the implementation of disaster emergency plan and the public disaster education for emergency respondents. The communication tool, media, strategy, and audience should consider in the development of the communications strategy for all disaster preventions (United Nations Environment Programme, 2008). According to mention above, the role of risk communication with community is sensational action. Therefore, the stakeholders who willing to be the effective ways of successful risk communication should be faithfully reliable information and understandably transmit communication to rely on residents especially in all disaster event situations. However, one of severe disaster event situation that it was concerned with this cooperative relationship between government and non-government for

disaster prevention in this study was disaster fire prevention. Therefore, I would like to present disaster fire prevention the latter.

## **2.3 DISASTER FIRE PREVENTION**

As I mentioned above that one of severe disaster event situation that it was concerned with this cooperative relationship between governmental and non-governmental disaster prevention in this study, was disaster fire prevention. Therefore, I would like to describe four parts of disaster fire prevention in this content. First part, I would introduce the function of fire prevention. After that, Fundamental of fire would follow the latter. On the third part, I would like to investigate the human behavior in fires. Eventually, Fire prevention and management became the last part on disaster fire prevention in this content. After completed all contents, were composed of the role of disaster prevention, basic of disaster risk communication, and disaster fire prevention. I would end up with summary for this chapter 2.

### **2.3.1 The Function of Fire Prevention**

As I mentioned on the role of disaster prevention part. One of severe disaster in the world besides Earthquake, Typhoon, and Flooding, Fire is the disaster can cause many properties and life as well. There were described the function of fire prevention which related with human being in this content. As known, Fire has been a part of human life and consciousness. Human race has benefited on fire for warmth, light, cooking food and energy of our daily lives but humankind seldom relied to prevent a danger on fire. Recently, notification many products produced in a modern society, Unmanageable fire can damage our life and properties, and this relates to effective the social value. Therefore, intention to fire

prevention is essential of living in a modern society (Quintiere, 2006). Human should understand fundamentals of fire phenomena to avoid a danger of them. Moreover, Fire prevention such as fire drill, fire training, fire extinguishing, and performance of fire safety skills, like rolling and crawling to the door, require both mental and motor activity, need to learn for protecting properties and lives (Holme & Jone, 1996). Recently, some researchers tried to make a simulation model for occupant movement in the evacuation route. They wanted to understand the relation between space and human behavior in the office building, for example, the time for escape, time for waiting, and intersecting of Human behavior movement (Okazaki & Matsushita, 2004). Therefore, the function of fire prevention is a part of essential to understand the fire related with live and livelihoods in daily life. Therefore, I would like to propose fundamental of fire in the next content that residents should understand a natural of fire or fundamental of fire.

### **2.3.2 Fundamental of Fire**

In this content, I would propose a fundamental of fire that resident understand clearly, what a fire is. First, fire prevention can be achieve stage in initial of ignite. Resident should understand a natural of fire. The Fire is the phenomenon of combustion which the elements of the fire triangle consists of 1) fuel combining with 2) oxygen in a chemical reaction to release 3) energy and other chemical product (Quintiere, 1997). Therefore, three essentials are needed to continue the combustion to become the fire. However, fifteen per cent of oxygen cannot be enough to ignite the fire. On the other hand, when oxygen reaches to twenty-one per cent to become the ignition temperature, they can be started to ignite the fire. According to the fire principle, one is of three elements in the nature of fire, lacked to combine in each processing. The fire will not ignite if each source is eliminated. Nevertheless, the target to control the oxidation for the fire extinguishing classify by 1) removal of the fuel, 2) reducing

the oxygen supply, 3) cooling the temperature from the fuel, 4) separating the chain reaction of the oxidation (Cote & Bugbee, 1988). Generally, to control the combustions, the water is mainly of the fire extinguishing because the water has a high vaporization heat, 2260 kJ/kg, large quantities, and low price as water. Moreover, water is still easy to transport and use to the fire (Särdqvist, 2002). In – depth study, the water has the effective to cool the fuel, easy to find and low cost. For the reason, the water is appropriate to use as a tool with fire extinguishing for this research. Even though, more knowledge in natural of fire and using water to extinguish a fire is essential, but in fact residents still do not recognize how human act and response in Fire situation. This cause will affect to human decision making during a fire. Therefore, the next content, I tried to propose the Human behavior in fires to recognize residents.

### **2.3.3 Human Behavior in Fires**

As I mentioned above, residents still do not recognize how human act and response in Fire situation in case of Fire. For this reason, I would like to propose human behavior in fires in this content. As known, there are many human behavior occur during a fire. At the beginning, Occupants first became aware that something unusual was happening. Some researchers have recognized that people will always show the behavior in Stressful situation of their age, sex, past experience, training or cultural background (Proulx, 2002). While human being, as information gathering access, with circumstance during in fire emergencies, time pressure and stress created a physical warning of fire (Ozel, 2001). People become acting and aware of the fire in the stressful circumstance. Human response not only physical but also mental changed to emergency. However, the Human panic behavior has been caused of delay to response during emergencies (Sime, 1980). Decision-making during an emergency is very important to survival their lives. Therefore, many researchers have tried to improve an early warning and give more information to the occupants (Donald & Canter,

1990). Because some occupants may lack of reaction to recognize the Fire alarm signal which misunderstand the sound from a burglar alarm or a security door alarm (Tong & Canter, 1985). In addition, the information can be provided in early stage of a Fire development in their location and give more accurate reports of people (Fahy et al., 2009). According to research studied in England and the United States on Table 2.1 , Respondents were first asked to identify the behavior in fire , found that people were evacuation of the building , fight or control the fire, alert other individuals, alert the fire department. Moreover, this research studies also showed on Table 2.2 that the human behavior in Fire between Male and Female. Most male fought fire and Female concerned about alerting to people. (Flannery, 2001). Therefore, Human behavior in fire is one of importance role to response to avoid the fatal life for occupants. However, residents should learn how to survive in case of emergencies fire or against the initial fire on the early state. In contrast, the Fire Prevention is also concerned to daily life. The habitation should be prevented for a fire not only firefighter duty but also all occupants should be aware of this responsibility.

**Table 2.1 Comparison the Human Behavior in Fire between U.K. and U.S.**

BEHAVIOR	U.K. (%)	U.S. (%)
Evacuation	54.5	80.0
Re-entry	43.0	27.9
Firefighting	14.7	22.9
Moved through Smoke	60.0	62.7
Turned Back	26.0	18.3
Total U.K. and U.S.	2,193	584

**Table 2.2 First Actions of Occupants Relative to Sex of Occupant.**

First Action	Male (%)	Female (%)
Notified others	16.3	13.8
Searched for Fire	14.9	6.3
Call Fire Department	6.1	11.4
Got Dressed	5.8	10.1
Left Building	4.2	10.4
Got family	3.4	11.0
Fought Fire	5.8	3.8
Got Extinguisher	6.9	2.8
Left Area	4.6	4.1
Woke Up	3.8	2.5
Nothing	2.7	2.8
Had Others Call Fire Department	3.4	1.3
Got Personal Property	1.5	2.5
Went to Fire Area	1.9	2.2
Removed Fuel	1.1	2.2
Entered Building	2.3	0.09
Tried to Exit	1.5	1.6
Went to Fire Alarm	1.1	.19
Telephoned Others	0.8	1.6
Tried to Extinguish	1.9	0.6
Closed Door to Fire Area	0.8	1.3
Pulled Fire Alarm	1.1	0.6
Turned Off Appliances	0.8	0.9



Checked on Pets	0.8	0.9
Other	6.5	2.5
Total respondents	262	318

### 2.3.4 Fire Prevention and Management

Generally, the Fire Prevention is not only firefighter duty but also all residents should take responsibility to aware communities. Because Fire can spread and expand to neighbor, keep watching and be concerning each other are need to protect the scale up of boundaries. Therefore, fire prevention activities were able to propose in this content. Beginning, the concept of fire prevention is controlling the heat source and combustible materials in a location because each space is different conditions. Therefore, the planning of fire prevention is essential to protect the properties for example, taking care of heat source, combustible materials, having a floor plan with fire extinguishers' location, fire extinguishers and fire drill planning in living accommodation. However, residents have been crucially affecting with uncontrollable by fire situation in case of a combustible Fire. Fire Department will be able to in charge of the responsibility to protect life and property. The operational fire prevention not only fire fighting but including such as Consultation, Pre-fire plans, Public fire and life safety education, Records and reports, and Fire investigation (Rausch & Carter, 1999). These tasks can effectively support and improve for fighting fire. Therefore, Fire Department must have the best equipments, techniques, and training. Fire management and preparedness are the importance of with most fire departments (ESRI, 2007). However, the locations of fire department in their areas are essential to provide the effective respondent. Time is the factor for rescue to minimize loss for life and property. NFPA 1710, has been defined the time objectives for dispatch time in Fire Department such as one minute for turnout time, four

minutes or less for driving to the emergency scene and eight minutes or less to arrive on the scene (NFPA,2004). Moreover, four minutes is for the medical first responder (NFPA, 1997). According to the mention above, this research tried to examine the project with considerable these concepts by making GIS data and Fire simulation such as a computational model for urban fire spread and fire control even some researchers simulated fire spread to predict the individual building fire (Himoto & Tanaka, 2008). However, a variety of condition in a simulation model already concerned with location, wind influence, and human behavior as fire prevention and management. On the other hand, fire prevention and management part are one section of a strategy in disaster fire prevention. Unless fire prevention and management were successful, lacking of cooperation among stakeholders would be able to fulfill the community based disaster prevention in this chapter.

## **2.4 SUMMARY**

The overviews in the above sections make clear that the effective and appropriate countermeasure to improve the regional disaster prevention validity will be varied depending on the actual situation of the subject area. Especially, there is no doubt about the differences of the fundamental problems to be solved between developing countries and developed countries. Even if I mentioned only fire fighting, it goes without saying that there has to be a peculiar countermeasure for each subject area.

In developing countries, it may be said that making full use of the community resources such as regional volunteers or residents activities ought to become a key to improve the regional fire fighting validity in developing countries. For example, AUDMP and ADPC reported a situation in Laos (AUDMP & ADPC, 2003). This is also interesting report on a community-based fire risk assessment under the condition that there are not even any

organized voluntary fires fighting at all. It seems that Bangkok, our subject area, is intermediate between the case of Japan and the case of Laos in the matter of a fire fighting system, because there are both the governmental fire fighting and the organized voluntary fire fighting in Bangkok. However, the voluntary fire fighting groups in Bangkok is not placed as a part of the official fire fighting on a legal basis. In the past, indeed, there were some researches (Khunteetao, 2007) about voluntary activities in Thailand, but it is difficult to find other studies about solutions for the improvement of the regional fire fighting validity, especially, studies focusing on the relationship between official and voluntary fire fighting. Therefore, in this study, mentioning an establishment of a cooperative relationship between governmental and the non-governmental for regional fire fighting in Thailand, I would like to consider and propose an effective and sustainable solution to solve the above developing countries' problems. This consideration will be held in the following section [PART 1].

On the other hand, in developed countries, a reinvigoration of a community ought to become a key to improve the regional fire fighting validity much more at least in Japan. Some studies have already pointed out the above key point (Himoto & Tanaka, 2008). However, it seems that these studies did no more that point out this key point, and did not succeed practically in reinvigoration of a community. Therefore, in this study, mentioning a reinvigoration of a community, I would like to consider and propose an effective, sustainable and unstrained solution to solve the above-developed countries' problems. This consideration will be held in the following section [PART 1].

According to the above conclusions, the effective solutions for developing countries and developed countries seem to be very different. However, if it was possible to discuss and establish more comprehensive, common and fundamental strategy to solve the various problems, its strategy ought to be helpful and valuable for each area and each kind of disaster. Such a discussion tried in chapter 7 as a conclusion of this dissertation.

## **[PART 1]**

### **DEVELOPING COUNTRIES**

#### **- Practical Case Study on the Regional Fire Fighting in Thailand -**

This [Part 1] concluded with three chapters in a part of developing countries. The content composed of Chapter 3 to Chapter 5. In Chapter 3 presented Grasping the actual situation of the regional fire fighting in Bangkok, Thailand. Moreover, Chapter 4 presented The regional fire fighting validity map to make a regional fire fighting validity map and simulation in order to improve some regional fire fighting validity, indispensable strategies are not only a reinforcement the governmental fire fighting ability, but also a strengthening of the cooperative relationship between governmental and non-governmental fire fighting ability. Additionally, on chapter 5 presented the effectiveness of the practical approach to materialize a cooperative relationship between governmental and non-governmental fire fighting, based on the result of questionnaire in the past, into practice in the light of the facts, and to verify the effect of this practical approach on an establishment of a cooperative relations between the voluntary fire fighter and the governmental fire fighter in Bangkok. After completed with [Part 1], [Part 2] would describe in a part of developed countries to compare with developing countries in [Part 1].

## **CHAPTER 3**

### **GRASPING THE ACTUAL SITUATION OF THE REGIONAL FIRE FIGHTING IN BANGKOK, THAILAND**

In this chapter, I would like to grasp the actual state and background of the problems that need to be solved for the improvement of the regional fire fighting validity in Bangkok, Thailand, and examine the appropriate solution focusing on the relationship between official and voluntary fire fighting.

#### **3.1 BACKGROUND OF THE FIRE FIGHTING IN BANGKOK**

At the beginning of [part 1], I would like to mention the background of the fire fighting system in Bangkok, mainly based on some information obtained from the interviews with the Bangkok Fire and Rescue Department and the relevant.

##### **3.1.1 Basic information of fire fighting in Bangkok, Thailand**

Historically, Fire protection in Bangkok area was the duty of the Thai police, but on November 1, 2003, there was the transfer of fire protection in Bangkok area to be one of responsibilities of Bangkok Metropolitan Administration (BMA). During the past 5 years, Bangkok Metropolitan Administration recruited the fire fighters of which 70% are the new officers while some volunteers are more experienced in fighting fires. As a consequence, the joint operations were not successful as hoped. Moreover, the imbalance between government officials and volunteers occurred.

Recently, the Thai government plans to make Master Plan for International Fire Safety Development in Thailand. The objectives of the plan are reducing the ratio of fires, developing a management system to be efficient for scalable, and developing the efficient network of information storage. The plan focuses on reducing the numbers of fires and reduces casualties. It also requires staff to reach the fire scene within eight minutes.

### **3.1.2 Outline of the interviews**

The interview with 15 executives of the Bangkok Fire and Rescue Department was carried out in January 2010. The summary of the process for this interview is shown below.

At an early stage before some interviews, as one of the authors comes from Bangkok, we could have a rough impression of the state of fire fighting system in Bangkok that are discussed in the following paragraphs. However, thorough some interviews with some acquaintances in various circles who lived in Bangkok including general public and fire fighters, we could recognized that such impression was not simply our personal consideration but was an almost common knowledge. Additionally, we also get the impression that practical and effective solutions for the improvement of the regional fire fighting validity were not found out yet at the actual location. After such preliminary investigations, thorough the good officers of the fire fighters who sympathized with our opinion, we could get an opportunity to have an above-mentioned meeting in January 2010.

The information obtained from these interviews is described in the paragraphs that follow.

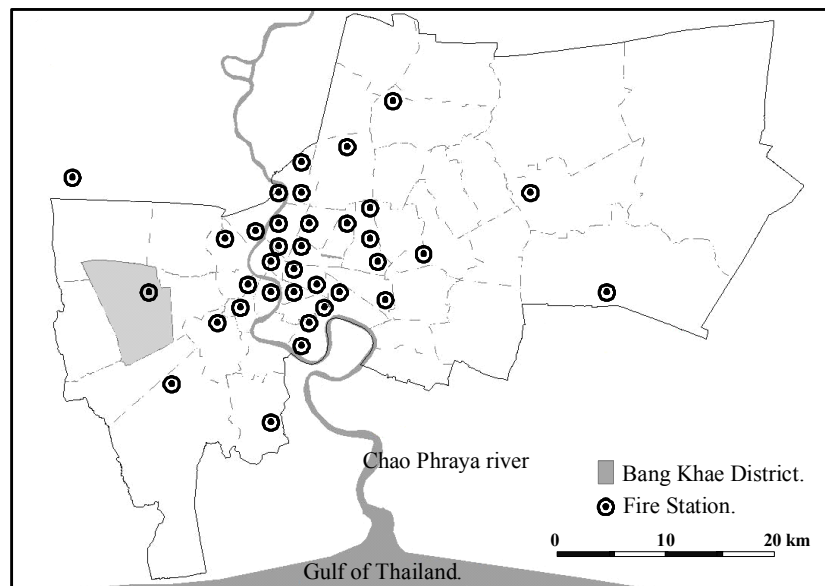
### **3.1.3 Background of a delay of governmental fire fighting**

It can be considered that the most fundamental problem is a fatal delay for governmental fire fighting to arrive at the fire scene. Consequently, at present, enough

**Table 3.1 Information of Tokyo and Bangkok Official Fire Stations**

		Tokyo	Bangkok
Area (km <sup>2</sup> )		1,750	1,568
Population (thousands)		12,989	5,702
Fire Stations	The number of fire stations	387	46
	(government)	289	35 (main), 11 (sub*)
	(voluntary)	98	-unidentified-
	allocation		
	Area (km <sup>2</sup> /station)	4.522	34.087
	Population (thousands of people /stations)	33.563	123.957
	The number of fire officers	44,445	1,500
	(government)	17,967	1,500
(voluntary)	26,478	-unidentified-	
allocation			
Area (km <sup>2</sup> /officer)	0.039	1.045	
Population (thousands of people /officers)	0.292	3.801	

\*note: sub stations just only like a parking on the streets without full-time officers



**Fig. 3.1 Distribution of official fire stations in Bangkok**

spraying water by governmental fire fighting cannot be in anticipation.

The fundamental solution is to establish more fire stations. However, it is difficult to realize the solution in a short period for the reason that the procurement of a revenue source and a building lot are difficult. Therefore, in fact, it is considered that the improvement of its potential abilities is badly needed.

