



Development of Comprehensive Disaster Risk Management Matrix for better decision-making and consecutive management on disaster risk reduction

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Abstract

In Japan, many municipalities face on the lack of human resources with high specialty and budget for disaster risk management. According to the survey by the Ministry of Internal Affairs and Communications, one third of municipalities have no specific staff for disaster risk management. This leads to difficulty in planning appropriate measures according to the characteristics and circumstances of each municipality. In actuality, through the questionnaire survey which our group conducted to municipalities, they pointed out the limitation of human resources and budget as the top and the 2nd most critical issues on the disaster-related measure planning.

On the other hand, under the circumstance that the number of municipality staffs has been decreasing for the last 20 years, the good coordination against large-scale disaster is necessary among individual, community, local municipality and government. However, there is no proper table and coordination system which individual and community can join on the planning of municipalities. Considering these issues, the primary objective of this study is to provide useful and robust tool for the effective and cooperative disaster-related measure planning including concrete action plan.

To achieve this objective, the Comprehensive Disaster Risk Management Matrix using the concept of the project management was developed and proposed as one of the outputs by the Special Committee for Regional Disaster Prevention Plan on Japan Society for Civil Engineering, which was established after the Great East Japan Earthquake in 2011. This matrix has stakeholders on vertical line, and seven phases on disaster management cycle, namely, damage mitigation, preparedness, prediction and early warning, damage assessment, emergency disaster response, recovery and reconstruction on horizontal line. Disaster-related measures including detail information and past good practices were listed up in each cell, which is named as Ideal Situation Matrix (ISM), so that each stakeholder can find what and how to do in each phase. This matrix is expected to be utilized in the discussion on the role and coordination according to the each capacity of stakeholders.

Another function of the matrix is to generate action plan containing effective disaster-related measures. Action Item Matrix (AIM), which is equivalent to the aggregation of necessary measures, can be obtained by the difference between ISM and Current Situation Matrix (CSM), which is ISM-CSM. Finally, the action plan can be produced by prioritizing the AIM with effectiveness considering provided time and budget.

The local government is expected to check the state of the progress by continuously comparison of the two matrixes, which enables disaster risk management to be on the Plan-Do-Check-Act management cycle. This methodology is expected to be the powerful tool for both robust policy-making and effective management according to the social and environmental situation.

Keywords: Disaster Risk Management, Comprehensive Disaster Management Matrix, Project Management



1. Introduction

The work presented here is for developing useful and robust tool for the effective and cooperative disaster-related measure planning.

After the Sendai Framework adopted at the Third UN World Conference on Disaster Risk Reduction in 2015, more and more attentions are paid to disaster risk reduction (hereinafter referred as “DRR”) activities. However, most of the persons in charge of DRR measure planning in local governments and communities do not have enough experience and expertise to make proper DRR activity from the comprehensive viewpoint, which leads to have tendency to work with the easy and noticeable activities. Under this situation, the tool for logical and comprehensive DRR measure planning is strongly required.

In this background, the Comprehensive Disaster Risk Management Matrix (hereinafter referred as “CDRM Matrix”) using the concept of the project management was developed and proposed as one of the outputs of the Special Committee for Regional Disaster Prevention Plan on Japan Society for Civil Engineering (JSCE), which was established after the Great East-Japan Earthquake in 2011.

In the following, the existing situation of DRR measure planning in Japan is reviewed in Chapter 2; the necessary factor for comprehensive disaster risk management and the overview and methodology of the CDRM Matrix is explained in Chapter 3; the component of the CDRM Matrix published on the website is described in Chapter 4; and finally the conclusion and future issues are stated in the Chapter 5.

2. Situation of disaster management planning in Japan

In Japan, as many other countries face, it is difficult to get enough budget for DRR measure planning. Fig.1 shows the transition of DRR-related budget in Japan. It was increased temporarily after the 1995 Kobe Earthquake, but since then it continued to decrease until the 2011 Great East-Japan (Tohoku-Pacific Ocean) Earthquake. This fact illustrates the difficulty getting constant budget and maintaining the continuous implementation of DRR measures.