**Table 3.1** shows the basic information of Tokyo and Bangkok fire stations, and **Fig. 3.1** shows the distribution of fire stations in Bangkok. As seen from **Table 3.1** and **Fig. 3.1**,



Fig. 3.2 Traffic congestion in arterial roads



Fig. 3.4 The fire hydrant is hidden under a stall



Fig. 3.3 Many vehicles always park their cars on the local streets



Fig. 3.5 Governmental fire fighters

compared with similar areas in both regions, the number of official fire stations in Bangkok is much fewer than that of in Tokyo. As for Bangkok official fire fighting, as a result of a small number of the official fire stations and the long distance from fire stations to the sites of fire, it becomes more difficult for the fire fighter to be well aware of the regional road networks in every corner. Actually, the government fire-trucks, which are turning back or losing way, can frequently be seen. From the actual situation above, as a logical consequence, the time required from the official fire stations to the scenes of fire extends. To make matters worse, the confirmed traffic congestion in arterial roads (Fig. 3.2) and the parking on the local streets (Fig. 3.3) also mean delay of the government fire-trucks arrival to the site of fire.

Additionally, the following matters often lead to the delay of starting time for spraying water when the fire fighters arrive at the site of fire. For example, frequently, it is difficult for



fire fighters to find any fire hydrants for the reason that the stalls items sometimes cover and hide the fire hydrant (**Fig. 3.4**). Moreover, the lack of governmental fire officers' knowledge also leads to delay. With a background of the lack of knowledge, we have to point out that there was a major reorganization which moved the duty of fire protection from the police authority to the Bangkok Metropolitan Administration (BMA) in November 1, 2003. For that reason, the new fire fighters whose knowledge and experiences are not enough account for almost 70 percent of all current governmental fire fighters (BMA).

With these states as background, the delay of the government fire fighting returns (**Fig. 3.5**) to normal, and the fact is that the residents cannot expect enough water discharged only by official fire-fighting when a fire occurs.

#### **3.1.4 Non-governmental fire fighting activity**

As mentioned above, it seems that it is difficult for governmental fire fighters to gain confidence from residents. As a result, in Bangkok, a while before the governmental fire fighters arrive at the site of fire, a voluntary fire fighting groups in the region play a very important role. Unlike the governmental fire fighters, as members of voluntary fire fighting groups are the residents, the advantage of a voluntary fire fighting groups is the speed of action after all. However, we should pay attention to some points of difference between Japanese voluntary fire fighting groups and Bangkok ones.

In Japanese case, as mentioned above, the voluntary fire fighting groups take part in the official fire fighting together with the governmental fire fighting based on a legal basis. On the other hand, in Bangkok case, voluntary fire fighting group does not have such an official role, and is no more than a spontaneous activity by residents. The qualities of the activity and equipment of each voluntary fire-fighting group are not at the same level depending on its effort, determination, and economic conditions. Moreover, there are not any periodical training



**Fig. 3.6** Voluntary fire fighters wear the same suits as governmental fire fighters



**Fig. 3.7** Voluntary fire fighters wear ordinary clothes

and official disposition of equipment by municipality. As matters stand, the fact is that we can see only a few highly-developed voluntary fire fighting groups which are not at all inferior to the governmental fire fighting (**Fig. 3.6**) while many voluntary groups still have inferior knowledge, skills and activity (**Fig. 3.7**).

For example, the following cases, which are capable of leading the residents' distrust of the inferior voluntary groups, can be seen frequently. Firstly, the crowds of the volunteers' cars frequently obstruct the governmental fire fighting activity at a site of fire. Secondly, there are thieves at a site of fire pretending to be voluntary fire fighters. Thirdly, for the reason that they can receive a reward according to the number of the injured bodies which are carried by them to hospitals, some volunteers concentrate on just only scrambling for injured bodies without any first aid and fire extinguishing. Another point is about some volunteers' cars with fake sirens ringing to dodge through some traffic congestion.

Moreover, in actual state, it is difficult for governmental fire fighters and residents to distinguish between the sensible volunteers and inferior ones, between voluntary fire fighters and governmental fire fighters, or between volunteers and residents, for the reason that some volunteers wear the imitation of the governmental uniforms and some volunteers wear ordinary clothes. As a result, it seems that such an actual state makes building up reliance on various

voluntary fire fighting groups much more difficult.

### **3.2 IMPLEMENTATION OVERVIEW OF THE QUESTIONNAIRE SURVEY**

As the mentioned-above, in order to improve the regional fire fighting validity, it is considered that the smooth relationship between the governmental fire fighting and the voluntary is very important. Furthermore, it is necessary for each group to win another's confidence.

Definitely, on some basic laws in Thailand, it can be found some descriptions on the establishment of the cooperative relationship between government and volunteers for not only the fire event but also the whole disasters. However, through the above interviews, at least for the fire event, we also have an impression that any essential and effective practices for the establishment of the cooperative relationship between them have never been done successfully. Practically, it can be said that such a cooperative relationship does not exist at all.

Therefore, in order to investigate the feasibility of an establishment of the cooperative relationship between governmental and voluntary fire fighters, we carried out the questionnaire survey. As shown in **Table 3.2**, Bang Khae District is selected as the main subject area of 50 districts in Bangkok. The subjects of this investigation are the governmental fire fighters in Bang Khae fire station, the voluntary fire fighters and the general public in this area. Bang Khae District is located in the western of central Bangkok; its area is almost 46.55 km<sup>2</sup>. Its population is Bangkok's highest rank, approximately 193,448 people. The population density is 4,156 people per km<sup>2</sup>. It is difficult to completely grasp the number of voluntary fire fighting groups and voluntary fire fighters. The summary of the process for this questionnaire survey is shown below.

**Table 3.2 Summary of the Questionnaire Survey Design**

	Governmental Fire Fighter	Voluntary Fire Fighter	People
Date	February-March, 2010		
Area	Bangkok (Bang Khae District)		
Distribution	handing the questionnaire		Interview and Recording
Return	picking up later		
Sample	101	108	80

Generally, it can be said that it becomes very hard to do such a questionnaire survey in some developing countries. However, it seems that the reasons why these questionnaires were carried out smoothly for the most part were as follows. First, when we decided to select Bang Khae District as the main subject area, we could get some quite helpful suggestions from the above fire fighters who were like a mediator for the meeting in January 2010. Second, at the meeting in January 2010, we could get a permission of directors to distribute the questionnaire survey sheets among the fire fighters in Bang Khae fire station. Third, when we selected one voluntary fire-fighting group as a subject, we also could get an opportunity to become acquainted with the liaison person of this voluntary group with an introduction from the above fire fighter. Even if it was unsuccessful at first, after four or five times contacts by phone from Japan, it was successful in obtaining the liaison's consent to distribute the questionnaire survey sheets among the voluntary fire fighters in this group finally. Fourth, as it can be said that the questionnaire has not really taken root in developing countries, for the general public part of this questionnaire survey, we decided to switch the way to the interview method, which was carried out on the roadside.

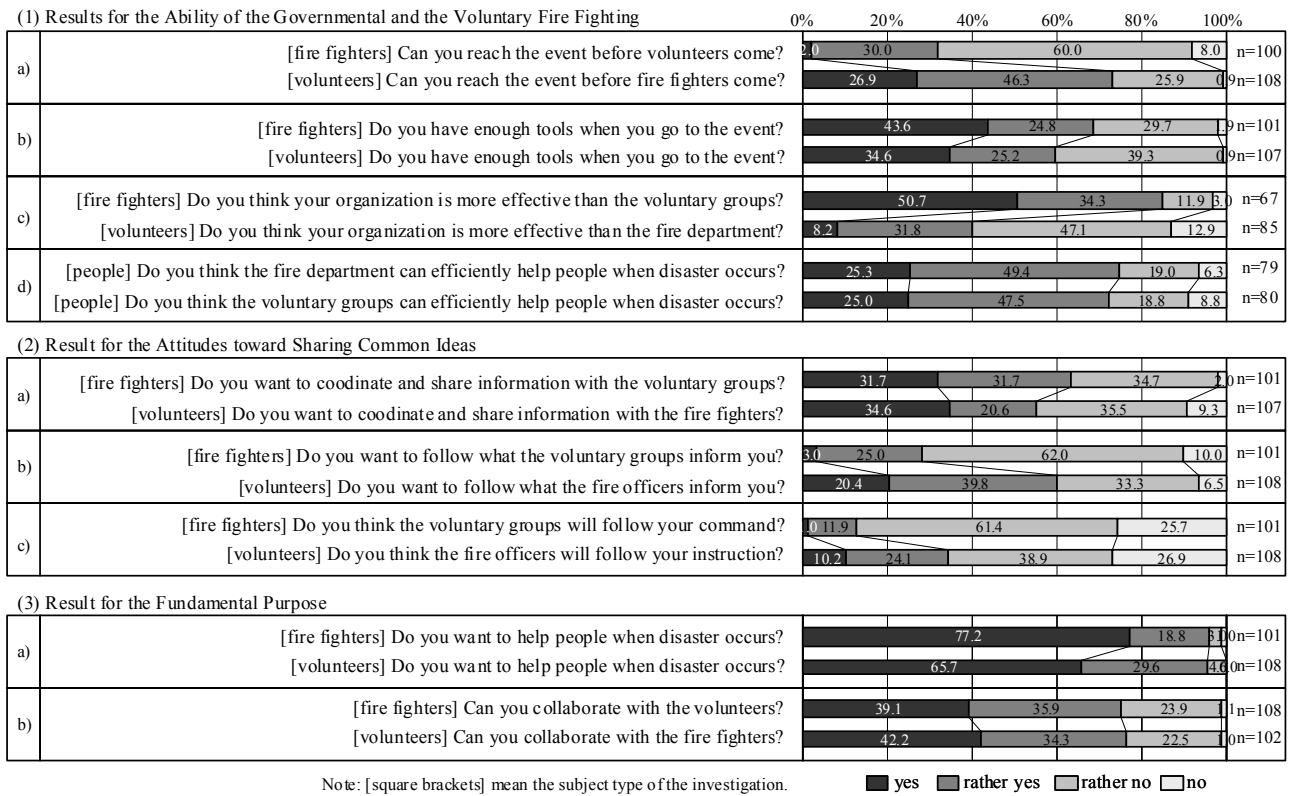
### 3.3 RESULTS OF THE QUESTIONNAIRE SURVEY

According to the actual situation mentioned in above, in order to investigate the feasibility of an establishment of the cooperative relationship between governmental and voluntary fire fighters, it is considered that it becomes important to investigate the following points of issue: how each groups recognize the own and the another side's ability for fire fighting, each groups' attitudes toward sharing common ideas to one another, and whether each groups hold in common the quite fundamental purpose of "saving Life" in the first place or not. These points of issue are discussed in the following paragraphs.

#### (1) Abilities

The first point of issue is concerned with the ability of the governmental fire fighter and the voluntary one. On this point, it is considered that there are two sides "the rapidity of reaching the site of fire" and "the fire fighting ability at the site of fire". According to the information mentioned in above chapter, at present, it is assumed that "the rapidity of reaching the site of fire" is higher for the voluntary fire fighting groups than for the government. On the other hand, "the fire fighting ability at the site of fire" is higher for the governmental fire fighting than the voluntary groups. These conjectures almost can be confirmed in **Fig.3.8 (1)**.

**Fig.3.8 (1a)** shows the survey result concerned with "the rapidity of reaching the site of fire" for the both sides of the governmental fire fighters and the voluntary one. According to these results, it can be said that there is significant difference between both recognitions ( $p=0.000$ )<sup>[1]</sup>. Therefore, it is clear that the recognition which the voluntary group is superior in the rapidity is in common between both sides. On the other hand, **Fig.3.8 (1b)** shows the survey result concerned with "the fire fighting ability at the site of fire". The questions are in self-awareness form, not relative comparison form. According to these results, for each group, the percentage of respondents who recognize that own tool is enough is less than 50 percent.



**Fig. 3.8 Results of the Questionnaire Survey**

Therefore, it can be said that the expansion of each group’s facilities becomes an important issue for the present. Additionally, it can be seen that such a tendency is slight remarkable in the voluntary group more than in the governmental group, although it cannot be said that there is a significant difference between them ( $p=0.167$ )<sup>[1]</sup>. Moreover, according to **Fig.3.8 (1c)**, it can be said with a statistical significance ( $p=0.000$ )<sup>[1]</sup> that the recognition which the own organization is more effective than the other side is lower in the voluntary group than that of the governmental group. From the above, it can be said that the following matters are confirmed. The both groups recognize that the voluntary group is superior to the government one in “the rapidity”, and also recognize that the government group is superior to the voluntary one in “the fire fighting ability”.

Additionally, we have shown the survey result from the viewpoint of the general public about an overall expectation of the ability for each side in **Fig.3.8 (1d)**. According to this result, the general public can put their hope on neither the voluntary group nor the government

one, rather than have great expectation on only one side of the two groups (There is no significant difference between them at a level of 5% ( $p=0.784$ )<sup>[2]</sup>).

## **(2) Attitudes toward Sharing Common Ideas**

The second point of issue is concerned with the each groups' attitudes toward sharing common ideas to one another. According to the information mentioned in above chapter, it is assumed that the greater part of governmental fire fighters and voluntary ones may not necessarily have positive attitudes towards sharing common ideas. This conjecture almost can be confirmed in **Fig.3.8 (2)**.

According to **Fig.3.8 (2)a)**, it can be said that the percentage of approval opinions about sharing information in common is not so high on each groups (There is no significant difference between them at a level of 5% ( $p=0.407$ )<sup>[1]</sup>). Especially, according to **Fig.3.8 (2)b)**, the percentage of approval opinions about following the information of another group is very low (There is a significant difference between them at a level of 5% ( $p=0.000$ )<sup>[1]</sup>, but the fact that the approval opinions is a small minority is basically common.). Additionally, according to **Fig.3.8 (2)c)**, from the opposite viewpoint, the percentage of approval opinions about the prospect of another group's following a command or instruction from my own organization is also very low (There is a significant difference between them at a level of 5% ( $p=0.032$ )<sup>[1]</sup>, but the fact that the approval opinions is a small minority is basically common.).

From the above, for an establishment of the cooperative relationship such as sharing common information, it can be said that both groups' opinions are mostly negative. Namely, it also seems that it can be assumed as if such a negative attitude toward sharing common ideas is caused by an overwhelming lack of confidence.

### **(3) Fundamental Purpose**

The third point of issue is concerned with the quite fundamental purpose of “Saving Life” in the first place. According to the above results, it must be considered that it is difficult to establish the cooperative relationship between each group in the present circumstances. However, granting the expectation of ability and the attitudes toward sharing common ideas are negative among each other, if the each groups hold in common the quite fundamental purpose of “Saving Life” in the first place, it still can be considered that it is possible for each groups to establish a smooth cooperative relationship from a long-term viewpoint.

From this point of view, according to **Fig.3.8 (3)a**), it is clear that both groups are active for the quite fundamental purpose of ‘Saving Life’. Namely, it is easy to be confirmed that the quite fundamental purpose of each group is identical (There is no significant difference between them at a level of 5% ( $p=0.078$ )<sup>[1]</sup>).

However, from **Fig.3.8 (3)b**), it is also confirmed that the percentage of approval opinions about the establishment of the cooperative relationship is not so high on each group (There is no significant difference between them at a level of 5% ( $p=0.684$ )<sup>[1]</sup>). Namely, it is considered that these results should be explained as follows: There are plenty of problems that need to be solved at present. Still more, the most serious problem is the recent situation that neither of each group recognizes the other’s opinions correctly. It is, therefore, exceedingly important that each group recognizes that their fundamental purpose is identical.



### 3.4 SUMMARY

According to the above results, at present, it seems that there is very little feasibility of an establishment of a cooperative relationship between the governmental fire fighters and voluntary ones. On the other hand, it is also confirmed that the fundamental purpose of fire fighting activity is the same for both groups. In this sense, it can be said that there is a glimmer of hope.

Therefore, in order to increase this feasibility, as a first step, it can be said that it is important for both to understand the validity of the establishment of the cooperative relationship after understanding the strong and weak points of both. However, it seems that it is difficult to understand how much the seemingly slight difference such as the establishment of the cooperative relationship has an influence on an improvement of the regional fire fighting validity. Accordingly, it can be also said that a certain countermeasure which can lead the well understanding for the above influences are needed. In the next chapter, “The Regional Fire Fighting Validity Map” will be made on a trial basis and proposed as a practical tool for risk communication in order to improve each group’s understanding about the effect of the establishment of the cooperative relationship.

#### NOTE

[1] These statistics are the Mann-Whitney U test<sup>8</sup>). It is a non-parametric statistical hypothesis test. It can be applied to the comparison of two independent random samples whose measurement scales is ordinal.

[2] These statistics are the Wilcoxon signed-rank test<sup>9</sup>). It is a non-parametric statistical hypothesis test. It can be applied to the comparison of a pair of samples whose measurement scales is ordinal.

## CHAPTER 4

### THE REGIONAL FIRE FIGHTING VALIDITY MAP

In this chapter, I would like to develop and propose “The Regional Fire Fighting Validity Map” on a trial basis as a practical tool for risk communication. As I mentioned in 3.4, the purpose of this mapping is to improve understanding about the effect of the establishment of the cooperative relationship. According to this aim of this mapping, it seems that this mapping can be called ‘the Solution-Oriented Mapping’. Incidentally, the effectiveness of this map will be verified in the next chapter.

#### 4.1 BASIC CONDITIONS OF THIS MAPPING

In Tokyo, there is a high potential risk of spreading fire because of high density of wooden houses. Moreover, Japan is subject to frequent earthquakes. Accordingly, the target of typical measurements against fire disasters is always spreading fire risk caused by large earthquake. In fact, at present, all so-called ‘Fire hazard map’ in Japan is made under conditions such as the above two kinds of risks.

In contrast, in Bangkok, except for slum areas, the density of wooden houses is not so high, and the spreading of fire risk is not so serious. Therefore, it can be said that the safety in the region is settled by “the causing fire risk itself” and “the regional fire fighting validity”. Among these factors, the former has a quite considerable uncertainty. Consequently, this mapping assumes that “the causing fire risk itself” is constant and can be neglected. Therefore, only the latter “the regional fire fighting validity” is considered in this mapping.

To evaluate the regional fire fighting validity, we set a [cumulative spraying water amount] as an evaluation index. This amount is defined as the total amount of water supplied by both the governmental fire fighting and the voluntary fire fighting at a given time  $T_V$ .

The governmental fire fighters always turn out from each fire station with the prescribed equipment when they receive an emergency call. In Bang Khae district, there is just only one fire station. However, if a fire occurs in Bang Khae district, some support fire engines will come from neighboring six main fire stations and one sub fire station.