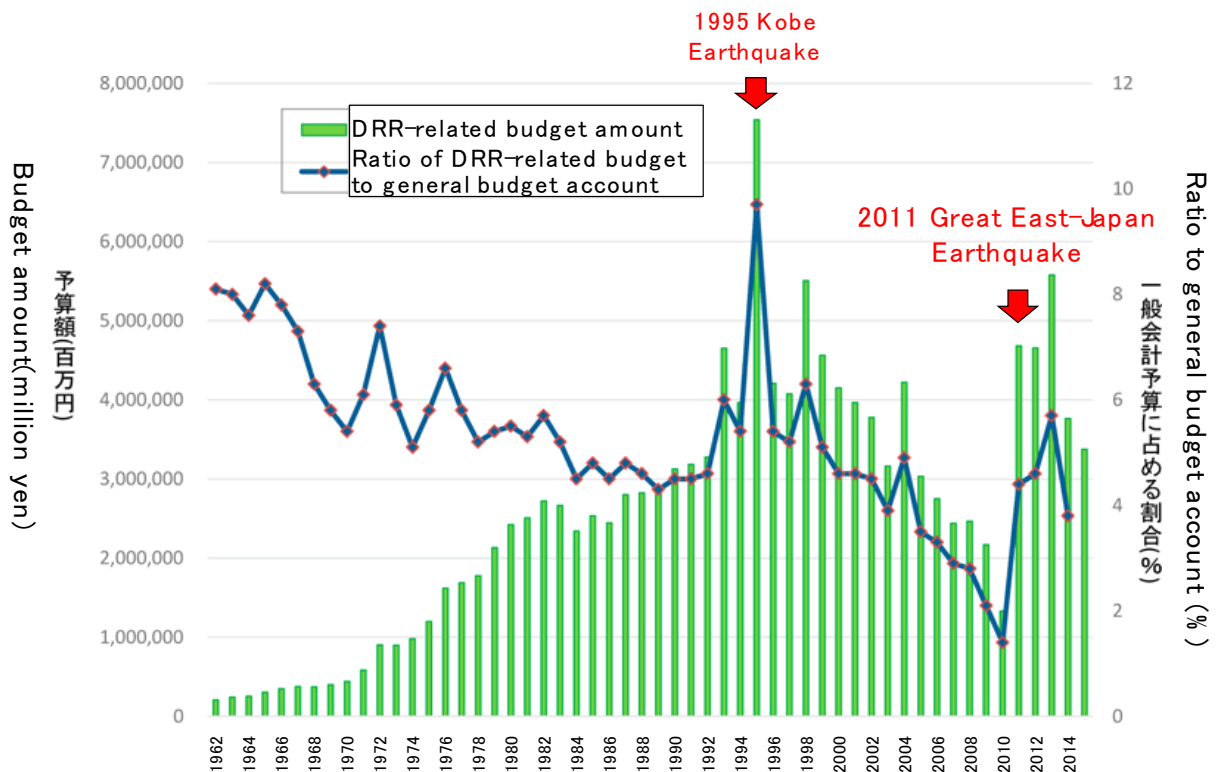


Fig. 1 – Transition of budget related to DRR in Japan [1]



As a background of this trend, there are two critical problems at local level.

One problem is that local governments do not have enough budget and resources for DRR planning. Fig.2 illustrates the result of questionnaire survey which our team conducted to municipalities in 2012[2]. As this figure shows, many of local governments pointed out the lack of professional staff and budget as the top and the 2nd most critical issues on the DRR measure planning.

As a matter of fact, another survey data by the Ministry of Internal Affairs and Communications shows that one third of municipalities in Japan have no specific staff for disaster risk management [3]. This situation leads local governments to have difficulty in planning appropriate measures according to the characteristics and circumstances of their municipality.