On the other hand, the voluntary fire fighters' whereabouts are exactly unknown. However, it is true that the voluntary fire fighters exist at a fixed rate. And it is also fact that they turn out from some bases which are dotted about the region (refer to **Fig.4.1**) or each of their homes. Among them, the former volunteers from some bases go by one or two pick-up trucks with a fire pump, but the latter volunteers come directly from each of their homes do not have any effective extinguishers. Therefore, the spraying water by voluntary fire fighters starts as soon as the fire pump arrives. Consequently, in case of the evaluation on [cumulative spraying water amount], it is enough to consider only the former volunteer's activity. Incidentally, the departure timing is divided depending on the timing of the interception of a radio message among the governmental fire fighters.

The details of the parameters that express the governmental fire fighting ability and the voluntary one are shown in **Table 4.1**. Some settings of values in **Table 4.1** are based on some information obtained from the above interviews. Moreover, as there are some stochastic factors, the Monte Carlo method is adopted in this mapping in order to stably obtain the value of [cumulative spraying water amount].

**Table 4.1 Expression of fire fighting activity process in this mapping**

Subject	Process	Note																																														
People	Emergency call	After an outbreak of fire, time required to emergency call is indicated as ' $t_{p1}$ (sec.)'. ( $t_{p1}$ =300, as a default)																																														
Governmental fire fighting	Turning out	After receiving an emergency call, time required to turning out is indicated as ' $t_{g1}$ (sec.)'. ( $t_{g1}$ =180, as a default)																																														
	Approach	After turning out, time required to arrive at a site of fire is indicated as ' $t_{g2}$ (sec.)'. The approach routes are chosen by the shortest distance within the utilizable roads limited by a fire engine's width, an obstruction by parking on local streets occurs at a rate ' $p_1$ ' and an obstruction by crowds of the volunteers' cars. The moving distance is indicated as ' $x$ (km)'. The prescribed properties of fire stations and fire engines are as follows:																																														
<table border="1"> <thead> <tr> <th rowspan="3">Type</th> <th colspan="3">Cars (per one event, per one fire sta.)</th> <th rowspan="3">Loadage (liter)</th> <th rowspan="3">Width (m)</th> <th rowspan="3">Capacity (liter per min)</th> <th rowspan="3">Warming up (sec)</th> <th colspan="3">Speed (v: km/h)</th> </tr> <tr> <th rowspan="2">Bang Khae</th> <th colspan="2">neighbor fire sta.</th> <th rowspan="2">normal</th> <th rowspan="2">crowded</th> <th rowspan="2">Local street</th> </tr> <tr> <th>(main)*</th> <th>(sub)**</th> </tr> </thead> <tbody> <tr> <td>Large</td> <td>2</td> <td>2</td> <td>0</td> <td>10,000</td> <td>2.5</td> <td>590</td> <td>300</td> <td rowspan="3">40</td> <td rowspan="3">5</td> <td rowspan="3">20</td> </tr> <tr> <td>Medium</td> <td>2</td> <td>2</td> <td>1</td> <td>5,000</td> <td>2.5</td> <td>590</td> <td>300</td> </tr> <tr> <td>Small</td> <td>1</td> <td>1</td> <td>0</td> <td>1,500</td> <td>2.2</td> <td>590</td> <td>0</td> </tr> </tbody> </table> <p>[*note: 6 main fire stations, Bang Khun Thain, Dao Ka Nhong, Bang Khun North, Thon Buri, Tarad Phu, Talingchan] [**note: 1 sub fire station, Nong Khaem]</p>			Type	Cars (per one event, per one fire sta.)			Loadage (liter)	Width (m)	Capacity (liter per min)	Warming up (sec)	Speed (v: km/h)			Bang Khae	neighbor fire sta.		normal	crowded	Local street	(main)*	(sub)**	Large	2	2	0	10,000	2.5	590	300	40	5	20	Medium	2	2	1	5,000	2.5	590	300	Small	1	1	0	1,500	2.2	590	0
Type	Cars (per one event, per one fire sta.)			Loadage (liter)	Width (m)	Capacity (liter per min)					Warming up (sec)	Speed (v: km/h)																																				
	Bang Khae	neighbor fire sta.										normal	crowded	Local street																																		
		(main)*	(sub)**																																													
Large	2	2	0	10,000	2.5	590	300	40	5	20																																						
Medium	2	2	1	5,000	2.5	590	300																																									
Small	1	1	0	1,500	2.2	590	0																																									
	Preparation	Accordingly, ' $t_{g2}$ ' is expressed as ' $t_{g2}=360*x/v$ '. ( $p_1=0.3$ , as a default)																																														
		After arrival, time required to research the conditions is indicated as ' $t_{g3}$ (sec.)'. ( $t_{g3}$ =120, as a default)																																														
		After arrival, time required to connect some hoses is indicated as ' $t_{g4}$ (sec.)'. This value depends on the necessary number ' $y$ ' of hoses. The ' $y$ ' is divided by the distance between the fire engine and the site of fire. Time required to connect one hose is fixed as 8 seconds. The length of one hose is 20 meters. Accordingly, ' $t_{g4}$ ' is expressed as ' $t_{g4}=8*y$ '. (an upper limit of ' $y$ ' is set as 10)																																														
	Spraying water	After arrival, at first, try to find the nearest available hydrant. But, actually, some wrong matters happen at a constant rate ' $p_2$ ', for example, breakdown, fail to find because of items hiding the hydrant, and so on. Granting that the finding is success, moreover, if there is no cooperative relationship, volunteers often keep the hydrant to themselves and the governmental fire fighters cannot connect it. The possibility of such an obstruction case is defined as ' $p_3$ '. In any case, if not successful to connect to the nearest hydrant, try the next nearest hydrant. ( $p_2=0.2$ , $p_3=0.4$ , as a default)																																														
		After research conditions and connecting hoses, spraying water starts using the loadage water. Therefore, the time required since the outbreak fire to starting spray water is as follows: $t_{p1}+t_{g1}+t_{g2}+MAX(t_{g3}, t_{g4})$ So, [cumulative spraying water amount] by one fire engine is expressed as follows: $Capacity \cdot MIN[ T_v - \{ t_{p1}+t_{g1}+t_{g2}+MAX(t_{g3}, t_{g4}) \}, Loadage/Capacity ]$ After empty the loadage water, if already finished the connecting to the nearest hydrant successfully, spraying water can be continued. But if not successful, the fire engine has to try the next nearest hydrant.																																														
Voluntary fire fighting	Turning out	After succeeding in an interception, time required for turning out is indicated as ' $t_{v1}$ (sec.)'. ( $t_{v1}$ =60, as a default)																																														
	Approach	After turning out, time required to arrive at a site of fire is indicated as ' $t_{v2}$ (sec.)'. The behavioral rules in approach is the same as the government one, except for some properties as follows: <b>Type</b> : pick-up truck with a small pump, <b>Cars</b> : 2 cars per each base, <b>Loadage</b> : none, <b>Width</b> : 2.0 meters, <b>Capacity</b> : 350 liters per sec., <b>Speed</b> : the same as the governmental one.																																														
	Preparation	After arrival, time required to research the conditions is indicated as ' $t_{v3}$ (sec.)'. ( $t_{v3}$ =60, as a default)																																														
		After arrival, time required to connect some hoses is indicated as ' $t_{v4}$ (sec.)'. The behavioral rules is the same as the government one, except for some properties as follows: 1)There are not obstruction matters. 2) an upper limit of ' $y$ ' is set as 4.																																														
Spraying water	After research and connecting to the hydrant, spraying water starts. Therefore, the time required since the outbreak fire to starting spray water is as follows: $t_{p1}+t_{v1}+t_{v2}+MAX(t_{v3}, t_{v4})$ So, [cumulative spraying water amount] by one voluntary fire truck is as follows: $Capacity \cdot [ T_v - \{ t_{p1}+t_{v1}+t_{v2}+MAX(t_{v3}, t_{v4}) \} ]$																																															

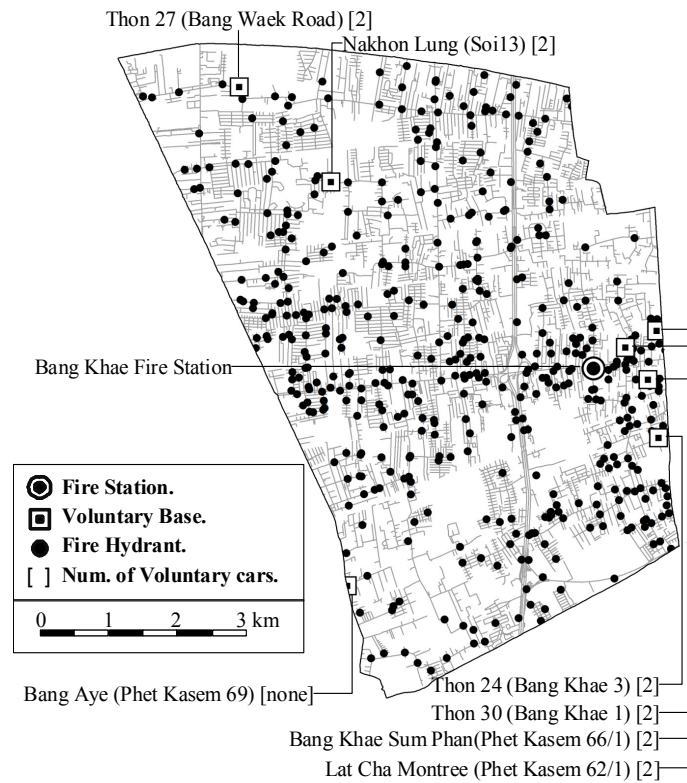


Fig. 4.1 Location of hydrants and voluntary groups' bases in Bang Khae District

## 4.2 OBSTRUCTIVE FACTORS AND COLLABORATION SCENARIOS

Referring to the above, if we rearrange the parameters affecting the [cumulative spraying water amount] as obstructive factors, the list is as shown in **Table 4.2**. Therefore, as a first step, it is important for both the governmental and voluntary fire fighters to understand how much the improvements of these seven factors have an influence on the regional fire fighting validity.

**Table 4.2** also shows the setting values which were used in the calculations for the drawing the Regional Fire Fighting Validity Maps. The following paragraphs give additional explanations of the above factors. Incidentally, these setting values include some real values based on the survey for the actual situation and some values as an assumption. These values should be used as sensitivity analyses in order to express the effects of the improvement of these seven factors related to cooperative relationship.

**Table 4.2 The 7 essential problems and collaboration scenario which were introduced at the pre-meetings**

No.	Problems	Examples of the collaboration scenarios			
		parameters			
		actual	collaborated		
1	Time loss by misunderstanding of the emergency telephone number <i>— In 2003, it was changed from “191” to “199”. But more than a few people does not know it.</i>	The both of the governmental fire fighters and the voluntary fire fighters can get emergency call immediately at the same time.	$t_{p1}=300$ sec.	$t_{p1}=0$ sec.	
2	Serious traffic congestions <i>— It causes the delay of fire engine’ arrivals.</i>	(It is quite difficult to be solved immediately.)	$v= 5$ km/h.		
3	Obstruction a fire engine’s traffic <i>— a) Illegal parking on local streets — b) Crowd of the volunteers’ cars in front of a fire site</i>	Almost all cars make way for the official fire engines.	a)	$p_1=0.4$	$p_1=0.0$
			b)	Volunteers’ cars parked in front of a fire site block the governmental fire engines	No blocking
4	Impossibility of putting fire hydrants to use <i>— a) Breakdown of hydrant — b) Some shops or street stalls often hind a hydrant. — c) Voluntary fire fighters who came earlier than official fire fighters often keep the hydrant to themselves. Therefore, the official fire fighters cannot connect to it.</i>	The both of the governmental fire fighters and the voluntary fire fighters maintenance it jointly at ordinary times, and the official fire fighters takes precedence.	a)	$p_2=0.4$	$p_2=0.0$
			b)		
			c)	$p_3=0.4$	$p_3=0.0$
5	Time loss for gathering information at the site of fire <i>— After arriving at a site of fire, official fire fighters have to spend time researching conditions and gathering information.</i>	The voluntary fire fighters who arrived earlier report the state of fire to the governmental fire fighters who arrived later.	$t_{g3}=200$ sec.	$t_{g3}=0$ sec.	
6	Loss of human resource for watching out for stealing fire fighting equipment <i>— For this reason, a loss of 2 or 3 human resource from the official fire fighting team causes a decline in the efficiency of the official fire fighting.</i>	The voluntary fire fighters perform the backward support in the governmental fire fighters.	$t_{g3}$ and $t_{g4}$ are doubled under the collaborated scenario	$t_{g3}$ and $t_{g4}$ are not increased	
7	Lack of volunteers’ equipment <i>— The volunteers’ equipment for extinguishing is hardly enough. Especially, when there are not any hydrants available, then most volunteers have nothing to do with the fire extinguishing.</i>	Increase a number of fire engines with water tank in each voluntary base.	none	1 (type: small)	

**(1) Time loss by misunderstanding of the emergency telephone number**

In Bangkok, almost seven years ago, the emergency telephone number “191” for a fire station was the same number as for a police station. Until November 1, 2003, with the reorganization which moved the duty of fire prevention from the police authority to BMA, the

emergency telephone number was then separated into “191 (police)” and “199 (fire station)”. However, at present, without the announcement of this change, there is a tendency for most people to dial “191” when a fire breaks out. Because of this harmful vertical division, when the police are informed of fire, it takes much more time for the nearest fire brigades to get the information and reach the site of fire. In this mapping, the value of ‘ $t_{p1}$ ’ which indicates the time loss by the people’s misunderstanding of the emergency telephone number is assumed as 300 seconds. Under the collaboration scenario, it is assumed that the value of ‘ $t_{p1}$ ’ is reduced to 0 second.

### **(2) Serious traffic congestions**

The traffic congestion on arterial roads has a strong influence on the rapidity of reaching the site of fire, and the traffic congestion improvement is, actually, quite difficult. So, in both scenarios, the value of ‘ $v$ ’ which indicates the speed of fire engines is assumed as 5 km per hour.

### **(3) Obstruction a fire engine’s traffic**

The fire engines frequently cannot go through some local streets, and sometimes has to turn back because of the obstruction of illegal parking. So, in this mapping, the value of ‘ $p_1$ ’ which indicates the incidence of such obstruction of illegal parking is assumed as 0.4. Under the collaboration scenario, it is assumed that the value of ‘ $p_1$ ’ is reduced to 0 second.

On the other hand, if the greater part of governmental fire fighters and voluntary ones have positive attitudes towards sharing common ideas to one another, it can be said that the obstructing incidence of the crowds of volunteers’ cars will be reduced. Therefore, under the improved scenario, it is assumed that such an obstruction will not occur.

### **(4) Impossibility of putting fire hydrants to use**

When governmental fire fighters try to set their equipment, some obstructing matters often occur, for example, breakdown of hydrant, fail to find the hydrant because of hiding it by

some items, and so on. Accordingly, in this mapping, the value of ' $p_2$ ' which indicates the failure incidence of finding the nearest available hydrants is assumed as 0.4. Under the collaboration scenario, it is assumed that the value of ' $p_2$ ' is reduced to 0.0.

On the other hand, when governmental fire fighters try to connect their equipment to the available hydrant, voluntary fire fighters who came earlier than governmental one frequently keep the hydrant to themselves. Therefore, the governmental fire fighters cannot connect it. In this mapping, the value of ' $p_3$ ' which indicates the incidence of such an obstacle is assumed as 0.4. Under the collaboration scenario, it is assumed that the value of ' $p_3$ ' is reduced to 0.0.

#### **(5) Time loss for gathering information at the site of fire**

When arriving at a site of fire, firstly, the fire fighters spends time researching conditions and gathering information. However, if governmental fire fighters can get such information immediately from the volunteers who can reach the site of fire earlier, it seems that it is possible to shorten the time required. Therefore, in actual situation, the value of ' $t_{g3}$ ' which indicates the time required to gather information at the site of fire is assumed as 200 seconds. On the other hand, under the collaboration scenario, it is assumed that this value is reduced to 0 seconds.

#### **(6) Loss of human resource for watching out for stealing fire fighting equipment**

In actual situation, the loss of 2 or 3 human resources from the governmental team is unavoidable. Therefore, in this mapping, it is assumed that the value of ' $t_{g3}$ ' which indicates the time required to gather information at the site of fire and the value of ' $t_{g4}$ ' which indicates the time required to connect hoses are doubled. However, if the greater part of governmental fire fighters and voluntary ones have positive attitudes towards sharing common ideas to one another, it can be said that more efficient allocation of human resources can be put into practice. Therefore, under the collaboration scenario, it is assumed that the values of ' $t_{g3}$ ' and



' $t_{gd}$ ' are not increased.

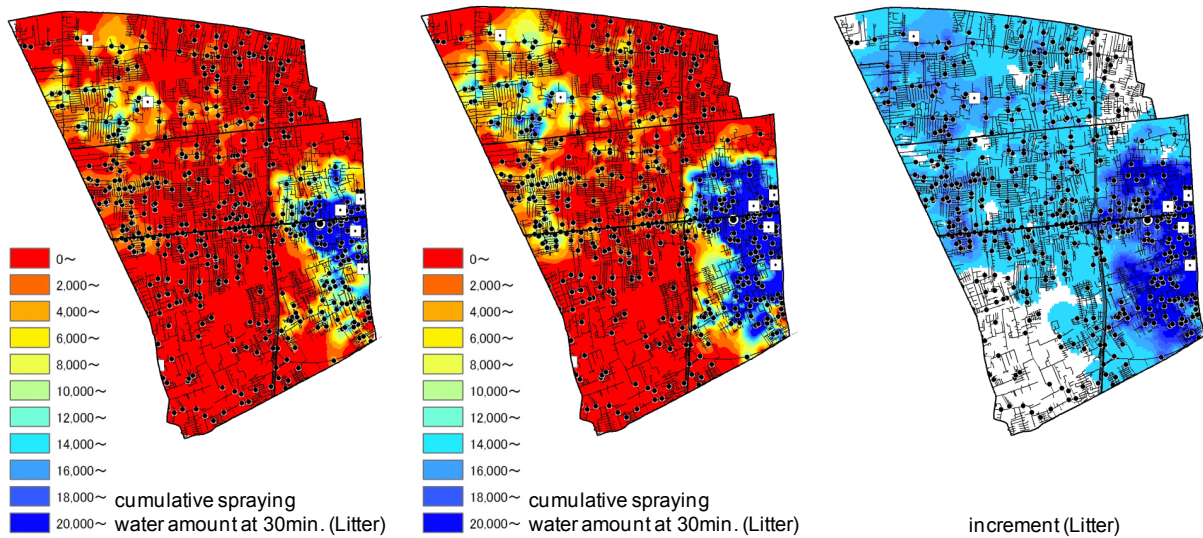
#### **(7) Lack of volunteers' equipment**

The volunteers' equipment for fire extinguishing is hardly enough. Especially, when there are not any hydrants available, then most volunteers have nothing to do with the fire extinguishing. Therefore, in this mapping, the number of fire engines with water tank in each voluntary base is assumed as zero. On the other hand, it can be said that it is possible to increase the fire engines with water tank in each voluntary base with efforts in the future. Therefore, it is assumed that this number is increased to one under the collaboration scenario. This assumption means complete integration with governmental fire fighting and the voluntary one.

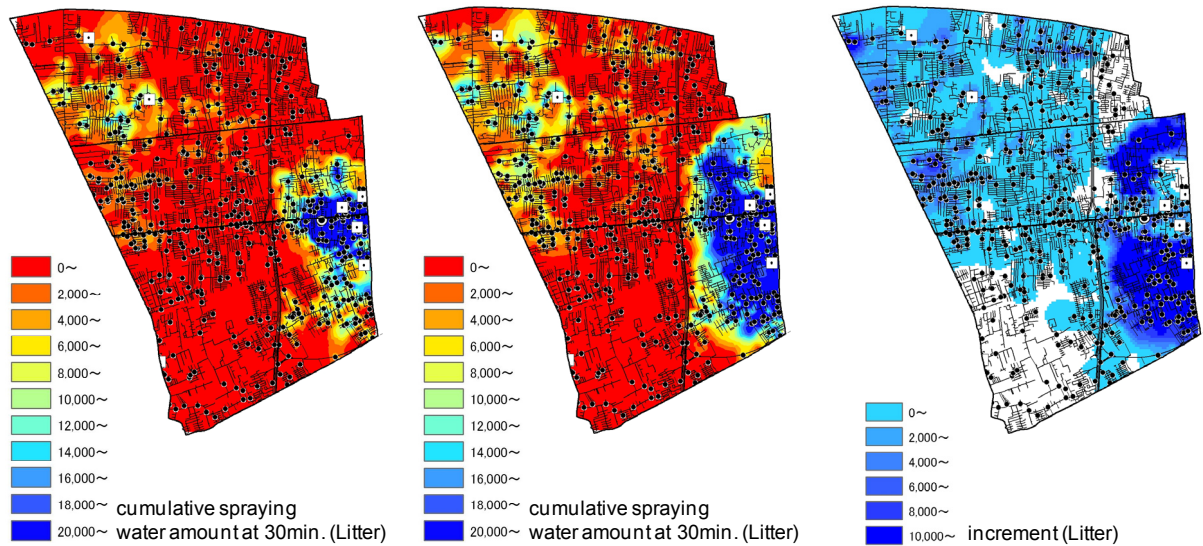
### **4.3 REGIONAL FIRE FIGHTING VALIDITY MAP UNDER THE SEVERAL SCENARIOS**

The regional fire fighting validity maps under the actual situation and the above several collaboration scenarios as **Table 4.2** (except for No.2) are shown in from **Fig. 4.2** to **Fig. 4.7**. In each figure, the left side (shown as (1)) shows the mapping under the actual situation, and the middle (shown as (2)) shows the mapping under the each collaboration scenario. In both mapping, the [cumulative spraying water amount] as an evaluation index can be indicated by a shade as shown in the legend. This shade is mapped out by an interpolation based on the 8,527 evaluation points which are dotted on the roads at intervals of 100 meters. Additionally, the right side (shown as (3)) shows the difference between the actual situation and the collaboration scenario.

It can clearly be seen that the remarkable betterment of [cumulative spraying water amount] is produced by each collaboration scenario. Meanwhile, it can be also seen that it is



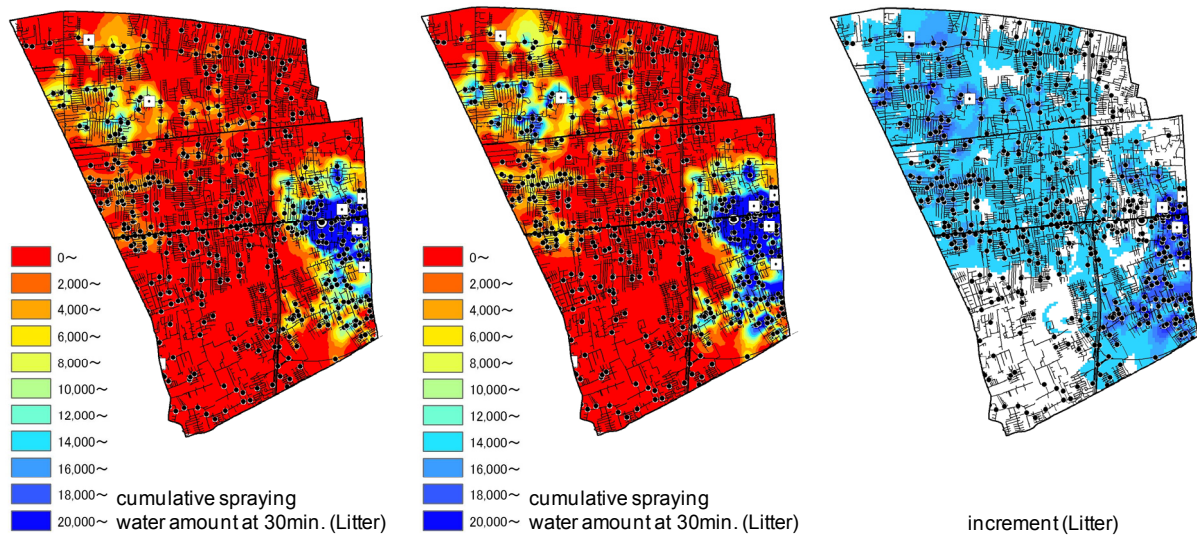
**Fig. 4.2 The effect of the collaboration scenario No.1**  
 (Time loss by misunderstanding of the emergency telephone number)



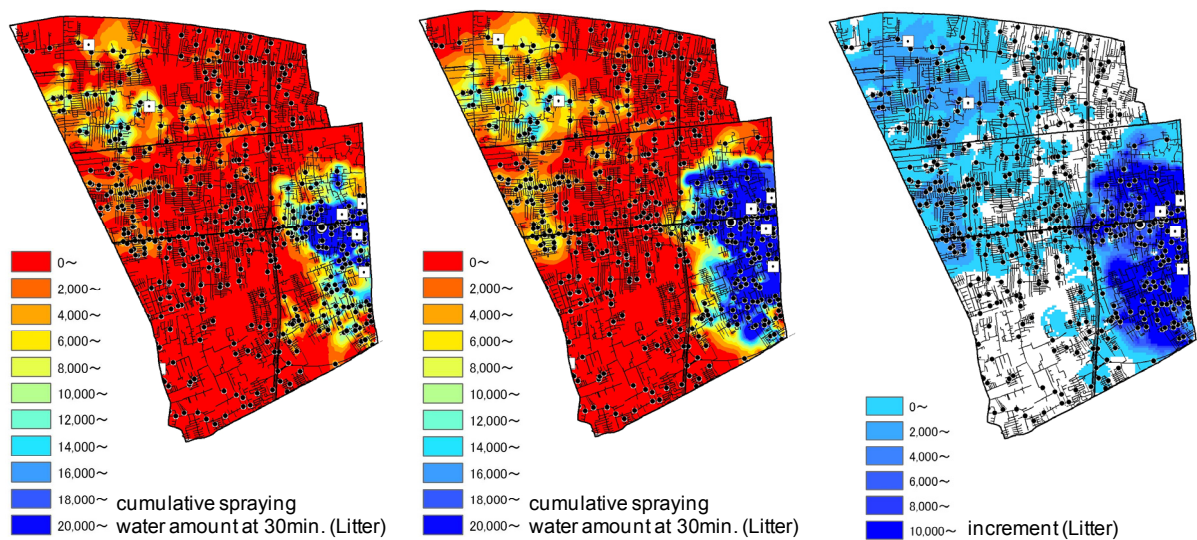
**Fig. 4.3 The effect of the collaboration scenario No.3**  
 (Obstruction a fire engine's traffic)

difficult to achieve fully high fire fighting by only one collaboration scenario.

Then, the effect under the condition that all collaboration scenarios are executed completely is shown in **Fig. 4.8**. According this map, it can most clearly be seen that the quite remarkable betterment of [cumulative spraying water amount] is produced by the thorough collaboration.

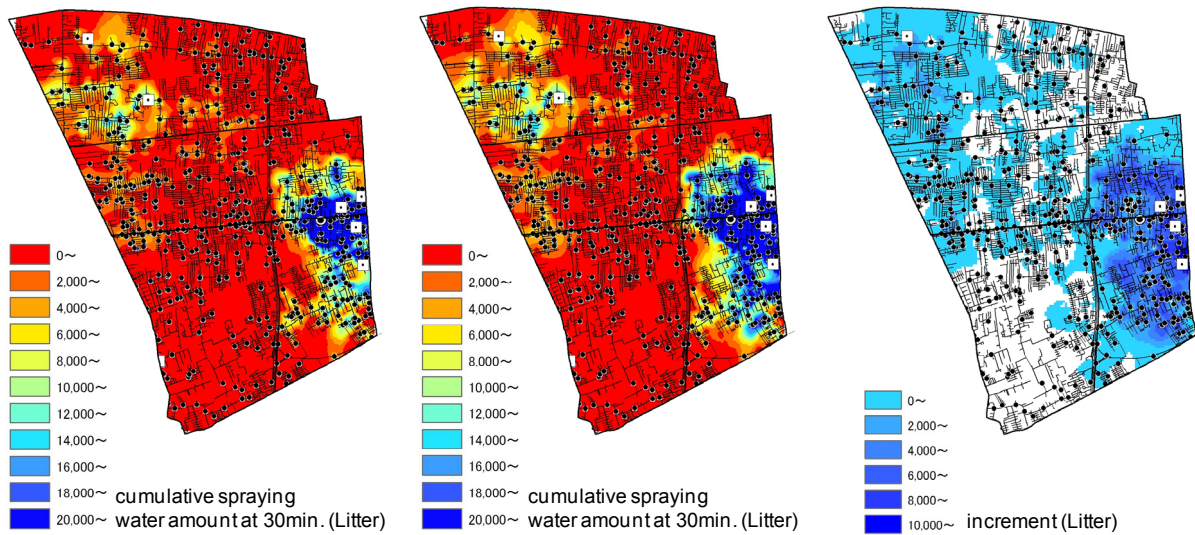


**Fig. 4.4 The effect of the collaboration scenario No.4**  
(Impossibility of putting fire hydrants to use)

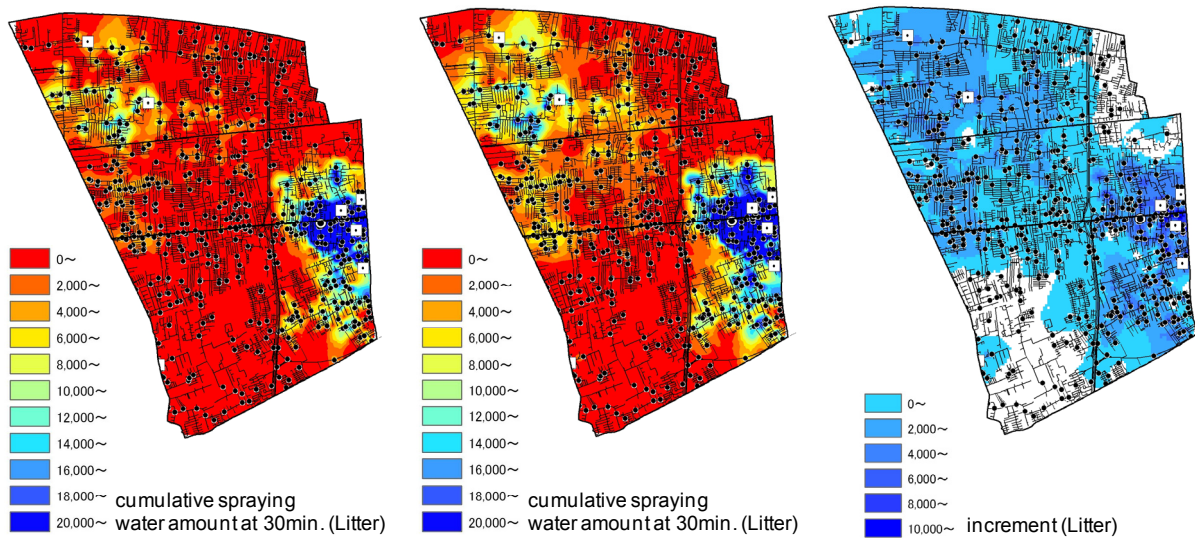


**Fig. 4.5 The effect of the collaboration scenario No.5**  
(Time loss for gathering information at the site of fire)

However, in details, it can also be seen that the marked betterment occurs at the sites which are close to the governmental fire station, voluntary fire fighting bases and fire hydrants. It seems that such a betterment is partially limited since the local road networks are not functionally linked. Of course, it is considered that the heavy traffic congestion on arterial roads also obstructs the spread of the betterment of [cumulative spraying water amount].



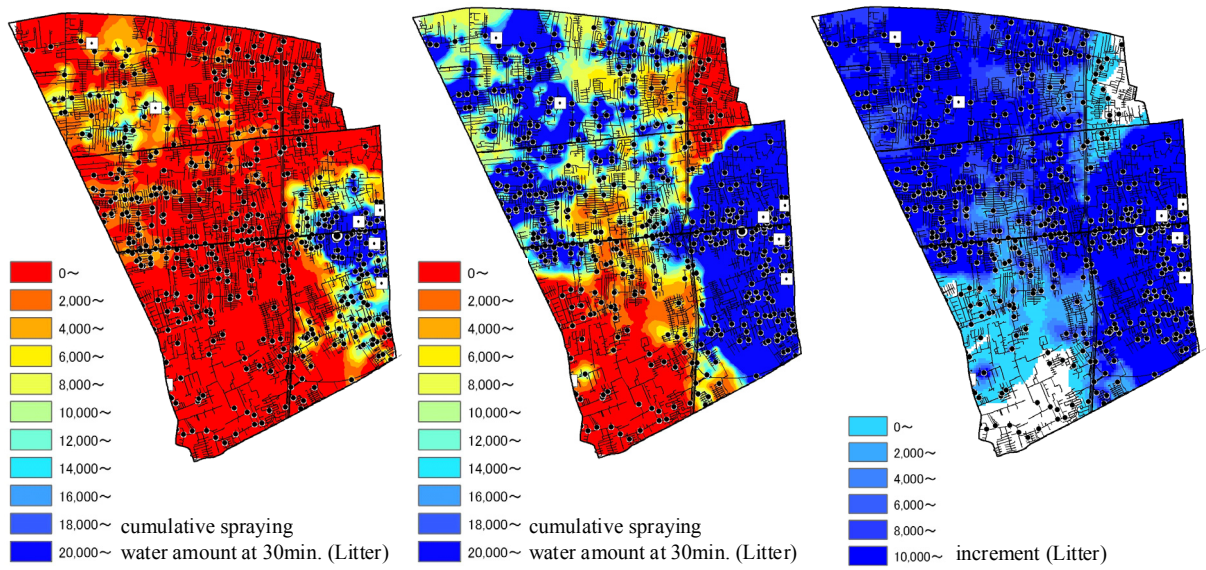
**Fig 4.6 The effect of the collaboration scenario No.6**  
(Loss of human resource for watching out for stealing fire fighting equipment)



**Fig. 4.7 The effect of the collaboration scenario No.7**  
(Lack of volunteers' equipment)

At any rate, it can be said that such a regional fire fighting validity map as shown above will be helpful for each stakeholder to understand how effective the establishment of the cooperative relationship is.

In the next chapter, the above “list of 7 essential factors” and “regional fire fighting validity maps” will be used in practice as the workshop contents, and will be practically shown



**Fig. 4.8 The effect of the all collaboration scenario**

to the governmental fire fighters and the voluntary fire fighters in Bang Khae district.

## CHAPTER 5

### THE EFFECTIVENESS OF THE PRACTICAL APPROACH TO MATERIALIZING A COOPERATIVE RELATIONSHIP

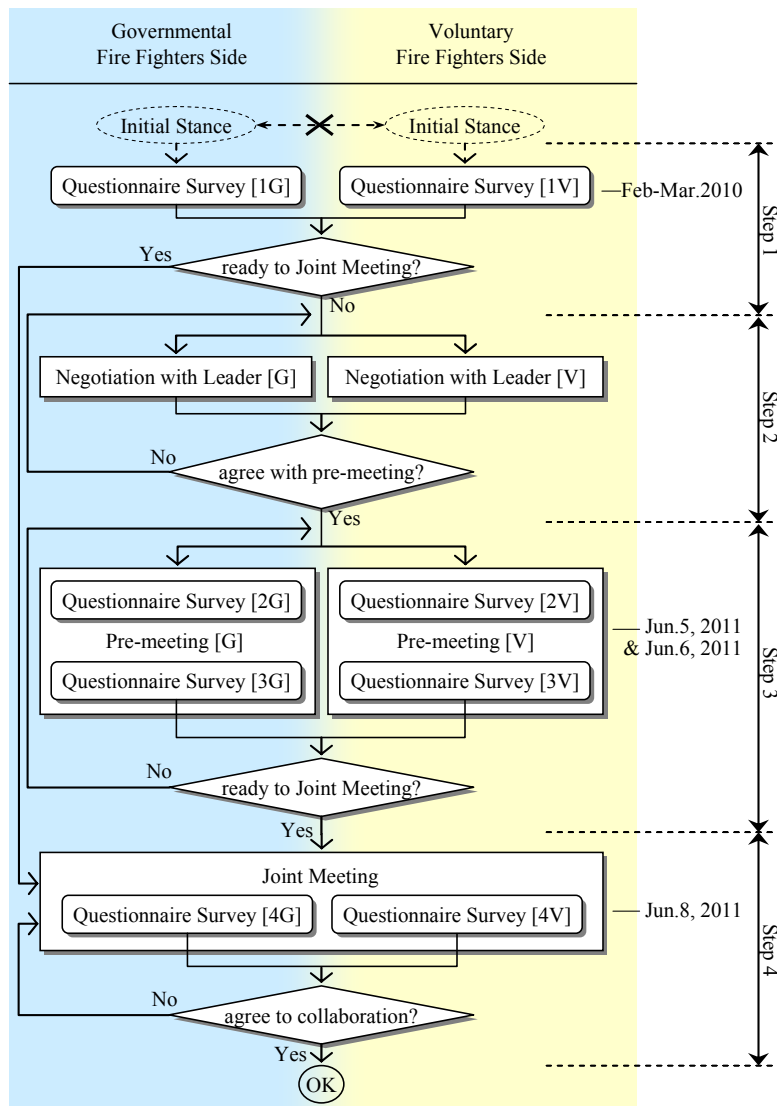
#### 5.1 INTRODUCTION

In chapter 3, it has been reported that the fundamental problems that should be solved first and foremost in Bangkok were not only a shortage of fire stations, but also an uncooperative relationship and the lack of trust between the governmental fire fighting and the voluntary fire fighting. It also has said that it was difficult to solve these problems at once because they were deep-rooted chronic problems. In chapter 4, although the regional fire fighting validity maps which ought to be useful for materializing a cooperative interpersonal relationship has been proposed, yet the validity of the map has not been ascertained.