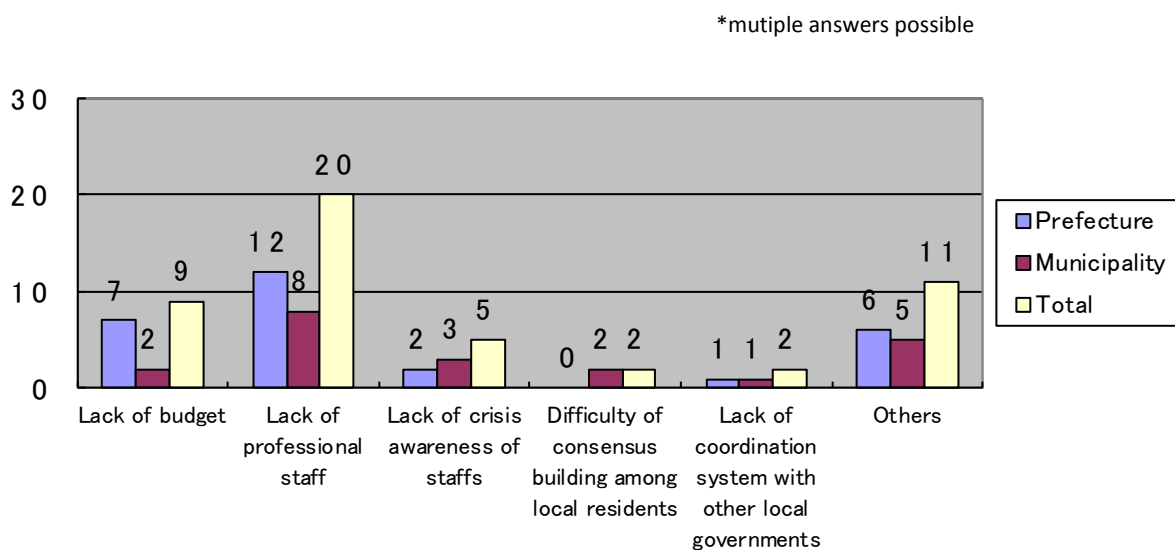


Fig. 2 – Questionnaire survey result on “What is the most critical issue on DRR measure planning”

Another problem is that there is no appropriate table or coordination system which local residents and community can join on DRR planning at government level, though the good coordination against large-scale disaster is strongly required especially under the situation of depopulation in Japan.

Based on these problems, it is required to develop a robust tool for DRR measure planning which has characteristics as follows:

- 1) The tool with which DRR measure planners can make own action plan by themselves even if they have few human resources and expertise.
- 2) The tool which enables individual, community, local municipality and government to discuss and coordinate DRR measure planning together.

As the solution for issues described above, the Comprehensive Disaster Risk Management Matrix was developed and proposed by the Special Committee for Regional Disaster Prevention Plan on JSCE, which was established after the 2011 Great East-Japan Earthquake.



3. The overview and methodology of the Comprehensive Disaster Risk Management Matrix(CDRM Matrix)

3.1 The basic concept for comprehensive disaster risk management

The basic concept of the CDRM Matrix is based on the project management and program management, and it is composed from two important factors on DRR, namely, disaster management cycle and good balance among stakeholders. Next two sections introduce these important factors.

3.1.1 Disaster management cycle

DRR measures are composed of pre-disaster measures and post-disaster measures. Furthermore, as Fig.3 shows, these two can be divided into seven phases, namely, damage mitigation, preparedness, prediction and early warning, damage assessment, emergency disaster response, recovery and reconstruction. Effective disaster measures can only be implemented with good combination of measures on these seven phases, based on the characteristics of hazard type and social condition.