Accordingly, in this chapter, I would like to put an approach, using the regional fire fighting validity maps, into practice in the light of the facts, and to verify the effect of the maps. I would like to put this approach into practice quite carefully as a number of negotiations, meetings, and questionnaire surveys.

#### 5.2 FRAMEWORK OF THIS APPROACH

In this content, I would like to discuss the framework of this practical approach as shown in **Fig. 5.1**. The aim of this approach is for the both parties to establish a cooperative interpersonal relationship for regional fire risk reduction in Bangkok. In this approach, I set



**Fig. 5.1 Framework of this approach**

several checkpoints to confirm their actual stances toward this aim during this approach on all such occasions. The framework of this practical approach was composed of four steps as follows.

### 5.2.1. Step 1: Initial stance

In chapter 3, the questionnaire surveys were conducted on both the voluntary fire fighters and the governmental fire fighters in Bang Khae district, Bangkok, Thailand. It may be said that the aim of these surveys were to investigate their initial stances toward

collaboration. Therefore, I would like to interpret these previous surveys as a first step in this practical approach. In other words, the following practical activities in this framework should be based on the result of these previous surveys, and should be carried out for the same district as the previous surveys.

In **Fig. 5.1**, I use the symbol “Questionnaire survey [1G]” and “[1V]” to represent these previous surveys for the convenience of description. As a whole, the conclusions of the previous study were that an immediate accomplishment of an establishment of a cooperative relationship over the chronic conflict and discord was not so easy, and that the key to the solution of this matter was a mutual understanding, not conveying the will of the governing to the one governed. Therefore, we would like to rearrange here the essential points as follows.

[point 1] *Both parties should recognize that the other’s most fundamental public spirit is identical with the own one.*

[point 2] *Both parties should recognize that a collaboration is effective on an achievement the above unity of public spirit.*

[point 3] *Both parties should recognize that it is possible to achieve a collaboration.*

If these three conditions had been satisfied, then it could have been smoothly to establish a cooperative relationship between them. Additionally, the problem which I have to consider next is the difficulty to have a place for discussion with them in order to achieve the above three points. Therefore, I would like to add the following another point;



[point 4] *Both parties should recognize that a place for discussion is essential in order to put the above three points into practice.*

Accordingly, as a breakthrough, we focus our efforts on holding a meeting based on “point 4”.

### **5.2.2 Step 2: Negotiation with leaders**

However, it is also considered that such a joint meeting should be held after careful preparations, not be set abruptly, because it was clear that both were not ready for a face-to-face discussion at this point. Therefore, it is also considered that we should hold the separated pre-meetings for each party as a parallel before the joint meeting. However, it also seems that such a pre-meeting is still unthinkable matter from the both parties’ points of view, even if the pre-meetings were separated. Accordingly, we started to focus our efforts on the negotiation to hold the separated pre-meetings.

The persons to contact about this matter were mainly leaders of the both parties. At first, as we thought, both leaders had a negative stance toward holding such a series of meetings. Therefore, we began to try to make a relationship of mutual trust between the leaders and us. After that, when we began to feel that the leaders had trust in us, we began to talk about the four essential points as given above.

Such eager negotiations were started at about April 2010, and continued for about one year until making decision on holding the separated pre-meetings. During this period, authors tried to keep on telephonic communications with the leaders at least once a week. And author also visited once the voluntary fire fighters’ base in Bang Khae district and the Bang Khae fire station on August 2010.

Through such eager negotiations, the leaders’ stances toward these meetings changed

to positive finally. Therefore, we judged that minimum requirements for holding the separated pre-meetings were satisfied, but it was also true that there was no guarantee that such a positive change would occur for ordinary members of the both parties.

### **5.2.3 Step 3: Separate pre-meetings**

Progressed as described above, we held two separated pre-meetings as a parallel. The purpose of these pre-meetings was to prompt the both parties to approve holding a joint meeting. Therefore, in this pre-meetings, we gave explanation for the four essential points as given above, not only by reporting the results of the previous questionnaire surveys [1G] and [1V], but also by showing the Regional Fire Fighting Validity Map which was developed in the previous study in order to show the effect of a collaboration on a regional fire risk reduction as a simple visualization.

In order to verify the pre-meetings, we conducted surveys using questionnaire forms before and after these pre-meetings. The questionnaire survey [2G] and [2V], as shown in **Fig. 5.1**, was conducted to confirm their prior cognitions which were not affected by information brought up at the pre-meetings. Furthermore, the questionnaire survey [3G] and [3V] was conducted to confirm their posteriori recognitions which ought to be affected by information brought up at the pre-meetings.

However, if we considered pessimistically, one possibility was to assume that these pre-meetings did not only have any influence on their stances but made their stances negative. Another possibility was that their stances before the pre-meetings had been already turned into positive one. The former possibility will be verified by comparison with the results of [2G] and [3G], or with the results of [2V] and [3V]. And the latter possibility will be verified by the result of [2G] and [2V].

Especially, if the results of [3G] and [3V] made it clear that their posteriori stances for

having contact each other were not so positive, then we had to judge that it was still too early to hold a face-to-face discussion as a joint meeting. A full account about this point will be given in chapter 5.3

#### **5.2.4 Step 4: Joint meeting**

Actually, we ended up by holding the joint meeting. The details of the joint meeting will be given in chapter 5.4. In this joint meeting, we gave explanation for the four essential points as given above by reporting the results of the previous questionnaire surveys [2G], [3G], [2V], and [3V]. After that, we took a lot of time for discussion.

At the end of the joint meeting, we also conducted survey [4G] and [4V] using questionnaire form as a final checkpoint. As we mentioned above, no one has succeeded in holding such a joint meeting and establishment a cooperative relations between them in the past. In this sense, the result of [4G] and [4V] which indicated whether their stances turned into positive one or not has a quite significant meaning, and decides the success or failure of this approach.

### **5.3 SEPARATED PRE-MEETING**

In this section, I would describe the detail of two separated pre-meetings. Firstly, in 5.3.1, we will explain what kind of information was presented on the pre-meetings. Continuously, in 5.3.2, we will give details of the results of the questionnaire survey. **Fig. 5.2** and **Fig. 5.3** show the situation of the separated pre-meeting at the fire voluntary side, and **Fig. 5.4** and **Fig. 5.5** show the situation of the separated pre-meeting at the governmental side (at Bang Khae fire station).



Fig. 5.2 Separated pre-meeting at the fire voluntary base



Fig 5.3 Commemorative photograph after the separated pre-meeting at the fire voluntary base

### 5.3.1 Contents of the pre-meetings

As Table 5.1 shows, the pre-meetings were held separately for the governmental fire fighters and the voluntary fire fighters. But the contents of both were totally same.

At the beginning, the questionnaire surveys [2G] and [2V] were conducted to grasp



Fig 5.4 Presentation at the separated pre-meeting for the governmental side (at Bang Khae fire station)



Fig 5.5 Discussion at the Separated pre-meeting for the governmental side (at Bang Khae fire station)

the prior recognitions.

After that, we made a summary report of the results of the previous questionnaire surveys [1G] and [1V], focusing the points of (2a), (2b), and (2c) as shown in **Table 5.1**, while screening slides. The shapes of graphs in these slides were totally same as reported in chapter 3. This part may be reworded as giving information on the “point 1” mentioned in the

**Table 5.1 The outline of the pre-meetings**

	Governmental Fire Fighter Side	Voluntary Fire Fighter Side
Date	June 6th, 2011 / 9:30a.m.-11:30 a.m.	June 5th, 2011 / 9:30 a.m.-11:30 a.m.
Place	Conference room in Bang Khae fire station	Bang Khae fire voluntary base
Number of participants*	22	42
Contents	1. Questionnaire Survey [2G]	1. Questionnaire Survey [2V]
	2. Summary report of the previous questionnaire survey [1G] and [1V] (2a) The both parties recognized what is own advantages and disadvantages. And it seems that both were complementary to each other, and the collaboration was fairly efficient. (2b) The both parties had almost negative attitudes toward collaboration each other. (2c) The both parties had a common public spirit “saving lives as much as possible”.	
	3. Explanation about the effectiveness of collaboration (using the Regional Fire Fighting Validity Map) (3a) Actual situation about the fire fighting validity in this area. (3b) The 7 essential problems with the collaboration scenarios for improvement the actual situation. (3c) The effectiveness of the above collaboration on regional fire risk reduction.	
	4. Others	
	5. Discussion	
	6. Questionnaire Survey [3G]	6. Questionnaire Survey [3V]
	7. Commemorative photograph	
	8. Lunch	

\*Note: This number means just only the respondents of the questionnaire surveys. Actually, one after another came to the room. Therefore, there were more audiences than these numbers.

### 5.2.1.

Continuously, we explained about the effectiveness of collaboration between the governmental fire fighters and the voluntary fire fighters, using the Regional Fire Fighting Validity Maps which were shown in chapter 4. In this part, the seven essential problems for the improvement of the fire fighting validity in this area were proposed with seven collaboration scenarios corresponding to the each problem. In addition, the effectiveness of each collaboration scenarios was shown in mapping as compared with the actual situation. At any rate, this part may be reworded as a giving information on the “point 2” mentioned in the previous chapter.

Next, we presented some other topics expected for participant to have interest, for example, a fire volunteer system in Japan, recent disasters, and so on.

After a discussion, to grasp the prior recognitions, we also conducted the questionnaire surveys [3G] and [3V]. In the end, to cultivate mutual friendship, we took a commemorative photograph as **Fig. 5.3**, and talked about various topics over lunch.

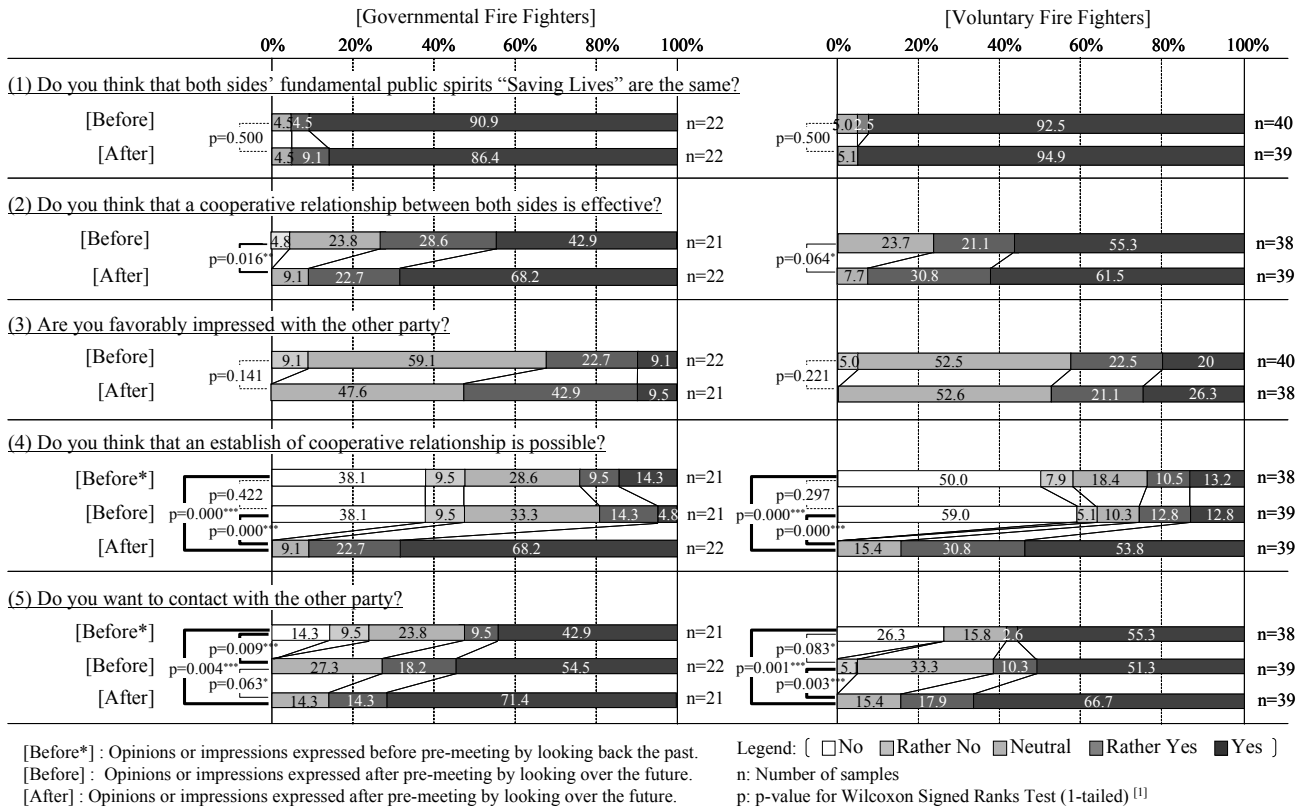


Fig. 5.6 Results of the surveys before and after the pre-meetings

### 5.3.2 Changes of their cognitions

Fig. 5.6 shows the results of five questions on these surveys. At this figure, the results of the governmental side are shown in the left side of row, and the results of the volunteer side are in the right side of row. In this figure, the results of survey [2G] and [2V] are indicated as [before], and also the results of survey [3G] and [3V] are indicated as [after]. These graphs are arranged vertically in order to make it easier to understand the changes of each questions before and after.

According to Fig. 5.6(1), it is clear that the both of the governmental fire fighters and the voluntary fire fighters thought, not only on [after] but also on [before], that the most fundamental public spirit "Saving life" was the same with each other. It is likely that one of the reasons why their cognitions on [before], corresponded to "point 1" mentioned in the

previous chapter, had already become desirable one was that the leaders who had already recognized it before by our negotiations had broadcasted information to the members.

Continuously, according to **Fig. 5.6(2)**, it can be said that a great number of respondents on the both parties had thought before that the collaboration was effective, but this number increased obviously after the pre-meetings. It may be said, at least, that the increase of it resulted from a giving information on the “point 2” mentioned in the previous chapter.

In contrast, although such obvious changes cannot be confirmed more clearly on their impressions in **Fig. 5.6(3)**, yet their impressions were not so negative.

On the other hand, according to **Fig. 5.6(4)**, it can be seen that their cognitions about the possibility of an establishment of a cooperative relationship were rather low on [before\*] and [before]. However, it is quite clear that their cognitions were changed into great hopes after these pre-meetings. We can say that the causes of this great changes were this pre-meetings with statistically significant difference, and that this part was succeed on giving information on the “point 3” mentioned in the previous chapter.

Such an upward tendency in their positive opinions can be also confirmed in **Fig. 5.6(5)**. Namely, both parties began to want to contact with the other party more strongly. According to this results, we judged that this part was succeeded on giving information on the “point 4” mentioned in the previous chapter, and that the both parties had changed to be ready for the joint meeting as a next step.

## **5.4 JOINT MEETING**

At the beginning of this approach, it is certain that we were concerned that both the governmental fire fighters and the voluntary fire fighters got into an altercation if they met



**Table 5.2 The outline of the joint meeting**

	Governmental Fire Fighter Side	Voluntary Fire Fighter Side
Date	June 8th, 2011 / 9:30a.m.-11:30a.m.	
Place	Conference room in Bang Khae fire station	
Number of participants*	23	15
Contents	1. Self-introduction	
	2. Summary report of the previous questionnaire survey [2G] [2V] [3G] [3V]	
	3. Re-presentation the 7 essential problems with the collaboration scenarios for improvement the actual situation	
	4. Discussion	
	5. Questionnaire Survey [4G]	4. Questionnaire Survey [4V]
	6. Commemorative photograph	
	7. Lunch	

\*Note: This number means only the respondents of the questionnaire surveys. Actually, one after another came to the room. So, there were more audiences than these numbers.

together abruptly in such a joint meeting. However, it was confirmed undoubtedly by the surveys on the pre-meetings that both were ready for the joint meeting. Consequently, we finally took the plunge and held the joint meeting. The purpose of this joint meeting was to verify their super ordinate perspective for collaboration, and to discuss how to solve subordinate problems.

#### **5.4.1 Contents of the joint meetings**

As shown in **Table 5.2**, both the governmental fire fighters in Bang Khae fire station and the voluntary fire fighters in Bang Khae district met together openly for the first time in the conference room. The key persons of both parties also took part in this meeting. The key person of the voluntary group was the Bang Khae District Former Counselor, and the key person of the governmental fire fighters was the chief of Bang Khae fire station. We got them to sit side by side in front of the other members, with the intension of giving the impression to the other members that both parties were on an equal footing with this meeting. At the beginning, in order to break the ice, we suggested all the members to introduce themselves as shown in **Fig. 5.7**.

After that, we made a summary report of the results of the previous questionnaire surveys [2G], [2V], [3G], and [3V], while screening slides. The shapes of graphs in these

slides were totally same as **Fig. 5.6**. The role of this part was not only a simple summary report, but to inform that each party's super ordinate perspectives for collaboration were totally the same in terms of the above essential points from 1 to 4. In brief, we tried to make them notice that a prejudice against the other party without a mutual understanding, like past, was quite shortsighted and unproductive for a regional fire risk reduction. Furthermore, we also emphasized that it is quite difficult to find any reasons why both parties do not try to establish a cooperative relationship, seeing these survey results as a third party. At this time, if such a summarizing had been appeared as an exaggeration to them, then they would complain about it. However, in practice, most members do agree with it.

Subsequently, we represented the seven essential problems and the collaboration scenarios for improvement the actual situation as we mentioned in the previous chapter and **Table 4.2** the role of this part was to suggest some subordinate immediate solutions for a realization of the super ordinate perspective for collaboration. We started a discussion part by this re-presentation.

At last, we also conducted a questionnaire survey ([4G] and [4V]) as a final checkpoint. Only in the final place, to cultivate mutual friendship between them, we took a commemorative photograph as **Fig. 5.8**, and talked about various topics over lunch.

#### **5.4.2 Their own proposals**

At this joint meeting, there were many discussions about the above seven essential problems and the collaboration scenarios as shown in **Table 4.2** these discussions were mostly positive and constructive. Moreover, both parties came to an agreement with the above collaboration scenarios. What has to be noticed that both parties proposed many original concrete ideas as follows beyond the collaboration scenarios who authors presented as a starting-point for discussion.



**Fig. 5.7** Discussion with both the governmental and non-governmental at the joint meeting



**Fig. 5.8** Governmental and Non-governmental took a picture together at Fire Station

### **(1) Time loss by misunderstanding of the emergency telephone number**

In the past, “191” was an emergency telephone number for both a police station and for a fire. However, since November 1, 2003, this emergency telephone number has been separated into “191 (police)” and “199 (fire station)”. Nonetheless, there is still a tendency for many people to dial “191” when a fire accident occurs because of insufficient announcement of this changing. Both parties understood that a full announcement was a duty of the governmental fire fighting. Nonetheless, the members of this voluntary fire-fighting group proposed that the voluntary fire fighters should also play a large part in a dissemination of this fact, on the ground that the voluntary fire fighters were closer to communities than the governmental fire fighters.

### **(2) Serious traffic congestions**

Generally, in Bangkok, a serious traffic congestion leads to a fatal delay of the governmental fire fighting arrival at the fire scene. At this point, it is true that the voluntary group has an advantage of not only being able to arrive at fire scene earlier than the governmental fire fighters but also being well versed in local road network. Before this meeting, we had thought that it had been difficult to find any measures. However, both parties worked out an original measure as follows. If it would have been possible for both parties to have their radio communication channel jointly, then the fire volunteers could suggest the way the governmental fire engine can go through smoothly.

### **(3) Obstruction a governmental fire engine’s traffic and activities**

At this meeting, both came to an agreement that the volunteers should not obstruct a governmental fire engine’s traffic and activities. Besides that, the fire volunteers proposed that the volunteers who could arrive earlier should prepare the own fire hose to be ready

when the official water supply truck reaches the fire scene.

#### **(4) Time loss for gathering information at the site of fire**

They came to an agreement that if it would have been possible for both parties to have their radio communication channel jointly as mentioned above, then both could relay the message to each other. For example, the fire volunteer who arrive the fire scene first can describe the situation to the governmental fire officers who can suggest how to deal with the situation while they are on the way.

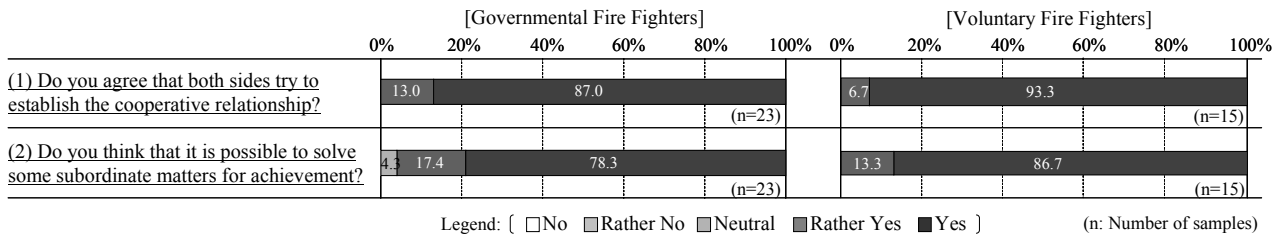
#### **(5) Loss of human resource to watch out for stealing fire-fighting equipment**

It was true that the governmental fire fighting equipment was often stolen by somebody who pretended to be a general public or to be even a voluntary fire fighter. For watching out for such a stealing, loss of human resource from the governmental fire-fighting team was unavoidable in the past. At this meeting, both came to an agreement that some of voluntary fire fighters should play a part in a watching out, and governmental fire fighter should concentrate on a extinguish activity.

Additionally, the leader of the voluntary group suggested an inspection for newcomer to avoid a wrongful person. Furthermore, the voluntary fire fighters themselves suggested that there should be the volunteer's ID card for every volunteer participating in fire extinguishing procedure. Such concrete proposals were seemed to be valuable to cultivate a mutual trust.

#### **(6) Lack of volunteers' equipment**

Actually, it is difficult to increase a number of fire engines with water tank in each voluntary base at once. Therefore, both parties came to an agreement that both parties try to



**Fig. 5.9 Results of the survey after the joint meeting**

perform their duties in cooperation with each other. Especially, they also had an agreement that the firefighters would allow the volunteer to use some of the official fire equipments at fire site on a relationship of mutual trust. Incidentally, when the fire volunteer needs to borrow the equipments from the governmental fire officers, they can use the above ID card as a guarantee for the loss of equipments. However, they also suggested that there would be no need to use these ID cards on condition that they would have full trust with each other in the long- run.

### 5.4.3 Their perspective for collaboration

At the end of the joint meeting, we also conducted a questionnaire survey ([4G] and [4V]) as a final checkpoint. It was quite simple survey that contains only two questions as shown in **Fig 5.9** Moreover, most part of this survey was devoted to an open-ended question.

According to **Fig 5.9(1)**, it is clear that both parties had a fundamental agreement on an establishment of a cooperative relationship with each other. Furthermore, what **Fig 5.9(2)** makes clear is that both parties also had a strong will to solve some subordinate and immediate problems. It can be considered that such a strong will results from various factors, such as the positive and constructive discussions as we mentioned in the previous section. From this viewpoint, we may conclude that the intended object of this approach at the beginning was satisfied.

The followings are some summarizations of typical replies to the open-ended

question. The following replies are sure to give authenticity to the above conclusion.

The most important point is that many participants thought highly of these meetings. According to these replies, before the series of these meetings, almost all participants did not notice that both parties have had the same fundamental stance on helping people. However, through the series of these meetings, both had begun to listen another party's opinion what they want. Additionally, some participants replied that if these meetings had not been launched, then both parties would not have had any chance to gather with unity of purpose over conflict and discord.

Especially, what needs to be emphasized is that most of them desired to have more meeting and continue the discussion with each other. They also replied that they had never talked and analyzed the problems in their own communities with each other in the past. That may be reason why continuous meetings are required by both parties.

As a whole, there were a lot of approving opinions to the several collaboration scenarios and so on, as we mentioned in (5.4.2). Additionally, some of them replied that a practical fire fighting training with each other was also required.

Only in the final place, to cultivate mutual friendship between them, we took a commemorative photograph, and talked about various topics over lunch. After that, this meeting broke up in a very friendly atmosphere.

## **5.5 CONCLUSION OF THE [PART 1]**

It follows from what has been discussed thus far that the intended object of this approach was satisfied. Namely, there is no doubt that this approach prompted both the governmental fire fighter and the voluntary fire fighter in this area to establish cooperative relations for the regional fire risk reduction. In view of the details of their history before this

approach, such a cooperative relations between them had seemed to be impossible. However, we may say that the strategy, which was devised as essential points from 1 to 4 according to an investigation of actual conditions, was helpful for solving this chronic problem peculiar to this district.

Turning now to the above strategy, far from being limited to a topic of a fire risk reduction in this district, it might have a wide application. That is to say, if we had concentrated to solve the subordinate immediate problems shortsightedly without their cognitions of both what was a super ordinate purpose and what was a context which connect the super ordinate purpose to the subordinate solutions, then both parties could not have approved of the subordinate solutions as shown in **Table 4.2**. In other words, we can compare the past situation to the proverb “cannot see the forest for the trees”. Needless to say, in this case, the word “forest” corresponds to the common public spirit “saving lives as much as possible” as a super ordinate purpose, and the word “tree” corresponds to the subordinate immediate problems as shown in **Table 4.2**. In brief, without unity of fundamental purpose, it is mostly impossible to solve any immediate conflicts or discords with the parties concerned. Moreover, what should be also emphasized is that several questionnaire survey reports for both parties played an important role in understanding of another party’s opinion, and that a visualization by the Regional Fire Fighting Validity Map made it possible for them to understand how effective a certain measure was on an achievement of the united purpose.

We should also mention a continuity. As for a continuity, it has been reported that it often happened that the outcome of certain practical activity (Katada et al., 2011), such as our approach, was brought to naught just as the prime mover suspended an activity. On the contrary, after the joint meeting, far from being brought to naught, the effect of our practical approach spread in various ways as follows. According to some interviews with both leaders in August 2011, both of them already started to put several ideas as shown in **Table 4.2** into



practice as much as possible. Above all, both have become to try to build up a closer connection with each other, such as a close teamwork at a fire site, calling each other by name, and so on. Furthermore, a fire drill at an elementary school and so on became to be executed under a collaboration between them. Incidentally, in the past the number of participants at the above fire drill was usually about five persons from Bang Khae fire station while there was no one from the voluntary fire fighting groups. On the contrary, almost 30 persons from Bang Khae fire station and almost 70 persons from the voluntary fire fighting groups join the fire drill at present. After such fire drills, many groups of schoolchildren became to make a field trip to the Bang Khae fire station with teachers, and both the governmental fire officers and the voluntary fire fighters became to deal positively with such visitors. We heard that this was quite a rare situation not only in Bang Khae district, but also in whole Bangkok's history. Because of this, this approach is attracting many people's attention, such as many voluntary fire fighters and governmental fire officers in whole Bangkok, the headman of Bang Khae district, the deputy governor of Bangkok Metropolitan Administration, and so on.

A future direction of this study will be to investigate the method or strategy to be prevailed widely not only throughout Bangkok and Thailand, but also to some regions whose official fire fighting ability is not enough in the world. The point of this investigation will be whether the practical approach should be executed in much the same way as the case of Bang Khae district or not. However, if we focus within Bangkok, we expect that it will be more simply. That is to say, it is likely that it is sufficient to introduce only the process of Bang Khae district as a pilot case study to the persons concerned in the future subject area, because most of such persons in Bangkok already have interest in this matter of Bang Khae district. In this sense, we may say that an investigation of an effective publicity strategy will become to be significant in Bangkok.

## **[PART 2]**

### **DEVELOPED COUNTRIES**

#### **- Trial Case Study on the Revitalization of the Regional Fire Preparedness in Japan -**

This [Part 2] would present in a part of developed countries in Chapter 6. However, this section would describe Trial Case Study on the Revitalization of the Regional Fire Preparedness in Japan to comparable with developing countries in [Part 1]. This [Part 2] fulfilled with five contents in this chapters as developed countries. First of all, I would like to propose introduction content. Then, Second content described the Frame of Analysis. Third content started investigating at Visualization the effects of “an approach to awaken a neighbor’s motivation” by using outputs of a fire spread simulation. After that, I would show the result of “Investigation and promotion of “an approach to awaken a neighbor’s motivation”. Last of this content would summarize in content of “Trial Case Study on the Revitalization of the Regional Fire Preparedness in Japan”. After all sections completed, Finally, Chapter 7 summarizes the thesis and the conclusions of this study.

## CHAPTER 6.

### AN ACTIVATION OF RESIDENTS' SPONTANEOUS MOTIVATION FOR REGIONAL FIRE IN JAPAN

#### 6.1 INTRODUCTION

##### 6.1.1 The background and the subject of this chapter

What is important in a regional fire risk reduction is not only a fire outbreak risk reduction on each houses, but also a fire spreading risk reduction as follows; a shortening the time till a perception of a fire outbreak, a shortening the time till telephoning to a fire station, a smoothing an extinguish at an early stage of fire, and so on.

However, at resent days in Japan where there is a highly developed fire fighting system, it seems that general people have tendency to think that a serious situation with many houses burned down by a spreading fire is quite unusual, because an ordinal fire fighting by both governmental fire fighters and fire volunteers can extinguish most of fires immediately. Namely, it has been more difficult than before for general people to intuitively feel such an indirect fire risk which comes from neighboring houses. The above present situation may be reworded as a situation where it has been difficult that some concrete activities (**cf. Table 6 1**) were roused to achieve a shortening the time till a perception of a fire outbreak, a shortening the time till telephoning to a fire station, a smoothing an extinguish at an early stage of fire, and so on.

In this chapter, having the above critical mind, I would like to consider the prerequisite to revitalize spontaneously residents' activities and motivations for a regional fire spread risk reduction. In these sentences, the word 'spontaneous' expresses a situation in which the residents' activities and motivations for a regional fire spread risk reduction are revitalized by some neighbors' approaches on their own initiative, not forcibly at the request of outsiders. Therefore, mainly, we will focus on local peoples' approaches on their own initiative in order to awaken a neighbor's activity and motivation for a regional fire spread risk reduction. After that, I would like to propose the frame of analysis following content.

### **6.1.2 Outline of this chapter**

The fundamental purpose of this part is to examine the effective measurement for improvement of the regional fire fighting ability in the developed countries. I think that the Japanese case is one of the good examples to examine this fundamental purpose at least, even though there may be some specific characters and problems in Japan. At glance, the course of the examination for the above purpose seems to be completely deferent with the developing countries. However, I think that the fundamental course or strategy for the examination ought to be the same as that of the discussions for the developing countries which in [part 2]. Namely, the outline of this chapter is as follows.

First of all, I would like to begin the discussion by considering what the fundamental issues in the improvement of the regional fire fighting ability at the subject area. This discussion will be hold in 6.2. Secondly, I would like to make some materials that can be expected to be a practical tool to solve the above issue. This discussion will be hold in 6.3. Finally, I would verify the validity of the above materials in 6.4.

## **6.2 FRAME OF THIS ANALYSIS**

### **6.2.1 Basic assumption of assumption of spontaneous revitalization for a regional fire risk reduction**

About an improvement in local disaster prevention activities, the importance of the spontaneous was already pointed out by several researchers and organizations (Katada, 2009; Katada, et al., 2010; Cabinet Office, Government of Japan, 2004; Ministry of Education, Culture, Sports, Science and Technology; 2007). And more generally, an intrinsic motivation used to be referred by many psychologists. According to these references, if an activity was done reluctantly because the administrative support would not be enough, or if an activity was simply based on an extrinsic motivation such as a control or a regulation by others, then this activity ought to become heterogeneously or dependently on others. For this reason, there are some possibilities that disaster prevention activities will not be done if an administration will be able to give enough support, or if there will be no control or regulation by others. In brief, these references pointed out that what is important in order to avoid the above situation and in order for the disaster prevention activities to be permanent is whether the activity is based on an intrinsic motivation such as a desire “I want to survive” or not. In contrast to the above personal action, we consider about a region as a unit in this study. Namely, we will discuss here about a spontaneous improvement of a regional fire fighting ability. At this point, we will focus on a local people’s approach to promote a neighbor’s action for fire spreading risk reduction. There is no doubt about such an approach being a personal action. However, there is a possibility that the neighbor’s action promotes the next neighbor’s action.

A fire risk of each houses consists of an outbreak fire risk at own house and a fire spread

risk from another burning building. In order to reduce the former risk, own carefulness is important fundamentally. On the other hand, to reduce the latter risk, the parts where can be reduced by only own carefulness is not so big. The important point is that a fully reduction of the latter risk will not be achieved without a neighborhood's carefulness. Accordingly, a person ought to be motivated to promote a neighbor's carefulness as a logical consequence, if the person was conscious of not only an outbreak fire risk at own house but also a fire spread risk from another burning building. If such a carefulness was spread continuously to a neighborhood, and if such people accounted for the great part of the community, then such a transition should be regarded as a spontaneously improvement of a residents' activities and motivations for a regional fire risk reduction.

In this study, we would like to focus on the above local peoples' approaches on their own initiative in order to awaken a neighbor's activity and motivation for a regional fire spread risk reduction (we refer to this as "an approach to awaken a neighbor's motivation".), and to discuss a spontaneous regional fire risk reduction due to "an approach to awaken a neighbor's motivation" <sup>[1]</sup>. Incidentally, as far as we know, it is difficult to find other studies on the necessary conditions for "an approach to awaken a neighbor's motivation". In this study, we would like to set up the following two hypotheses in terms of the above based on the past studies.

### **6.2.2 Hypothesis**

Generally, it seems that "an approach to awaken a neighbor's motivation" is often explained as an altruistic action. However, as we mentioned above, it is a characteristic of a spontaneous regional fire risk reduction that "an approach to awaken a neighbor's

motivation” can be also explained as a self-regard action <sup>[3]</sup>. For example, Aoki et al pointed out that it may be rational, at least, for “an individual A” to share the cost of measures against disasters performed by a neighbor of “an individual A” (Iwami et al., 1980; Iwami et al., 1984; Aoki et al., 2009; Aoki et al., 2009;). According to this observation, we may set the following hypothesizes.

*[Hypothesis 1] Even more, an action with no burden of expenses such as an “approach to awaken a neighbor’s motivation” ought to be done easily.*

Aoki et al. also discussed on the premise that the “individual A” not only understands clearly the existence of an externality of a fire spread risk, but also recognize that sharing the cost of a neighbor’s countermeasure for flammability is effective on a fire spread risk reduction from a neighbor to the “individual A”. Therefore, we may also set the following hypothesizes additionally.