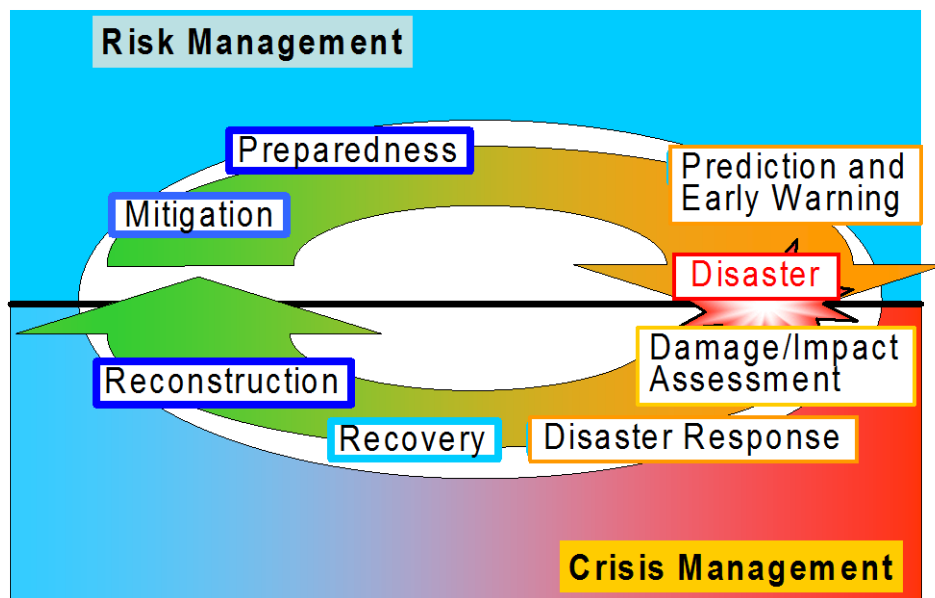


Fig. 3 – Disaster management cycle

3.1.2 Good balance among stakeholders

In addition to the seven phases illustrated in the previous section, it is also important on the effective DRR to share the responsibility and role; DRR measures should be implemented not only by the government but also by the local resident and communities. In Japan, we call it self-help effort, mutual assistance and public support.

In many cases, these three stakeholders can complement each other and this balance on DRR is quite important. It will cost a lot if everything is implemented only by government, but more effect with less cost will be obtained with self-help effort by local resident and mutual assistance by community.



3.2 Structure of CDRM Matrix

The structure of the CDRM Matrix describes the two important factors in the previous section: It has stakeholders on the vertical line and seven phases of disaster management cycle on the horizontal line as shown in Fig.4. By using this structure, the role and responsibility on each phase of disaster management cycle can be arranged properly among stakeholders, according to the capacity of each stakeholder.

Event ↓

	Damage Mitigation	Preparedness	Prediction and Early Warning	Damage Assessment	Emergency Disaster Response	Recovery and Reconstruction
SE (Self-help effort)	H					
	S					
MA (Mutual assistance)	H					
	S					
PS (Public Support)	H					
	S					

Fig. 4 – Structure of CDRM Matrix

3.3 Comprehensive and continuous disaster risk management system using the CDRM Matrix

The next issue is how to implement DRR measures not temporary but continuously and effectively. On this occasion, well-known methodology in project management can be applied to disaster risk management as Fig.5 illustrates.

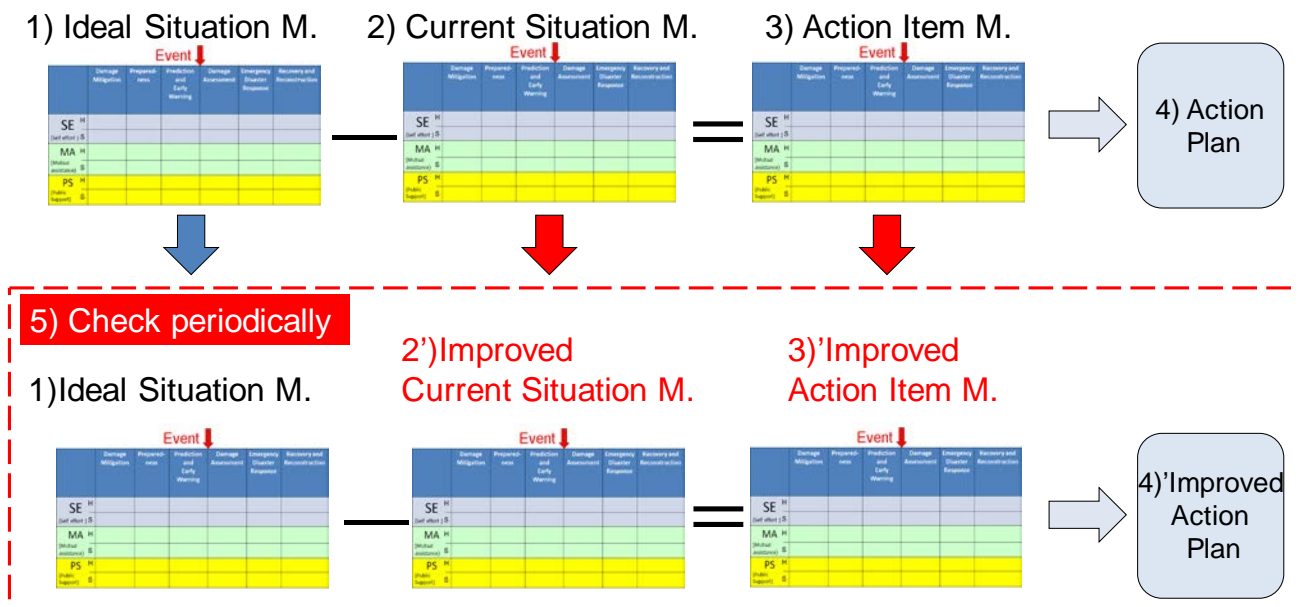


Fig. 5 – Continuous disaster risk management using the CDRM matrix



Here, each step for continuous risk management is described as follows:

- 1) In advance, DRR measures necessary for each stakeholder on each disaster phase are listed up in each cell, which is named as Ideal Situation Matrix (ISM).
- 2) Each stakeholder shall check whether each DRR measures are implemented or not with referring to ISM, which is named as Current Situation Matrix (CSM)
- 3) By deducting CSM from ISM, the aggregation of necessary measures can be obtained, which is named as Action Item Matrix (AIM).
- 4) Here, the action plan can be produced by prioritizing the AIM with effectiveness considering provided time and budget.
- 5) By implementing and checking above three steps periodically, improved CSM, AIM and action plan can be obtained. This periodical check enables DRR measures to be managed continuously and reasonably with the Plan-Do-Check-Act management cycle.

4 The development of the CDRM Matrix on the website

The CDRM Matrix is published on the JSCE website (only written in Japanese) [4]. This website is composed of three components, namely, (a) Matrix page, (b) Measure and project page and (c) Detailed project page. Each page has the following contents:

(a) Matrix page

This page on the website provides the CDRM Matrix for four types of hazard, namely, earthquake, tsunami, flood and volcanos. By clicking each grid of matrix, page shall move to (b) Measure and project page.

(b) Measure and project page

This page summarizes the DRR measures and projects which the selected stakeholder should implement on the selected phase at (a) Matrix page. By clicking each project, page shall move to (c) Detailed project page.

(c) Detailed project page

This page contains the detail of each DRR project and provides information about good practices and lessons learnt in past disasters.

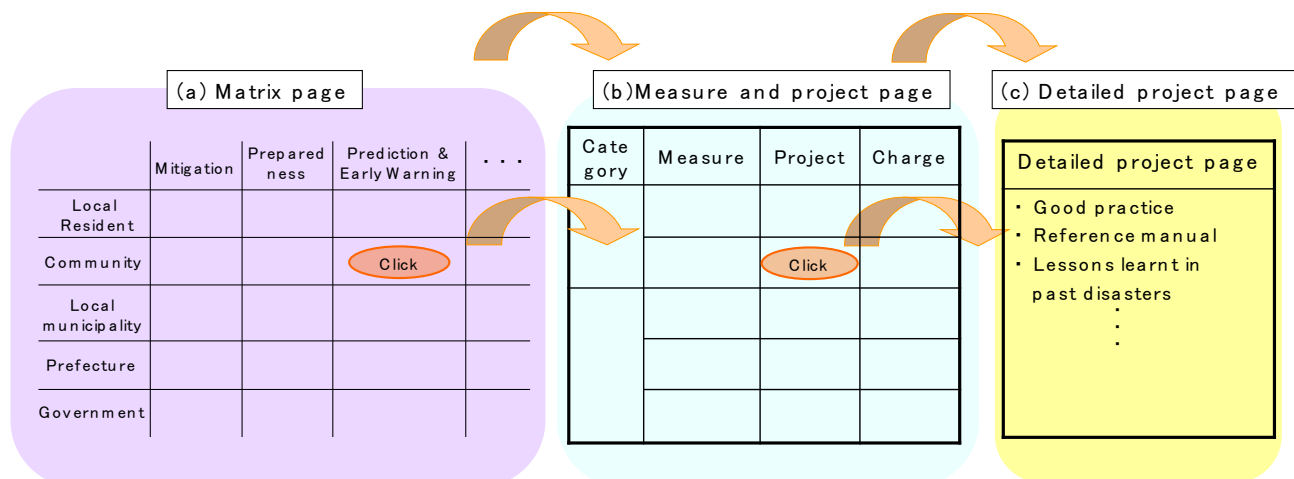


Fig. 6 – Structure of the CDRM Matrix on the website



Fig.7 and 8 show examples of (b) measure and project page and (c) detailed project page on the actual website. With this matrix, even if planners do not have enough knowledge on disaster or DRR, they can get to know what measure or project should be done in each phase of disaster management cycle. In addition, they can get useful information for actual implementation of DRR measures with this matrix.

ハード対策事業 Structural measures

施策分類	施策メニュー	事業リスト	担当
公共施設の耐震化・不燃化	公共施設の耐震化・不燃化	公共建築物(庁舎・出張所等)の耐震化等	財政
		公立学校の耐震化等	教育
		公立病院の耐震化等	福祉
		社会福祉施設の耐震化等	福祉
		公営住宅の建築事業の推進とオープンスペース等の一体的整備	都市
		町内会・自治会会館の耐震化等	総務
		橋梁等の道路施設の耐震化	建設
		港気施設の耐震化	建設
		上水道施設の耐震化	建設
		下水道施設の耐震化	建設
公共土木	公共土木	ダム・河川堤防の耐震化	建設
		ため池等、農林業施設の耐震化	建設
		コンビナートの屋外タンクの耐震	建設
		マノホール等埋設物の浮き上がり防止の推進	下水
		密集市街地の改善(住宅市街地総合整備事業、都市防災不燃化促進事業、木造密集市街地耐震事業)	都市
		市街地開発事業等の推進	都市
		民間再開発の誘導による公開空地の確保	都市
		公園緑地の整備・推進	都市
		都市計画道路の整備	建設
		広域遊歩道などの機能を有する都市公園の整備	都市
地域の耐震化・不燃化	地域の耐震化・不燃化	住宅地内の道路の新設、改良、拡幅	都市
		宅地耐震化推進事業の推進	都市

ソフト対策事業 Non-structural measures

施策分類	施策メニュー	事業リスト	担当
○計画策定	耐震改修促進	既存不適格建物の耐震化促進に向けた調査・研究	都市
○防衛機能の強化	不燃化・耐震化促進の支援制度整備	住宅等の耐震診断に対する補助	都市
		住宅等の耐震改修工事の設計及び工事費に対する補助	都市
		耐震診断・改修に関する助成制度の普及・啓発	都市
		木造住宅における簡易耐震診断の普及・啓発	都市
		特定建築物の所有者等への耐震診断及び耐震改修状況の把握及び啓発	都市
		耐震診断・改修に関する相談窓口の設置	都市
		宅地防災工事助成金制度の充実	都市
		都市防災不燃化促進事業	都市
		防火・準防火地域指定の拡大	都市
		市街地及びその周辺の農地の適切な保全・活用	農工
・都市不燃化のための土地利用政策	都市		
・文化財保護	建造物、美術工芸品保存施設の耐震化促進の推進	教育	

Fig. 7 – Example of (b) measure and project page (items of local government on the phase of damage mitigation)

<土砂災害情報相互通報システム整備>

◇ 参照リンクページ

- ・ [国土交通省／土砂災害情報相互通報システムの整備事例](#)
- ・ [静岡県／土砂災害情報相互通報システム整備事業](#)

Reference link or information
on installing early warning system

Fig. 8 – Example of (c) detailed project page (items about installation of early warning system)



5 Conclusion and future issues

The local government is expected to check the state of the progress by continuously comparison of the two matrixes of ISM and CSM, which enables disaster risk management to be on the Plan-Do-Check-Act management cycle. This methodology is expected to be the powerful tool for both robust policy-making and effective management according to the social and environmental situation.

On the other hand, this matrix is still a prototype and further revision is required. Our group is planning to add the feedback function of outputting the radar chart which shall indicate the weak point on DRR according to the user's input. In addition, our group will demonstrate in several local governments and get feedback from the users.

6. Acknowledgements

The authors would like to thank the members of the Special Committee for Regional Disaster Prevention Plan on JSCE for their strong support on this research.

7. References

- [1] Cabinet Office of Japan (2016): White Paper on Disaster Management 2017, 491-514.
- [2] The Special Committee for Regional Disaster Prevention Plan on Japan Society for Civil Engineering (2013): Overview of Output
- [3] Ministry of Internal Affairs and Communications (2015): Survey for Capacity Management of Local Government
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