*[Hypothesis 2] In order for an “individual A” to have a motivation for “an approach to awaken a neighbor’s motivation”, it ought to be necessary that the “individual A” understands not only the existence of an externality of a fire spread risk (Viewpoint (a)), but also that “an approach to awaken a neighbor’s motivation” has a certain effect on an own fire spreading risk reduction (Viewpoint (b)).*

In this study, at first, we would like to try to visualize the above “viewpoint a” and “viewpoint b” by using outputs of a fire spread simulation in chapter 6.3. In chapter 6.4, we would like to verify the above [hypothesis 1] by an investigation on a general trend of a

motivation for “an approach to awaken a neighbor’s motivation”. Continuously, we would like to also verify the above [hypothesis 2] by an investigation of an effect of a providing the above visualized fire spread simulation outputs for people on a promotion of a motivation for “an approach to awaken a neighbor’s motivation”

**Table 6.1 Examples of resident’s activities for regional fire spread risk reduction**

Effects	Examples of resident’s activities
a shortening the time till a perception of a fire outbreak	install a residential fire alarm
a shortening the time till telephoning to a fire station	same as the left
a smoothing an extinguish at an early stage of fire	a smoothing an operation of a hydrant and so on by a participation with a fire drill

### 6.3 VISUALIZATION THE EFFECTS OF “AN APPROACH TO AWAKEN A NEIGHBOR’S MOTIVATION” BY USING OUTPUTS OF A FIRE SPREAD SIMULATION

#### 6.3.1 The outline of the fire spread simulation

A great deal of studies has been accumulated on a fire-spreading simulation model. For examples, Saito et al. divided these models into the following four categories (Saito et al., 2006);

- 1) *Fire spread speed formula (HAMADA formula)\*, TOSHO formula\*\*, etc.,*

\*Japan Association for Fire Science and Engineering, 1997,

\*\*Tokyo Fire Department, 1997a; 1997b; 2001;

Itoigawa, 1988; 1989;

National Institute for Land and Infrastructure Management, 2003,



2) *Physics-based fire spread model (MLIT General Project Model\*\*\*, Himoto\*\*\*\*, etc.),*

\*\*\*Ministry of construction, 1982;

\*\*\*\*Himoto, 2005,

3) *Simulations (Applying the above 1) and 2) to practical areas)*

4) *Development of indicators (ratio of noncombustible area\*\*\*\*\*, etc.)*

\*\*\*\*\*National Research Institute for Earth Science and Disaster Prevention (NIED), 2008.

As the purpose of this paper is concerned, it is desirable that we adopt the type of the above 3) category, because both the purpose of this paper and the methods of the above 3) category intend to be applied to practical areas. Furthermore, the adopted method should be able to be expressive not only of the actual situation under the influence of the permanent fire fighting and the fire volunteer's activities, but also of the neighbors' concrete behaviors (**cf. Table 6 1**) which will be promoted by "an approach to awaken a neighbor's motivation"

Regarding to the fire spreading simulation model, we will discuss the outline of the fire spreading model in 6.3.1., the outline of the extinguishment activity model in 6.3.2., and the visualization of the neighbors' concrete behaviors which will be promoted by "an approach to awaken a neighbor's motivation" in 6.3.3.

In this study, we adopt the Physics-based fire spread model (MLIT General Project Model) as a basic model of the fire spreading logic. The followings are the some of the summaries of the characteristics of the model regarding to this study.

The model may express the fire spreading process and the effects of the measures against it in detail, because the detailed physical mechanism of fire spreading is reflected in

this model based on experimentations.

The calculations on this simulation are carried out based on the transition state of each “section”. The “section” is a uniform space bordered by the internal walls. The possibility of fire spreading to the next section is computed by calculating the states of each sections and the heat conduction.

The difference in the flammability of the structural type can be considered in the calculations.

The state of combustion at each section is calculated based on a heat generation rate ( $Q$  (kW)) as a function of time elapsed. Therefore, when the extinguishment activity model was added, then the influence by the rapidness and the delay of the spraying water will also be considered. Moreover, to decide the timing of the neighbor’s perception in the simulation, it is possible to use the timing of the flashover that is decided endogenously.

### **6.3.2 The outline of the extinguishment activity model**

What is expressed by the above fire spreading simulation model is only the situation in which any fire fighting is not done at all. In this paper, we add the model which can express [(1) fire fighting activities by the permanent fire fighting and the fire volunteers] and [(2) resident’s extinguishment at an early stage of a fire]. As its basic components, we adopt the extinguishment activity model which was developed by National Research Institute for Earth Science and Disaster Prevention (NIED, 2008). In this model, whether the fire was extinguished or not can be judged when [the total amount of sprayed water] reaches [a threshold value calculated from a multiplication the amount of burnt floor space by a coefficient] which is estimated every minute. What is distinctive is that this model includes

the logic in which the advancement of a fire is controlled by increasing the amount of sprayed water. To express the effect of extinguishments, it seems that the above logic becomes to be necessary. Additionally, it is also necessary to assume other logics which express some concrete extinguishment activities. Here we explain the parameters in [(1) fire fighting activities by the permanent fire fighting and the fire volunteers] and [(2) resident's extinguishment at an early stage of a fire].

**(1) Parameters in the fire fighting activities by the permanent fire fighting and the fire volunteers**

The extinguishment activities are assumed to be started through the following process;

- 1) Preparation after receiving a first fire reporting,
- 2) Turning out and move to a water supply nearest by the fire site,
- 3) Secure enough water supply and connect hoses,
- 4) Start spraying water.

**Table 6.2 Parameters of fire fighting activities**

	<b>Permanent fire fighting (official)</b>	<b>Fire volunteers</b>
(1) preparation	the time required = 120 second	the time required = 300 second
(2) turning out, and move to a water supply	speed: 40 kilometers an hour as an average / distance: x kilometers / root: the shortest distance	
(3) secure enough water supply, and connecting hoses	the time required for secure enough water supply as an average = 40 second the time required for connecting one hose as an average = 7 second Number of hoses = h / length = 20m / maximum number of hoses = 10	
(4) spraying water	500 liters / nozzle / minute (Number of nozzles per fire engine = 2 ) (Number of fire engines is depend on the regional basic plan)	
total time from (1) to (4) (second)	$T_j=120+x \cdot 3600/40+MAX(40, 7 \cdot h)$	$T_d=300+x \cdot 3600/40+MAX(40, 7 \cdot h)$

We set the parameters in the above process from 1) to 4) according to the interview with Kiryu Fire Department headquarters as shown in **Table 6.2**. Here, we assumed that the parameters in the fire fighting activities by the permanent fire fighting is the same as the

parameters in the fire fighting by the fire volunteers, except for the parameters regarding to the process 1). Therefore, the total time from process 1) to 4) is calculated as shown in the bottom of **Table 6.2**.

**Table 6.3 Parameters of fire fighting activities by residents**

Parameters of fire fighting activities by residents	
(1) a perception of a fire outbreak, and call to fire station	<p>the time required for a perception by the house owner = <math>t_p</math> (second) (from an outbreak of a fire to the perception)</p> <p>the time required for a perception by a neighbor : <math>t_f</math> (second) (from an outbreak of a fire to a flashover) (we assumed that a neighbor can percept the flashover at least) (we assumed that a neighbor can percept the flashover within a 20 meters radius)</p> <p>We assumed that the house owner or the neighbor call to a fire station "<math>t_i</math>" seconds after the perception.</p>
(2) move to the nearest simplified outdoor fire hydrant	<p>The house owner or the neighbor moves from the perception place to a simplified outdoor fire hydrant which is nearest one from where the fire started.</p> <p>Speed: 2 (m/s) Move distance : <math>y</math> (km)</p>
(3) operate the simplified outdoor fire hydrant, and move to the place where the fire started.	<p>the time required for an operation of a simplified outdoor fire hydrant = <math>t_o</math> (second)</p> <p>The house owner or the neighbor sprays water at the nearest place by the fire where the distance from the simplified outdoor fire hydrant is less than the length of the hose ( 20 meters radius).</p> <p>Speed: 2 (km/h) Move distance: <math>z</math> (km/h)</p>
(4) Spray water	60 liters / min / nozzle (Number of nozzle : 1)
Total time from (1) to (4) (second)	<p>(In the case of which a perception by the house owner is earlier than a neighbor's one) <math>T_i = t_p + y \cdot 1000/2 + t_o + z \cdot 1000/2</math> <math>= t_p + t_o + 500 \cdot (y+z)</math></p> <p>(In the case of which a perception by the neighbor is earlier than a house owner's one) <math>T_i = t_f + y \cdot 1000/2 + t_o + z \cdot 1000/2</math> <math>= t_f + t_o + 500 \cdot (y+z)</math></p>

## (2) Resident's extinguishment at an early stage of a fire

On referring to the extinguishment model by Himoto (Himoto et al., 2006), we express the resident's extinguishment activity. The possible factors relating to the controlling the fire growth could be as follows; [a perception of a fire outbreak], [telephoning to a fire

station] and [extinguishment at an early stage of fire] . Among these factors, with regard to the resident’s tool for [extinguishment at an early stage of fire], we consider the [simplified outdoor fire hydrant] which can spray water by only one resident’s operation. These three factors correspond to the activities shown in **Table 6.1**. The resident’s extinguishment at an early stage of a fire is also assumed to be started through the following process;

- 1) Preparation after receiving a first fire reporting.
- 2) Turning out and move to a water supply nearest by the fire site.
- 3) Secure enough water supply and connect hoses.
- 4) Start spraying water.

We set the parameters in the above process from 1) to 4) as shown in **Table 6.3**. Here, we assumed that the neighbors’ concrete behaviors (**cf. Table.6 1**) which will be promoted by “an approach to awaken a neighbor’s motivation” are expressed as shown in **Table 6.4**.

**Table 6.4 Influences on resident’s behaviors for a fire spread risk reduction**

	<b>Influences on resident’s behaviors for a fire spread risk reduction</b>
the time from a fire outbreak to a perception of a fire outbreak	(a house of a fire outbreak had not installed a residential fire alarm) a house owner will perceive an outbreak of a fire $t_p$ (=120 seconds) after the outbreak of the fire. (a house of a fire outbreak had already installed a residential fire alarm) a house owner will perceive an outbreak of a fire $t_p$ (=60 seconds) after the outbreak of the fire, and neighbors will also perceive the outbreak of the fire by the residential fire alarm sounds.
the time from the perception of a fire outbreak to a telephoning to a fire station	a shortening or a delay the time till telephoning to a fire station $t_r=600$ , or 0 (seconds)
the time from the perception to a starting an extinguishment at an early stage of fire	a smoothing or a delay an extinguishment at an early stage of fire by residents using simplified outdoor fire hydrants $t_o=30, 60, 90, 120$ , or $\infty$ (second)

### 6.3.3 Visualization the effect of “an approach to awaken a neighbor’s motivation” by using the fire spreading simulation

Until the last section, we gave an outline of the basic components of the fire spreading simulation. In this section, we try to make concrete materials which will be presented to the participants when we will observe the effect on promoting the motivation for “an approach to awaken a neighbor’s motivation” in the next chapter.

#### (1) Applying the simulation to practical area

The results of the fire spreading simulation are changed readily depend on the conditions and distribution of houses, road network, structural type, water supply, simplified outdoor fire hydrant, and residents. Therefore, in order for the participants to be able to understand the materials with much presence, it is desirable that the practical information related to the above conditions will be corrected as much as possible and will be considered in the fire spreading simulation.

In this study, we selected the place shown in **Fig. 6.1** (Hon-cho 1 choume and 2 choume, Kiryu city, Gunma prefecture) as a subject area of the simulation, and collected the above information with the cooperation of the neighborhood association as shown in **Fig. 6.1**. Among these, the locations of the simplified outdoor fire hydrants which were not provided at that time were discussed and decided as their wish. The regulation at numbers of fire engines in this subject area is as shown in **Table 6.5**.

**Table 6.5 Regulation at numbers of fire engines in the subject area**

Classifications		Regulation at number of fire engines
Permanent Fire Stations	Kiryu fire station	2 cars
	East fire station division	2 cars
	South fire station division	1 car
Fire Volunteer Groups	6 groups	6 cars (1 car / group)

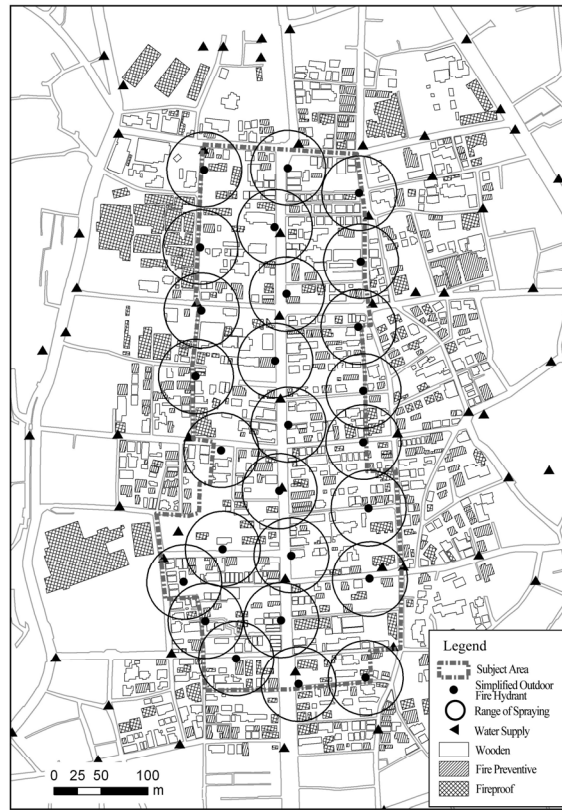


Fig 6.1 Simulation Area

## (2) Evaluation for a fire spreading risk

As we mentioned in the preceding paragraph, it is possible to set various scenarios in the fire spreading simulation. Especially, the setting of the fire breakout location affects definitely on the result of the fire spreading simulation.

Therefore, in this study, we grasp the fire spreading risk based on the  $p$  (fire-spreading rate) which is calculated from the fire spreading simulations on every possible condition that one section is set as a fire breakout point. The definition of  $p$  is as follows.

$$p = \text{COUNT}_{\text{FIRE}} / \text{COUNT}_{\text{IN}} \quad (1)$$

The value of  $p$  is the ratio of [the number of trials that the flames spread to the subjected section which is located within 20 meters from other burning sections ] to [the number of

trials that the subjected section is located within 20 meters from other burning sections]. Incidentally, the trial in which the own section is the starting point of the fire spreading simulation is not counted into the above  $COUNT_{IN}$  and  $COUNT_{FIRE}$ . The value of  $p$  which is computed by the way of the above calculation denotes the degree of the fire spreading risk at the subjected section suffered from the other sections.

The total number of sections in the subject area is 609. Therefore, 608 (=609-1) trials are needed to evaluate the every sections' fire spreading risk under the one scenario. Incidentally; these calculations are continued until finishing fire at each section of the subject area. Moreover, the result of the simulation changes according to the wind. In this study, we assume that the wind condition is invariable, because the purpose of this study is to compare relatively among several scenarios.

### **(3) Visualization the effect of “an approach to awaken a neighbor’s motivation”**

On the basis on the above preparations, we try to make concrete materials which will be presented to the participants when we will observe the effect on promoting the motivation for “an approach to awaken a neighbor’s motivation” in the next chapter. Incidentally, **Table 6.6** shows the list of the scenarios and the interpretations of them.

#### **a. Visualization of [the existence of an externality of a fire spread risk (Viewpoint (a))]**

**Fig. 6.2** shows the value of  $p$  by the distance from the place where the fire started to the subject section. The details of the scenario settings are the same as shown in **Table 6.6**. The scenario setting “almost actual (the permanent fire fighting will start rapidly. Residential fire alarms are not installed in any houses.)” is common to the case 1, 2, 3, and 4. The difference of the scenario setting between the case 1, 2, 3 and 4 is only the existence of the resident’s extinguishment at an early stage and its rapidness, but we

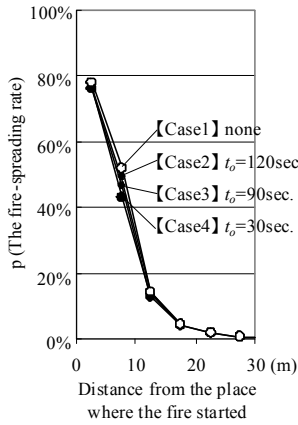


**Table 6.6 Simulation scenarios**

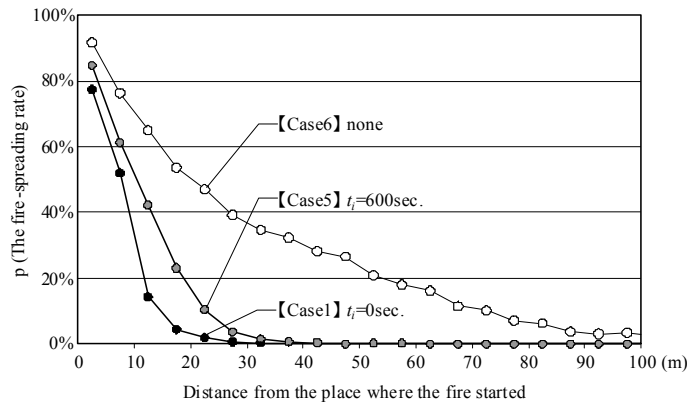
Activities which will be promoted by “an approach to awaken a neighbor’s motivation” (See Table 6.1 and Table 6.4)					an installation of a residential fire alarm	a shortening or a delay the time till telephoning to a fire station	a smoothing or a delay an extinguishment at an early stage of fire by residents using simplified outdoor fire hydrants	
details of the simulation scenarios, and explanations of the simulation scenarios								
Fig 6.2	Case 1	These scenarios express the situation similar to the actual (the permanent fire fighting will start rapidly. Residential fire alarms are not installed in any houses.)	A resident’s extinguishment at early stage of fire is ...	...not done at all.	(we verified that it has no effect on Fig 6.2)	none	$t_i=0$ (sec.)	none
	Case 2			...done quite slowly.		none	$t_i=0$ (sec.)	$t_o=120$ (sec.)
	Case 3			...done rather slowly		none	$t_i=0$ (sec.)	$t_o=90$ (sec.)
	Case 4			...done quite rapidly.		none	$t_i=0$ (sec.)	$t_o=30$ (sec.)
Fig 6.3	Case 1	These scenarios express the situation in which the resident’s extinguishment at early stage of fire will not be done at all, and in which the residential fire alarms are not installed in any houses.)	the permanent fire fighting will...	...start rapidly at the same time the fire breaks out.	(we verified that it has an effect on Fig 6.3)	none	$t_i=0$ (sec.)	none
	Case 5			...start 10 minutes after the breakout of the fire.		none	$t_i=600$ (sec.)	none
	Case 6			...not be done at all.		none	none	none
Fig 6.4	Case 6	These scenarios express the situation in which the permanent fire fighting does not work at all.	A resident’s extinguishment at early stage of fire is ...	...not done at all.	(we verified that it has an effect on Fig 6.4)	none	none	none
	Case 7			...done quite slowly.		none	none	$t_o=120$ (sec.)
	Case 8			...done rather slowly.		none	none	$t_o=90$ (sec.)
	Case 9			...done quite rapidly.		none	none	$t_o=30$ (sec.)
Fig 6.5	Case 4	These scenarios express the situation in which both the permanent fire fighting and the resident’s extinguishment at early stage of fire will work to a maximal degree.	Residential fire alarms are...	...not installed in any houses.	(we verified that it has an effect on Fig 6.5)	none	$t_i=0$ (sec.)	$t_o=30$ (sec.)
	Case 10			...installed in every houses.		installed	$t_i=0$ (sec.)	$t_o=30$ (sec.)

cannot find any influences of this factor upon the value of  $p$  according to **Fig. 6.2**.

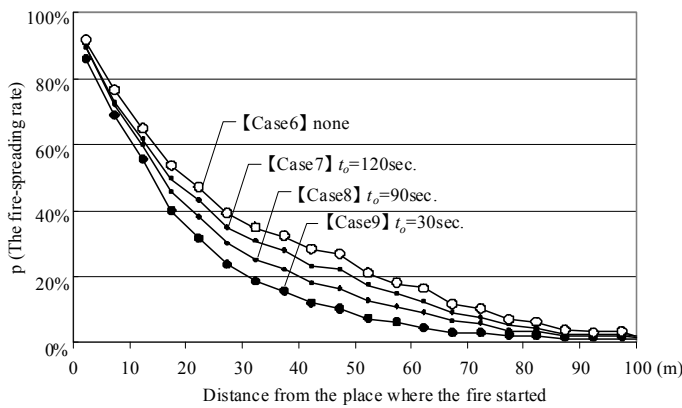
The reason for the above could be as follows. Therefore, under the condition similar to the actual situation (the permanent fire fighting will start rapidly), a resident’s extinguishment at early stage of fire has no effect on a fire spreading risk reduction, because the fire spreading risk had already been reduced fully. This result can be surely interpreted as the resent Japan situation where there is a highly developed fire fighting system as we mentioned in content 6.1, such as “it seems that general people have



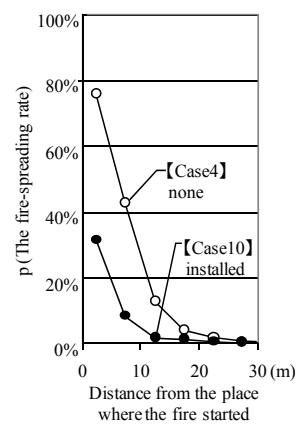
**Fig 6.2** The influences of the variation in  $t_0$  on  $p$



**Fig 6.3** The influences of the variation in  $t_i$  on  $p$



**Fig 6.4** The influences of the variation in  $t_0$  on  $p$  under the condition in which the permanent fire fighting does not work at all



**Fig 6.5** The influences of the installation of a residential fire alarm on  $p$

tendency to think that a serious situation with many houses burned down by a spreading fire is quite unusual, because an ordinal fire fighting by both governmental fire fighters and fire volunteers can extinguish most of fires immediately. Namely, it has been more difficult than before for general people to intuitively feel such an indirect fire risk which comes from neighboring houses. Therefore, we can interpret this tendency in the following way. Many people think that “If there are not any differences between [do] and [not do], then I should choice [not do] in order to avoid an unnecessary behavioral cost. In the above **Fig. 6.2**, the main point was a conjecture that the most effective factor was a highly developed permanent fire fighting system. Therefore, in **Fig. 6.3**, we

compare with [case 1: the permanent fire fighting will start rapidly at the same time the fire breaks out], [case 5: the permanent fire fighting will start 10 minutes after the breakout of the fire] and [case 6: the permanent fire fighting will not be done at all]. Namely, we will discuss the influences of the existence of the permanent fire fighting. According to this result, we can see a drastic tendency for the value of  $p$  to be increased as the permanent fire fighting becomes weak or delays. In other words, we can recognize anew that a recent daily life in Japan that is protected by a high-developed permanent fire fighting system, and how important a rapid reporting to a fire station is.

**b. Visualization of the fact [“an approach to awaken a neighbor’s motivation” has a certain effect on an own fire spreading risk reduction (Viewpoint (b))]**

On the other hand, as for the resident’s extinguishment at an early stage of a fire whose effect could not be seen on the value of  $p$  under the actual situation at all in **Fig. 6.2**, we will discuss about it in **Fig. 6.4** under condition that the permanent fire fighting is not done at all. According to **Fig. 6.4**, we should accept the fact that the value of  $p$  is still high at places far from the fire breakout point in each case, but then we should also recognize the effect of a resident’s extinguishment at much earlier stage of a fire on a decrease in the value of  $p$ .

If we compare with **Fig. 6.2** and **Fig. 6.4**, then we may say that a presentation of **Fig. 6.4** is helpful for people who live in an actual situation like **Fig. 6.2** to recognize [the effect of a resident’s extinguishment at much earlier stage of a fire] and [the usefulness of a participation in some fire drills on a shortening the time till starting the resident’s extinguishment.]

**Table 6.7 Outline of the questionnaire surveys for verification of the hypothesis**

<b>Date</b>	2010.7.13, 2010.7.20
<b>Subject</b>	Students (Faculty of Engineering, Gunma University) : 190
	(1) Prior Questionnaire Survey
	(2) Lecture including materials which were made in the previous section
	(3) Post Questionnaire Survey

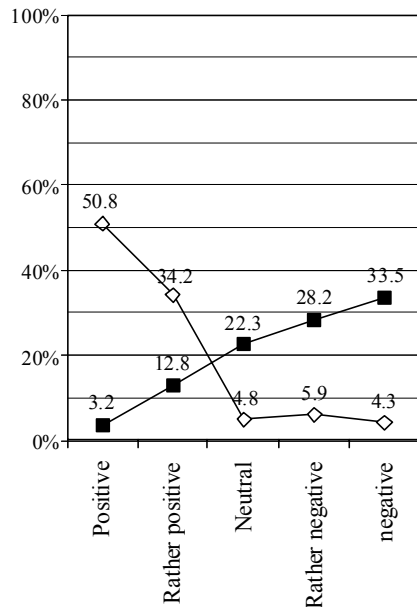
Next, in **Fig. 6.5**, we will discuss an influence of an installation of a residential fire alarm at a fire breakout house on the value of  $p$ . According to **Fig. 6.5**, we can see clearly the change of the value of  $p$  by an installation of a residential fire alarm at the fire breakout house within 20 meters. In brief, as for an installation of a residential fire alarm at every house, only its selfish benefit such as an own fail avoidance to evacuate has a tendency to be emphasized as a first meaning, but we can also emphasize that it can promote a neighbor's fire spreading risk reduction which the neighbor is suffered from a house owner installing a residential fire alarm.

In consequence, we may say that an approach to awaken a neighbor's motivation for such as [installation a residential fire alarm], [rapidly reporting to a fire station] and [a smoothing an operation of a hydrant and so on by a participation with a fire drill], has not only a benefit for a neighbor, but also a selfish benefit.

#### **6.4 INVESTIGATION AND PROMOTION OF “AN APPROACH TO AWAKEN A NEIGHBOR’S MOTIVATION”**

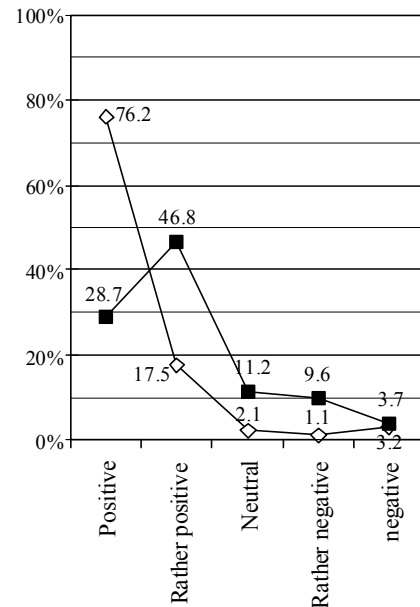
Until the preceding chapter, I verified the feasibility of the visualization of the above viewpoint (a) and (b) by using a fire spreading simulation. In this chapter, I would like to consider [hypothesis 1] on the basis of a investigation of a general inclination of a motivation

for “an approach to awaken a neighbor’s motivation”, and also consider [hypothesis 2] on the basis of an observation of the effect of a presentation of a visualized simulation outputs on a promoting a motivation for “an approach to awaken a neighbor’s motivation”.



**【Before】**  
 ■ Q1:Willingness to do “an approach to awaken a neighbor’s motivation”.  
 ◇ Q2:Willingness to do some preparedness against fire for myself

**Fig. 6.6 Pre-Questionnaire Survey**



**【After】**  
 ■ Q1:Willingness to do “an approach to awaken a neighbor’s motivation”.  
 ◇ Q2:Willingness to do some preparedness against fire for myself

**Fig. 6.7 Post-Questionnaire Survey**

### 6.4.1 The experimental conditions

As summarized in **Table 6.7**, we conducted an experiment in order to verify the above two hypothesis according to the following procedure.

At the start of the class, the pre-questionnaire survey was conducted under condition that there are not any expositions by the teacher. The main questions for this verification are as follows:

(Q1) Do you want to approach your neighbors in order to promote the neighbor's motivation for a fire risk reduction? (We refer to this as [Willingness to do "an approach to awaken a neighbor's motivation"])

(Q2) Do you want to do some preparedness against a fire for myself? (We refer to this as [willingness to do some preparedness against fire for myself])

The participants had almost 10 minutes to fill out the questionnaire.

After that, the participants had almost 70 minutes for some expositions about a fire fighting including several topics of **Fig. 6.2**, **Fig. 6.3**, **Fig. 6.4** and **Fig. 6.5**. Therefore, the information of the above viewpoint (a) and (b) which was assumed to have an effect to promote the participants' motivations for "an approach to awaken a neighbor's motivation" were presented definitely to the participants.

After the expositions, the participants also had almost 10 minutes to fill out the post-questionnaire survey. The questions of the post-survey were totally same as the pre-survey. The primary concern is the changes of the responses in the above Q1 and Q2 from the pre-survey to the post-survey.

## **6.4.2 The results of the experimentation**

### **(1) Verification for [hypothesis 1]**

**Fig. 6.6** shows the result of the pre-survey. According to **Fig. 6.6**, we can see that the positive responses to Q2 (willingness to do some preparedness against fire for myself) account for 85.0% of all respondents. On the other hand, it is clear that most of respondents have negative opinions for Q1 (Willingness to do "an approach to awaken a neighbor's motivation"). Namely, it is clear that this result does not support the [hypothesis 1].

## **(2) Verification for [hypothesis 2]**

Incidentally, **Fig. 6.7** shows the result of the post-survey. According to **Fig. 6.7**, as for the answers for Q1 (Willingness to do “an approach to awaken a neighbor’s motivation”), we can see the definite tendency contrary to the **Fig. 6.6**. That is to say, we can see that the positive responses to Q1 (Willingness to do “an approach to awaken a neighbor’s motivation”) account for 75.5% of all respondents. Namely, such a positive opinion for Q1 increased dramatically. Therefore, we can say that this result shown in **Fig. 6.7** supports the [hypothesis 2]; because it is clear that this result had been influenced by the information-giving of the above viewpoint (a) and (b) <sup>131</sup>.

Incidentally, it is interesting that the positive opinions for Q1 also increased after the information-giving. Furthermore, from now on, a follow-up survey will be needed to verify whether such remarkable changes are permanent or temporally.

## **6.5 SUMMARY**

In this study, we verified the requirements for an activation of residents’ spontaneous motivation for regional fire spreading risk reduction. Here, on the basic recognition that it is important that the residents’ activities and motivations for a regional fire spread risk reduction should be awakened spontaneously by some insiders’ (who live in the same community) approaches on their own initiative, not forcibly at the request of outsiders, the verifications were conducted focusing on [the local peoples’ approaches on their own initiative in order to awaken a neighbor’s activity and motivation for a regional fire spread risk reduction (“an approach to awaken a neighbor’s motivation”).

It was found from the results that a person who had understood deeply the existence of the fire risk which spread from its neighborhood, had a basic tendency to be motivated to awaken a neighbor's activity for a regional fire spread risk reduction. Especially, it is quite interesting that such a basic tendency can be explained as not only an altruistic motive but also a selfish motive.

On the contrary, it also became to be clear that such a basic tendency is not always majority in actual, especially in a recent daily life in Japan which is protected by a high-developed permanent fire fighting system. In contrast, we made some contents in order to promote such a motivation, and verified its usefulness. Whether these two hypotheses can be proved even for ordinary people or not is open to discussion.

Incidentally, as far as the details of the simulation model, it is difficult to find originality of the simulation model structure because the simulation model was based on the existing logics, which were already proposed by other researchers in the past. However, it is no exaggeration to say that one of the notable features of this study is the new proposal for utilization of the fire spreading simulation in order to activate various activities of the permanent firefighting, the fire volunteers and residents in daily fire accidents, not for utilization on a rare emergency with many houses burned down by a spreading fire due to a huge earthquake like a lot of past studies. In other words, as for a significance as a social technology, what has to be noticed is that we succeed to show a possibility that even such an existing simulation model can contribute for a spontaneous improvement of a regional fire fighting.



## ACKNOWLEDGEMENTS

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## NOTES

- [1] By definition of the psychological field, "external motivation" means that your motivation to attain your goal comes from a source outside yourself, and "internal motivation" means that your motivation to accomplish your goal comes from within you. If I followed these definitions which were definite in units of one individual, it has to be said that "Doing an activity due to neighbor's promoting" which was considered in this chapter seems to be based on an "External motivation". However, in the sense that a unit is a region as mentioned in this chapter, an improvement of the regional fire fighting validity by "Doing an activity due to neighbor's promoting" is not less than "internal".
- [2] I can give same logic examples as the Fire spreading topic (e.g. a personal activity for reinforcement own building or house for an earthquake-proof structure.
- [3] It is still unclear the effect of the presentation of only viewpoint (a) or only viewpoint (b) separately.

## **CHAPTER 7**

### **CONCLUSION AND SUMMARY**

To conclusion, there are many regions that governmental disaster fighting ability is still not sufficient in the globe because the balance on the relationship of governmental and residents are ambiguous. On the other hand, some regions in the balance situation among stakeholders have been a good relationship in developed countries. Nonetheless, an unbalance system has existed disputable problems because residents in communities have never recognize to serve themselves. Finally case, an official ability cannot support citizen. They have to help themselves when disaster occurred in developing countries even though this situation happened in some developed countries in the past. Therefore, I considered improving the abilities and relationship between local government and residents in the disaster preparedness mitigation some countries in the world.

I would like to say that the disaster activity of countries have to be characterized countermeasure for each own area. In my studied, I proposed the regional fire fighting validity to be a key for discovery solution in my study area. It became clear that the actual situation about regional fire fighting is different between Bangkok and Japan. By way of some practicable activities such as interviews, investigations, consideration and making the regional fire fighting validity map, it also became obvious that there are many impediment to improve the efficiency for fire extinguishers such as the minority of fire stations, chronic traffic congestion, insufficiency of fire fighting's ability, and so on. Especially, a crucial point of uncooperative relationship and untrustworthy mind between stakeholders should be remedial solution first and

foremost. It surely seems to be difficult to establishment of cooperative relationship at the beginning. However, I would recognize that each stakeholder already hold in common the fundamental purpose of “Saving Life”. As a result, it was confidently possible to establish a cooperative relationship from a long-term viewpoint. Surely, short of unity of fundamental purpose, it is impossible to solve immediate conflicts or discords with the parties concerned. Additionally, several questionnaire survey report that both groups admitted the role of another party’s disagreement, and that the visualization by the Regional Fire Fighting Validity Map produced to define how effective a certain measure was on an achievement of the united purpose.

According to all work principle above, I have been reported from both parties after departed the joint meeting in study area. My practical approach is far from being brought to naught because both of them already started to build up a closer connection with each other, such as a close teamwork at a fire site, calling each other name, and other executed under collaboration between them. For these reason, I can evaluate my research approach to proactively succeed following reported by both parties from a study area.

As I have mentioned above, some regions in the balance situation among stakeholders have been a good relationship in developed countries. But an unbalance system has existed disputable problems because residents in communities have never recognize to serve themselves. For principal cause of unbalance system, I considered that a highly developed disaster fighting system could protect resident’s daily life. General people have tendency to think a severe situation of a spreading fire in own communities that is normally intuitively not only surrounding circumstances but also critical mind.

For these reason, I decided to consider the prerequisite to revitalize spontaneously residents' activities and motivations for a regional fire spread risk reduction in my study because some neighbors' approaches on their own initiative, not forcibly at the request of outsiders. Therefore, I would like to work with local people's approaches on their own initiative in order to awaken a neighbor's activity and motivation for a regional fire spread risk reduction in the same community as a case study.

In this study, I found that a person who had understand deeply the existence of the fire risk which spread from its neighborhood, have a basic tendency to have a motivation to awaken a neighbor's activity for a regional fire spread risk reduction with altruistic motive but also a selfish motive. On the other hand, it also became obvious that a basic tendency is not always majority in actual. In fact, I made some contents in order to present such a motivation, and verified its usefulness. In particular, whether these two hypotheses can be verify even for ordinary people or not is open to discussion.

However, it is no overstatement to mention that one of the notable features of this study is a new proposal for utilization of the fire spreading to stimulate a variety of routine fire fighting duty simulation. That made my project vastly different from other previous studies excluding a spreading fire owing to a tremendous earthquake. I would encourage the successful to show an existing simulation model that can contribute for a spontaneous improvement of a regional fire fighting in daily life situation.

To summarize, it is clear that there is no doubt about the differences of the fundamental problems to be solved between developing countries and developed countries in disaster prevention activity. Even, I would mention just fire fighting scenario in this research. In fact, there have to be a peculiar disaster countermeasure for each subject area.

I would say that making full use of the community resource such as regional stakeholders activities ought to become a key to improve the regional fire fighting validity in developing countries. Therefore, I do confidently declare that all my strategies can make it clear to solve problems and to succeed an establishment of cooperative relationship between governmental and non-governmental for the regional fire fighting.

Simultaneously, I also would strongly believe in that even a reinvigoration of a community ought to become key to improve the regional disaster fighting in developed countries but not seem to be successful practically in reinvigoration of a community. Therefore, residents' activities and motivations for against disaster should be on their own initiative in order to awaken neighbor for disaster preparedness around their own communities.

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