Institutionalizing Disaster Lessons towards Proactive Investment for DRR

- the Japanese Experience -

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Today's Outline

Disaster Reduction & Sustainable Development
Japanese History of Disasters
Disaster Reduction in Modern Japan
1st Epoch 1959 Ise-wan Typhoon

Evolution of Seismic Standards
2 nd Epoch 1995 Hanshin Awaji EQ
Lessons Learnt & Necessity for Seismic Retrofitting
Nationwide Movement for DR

3rd Epoch 2011 Great East Japan EQ
Effectiveness of Preventive Approaches
Sendai City's Pre-Disaster Investment

Institutionalization of Lessons Learnt
Cultural Assets for Disaster Reduction

Sharing Experiences Across Borders

Ranking of Earthquakes 20-21st Century

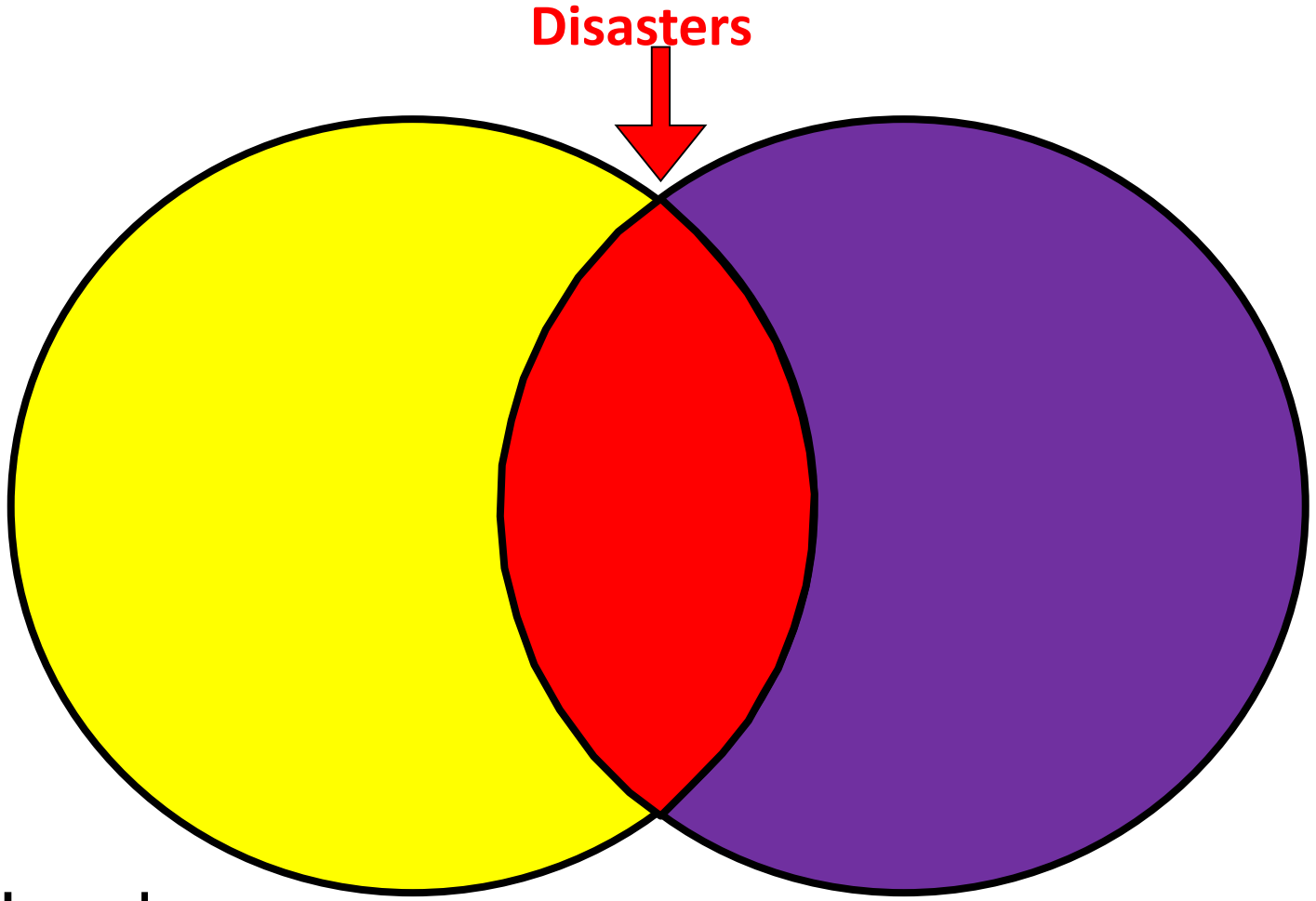
Strong Earthquakes

Year	Place	Magnitude
1960	Chili	9.5
1964	Alaska	9.2
2004	Indonesia Sumatra	9.1
2011	East Japan	9.0
1952	Kamchatka	9.0
2010	Chili	8.8
1906	Ecuador	8.8
1965	Alaska Aleutian Islands	8.7
2005	Indonesia Sumatra	8.6
1950	Tibet, Assam	8.6
1957	Alaska Aleutian Islands	8.6

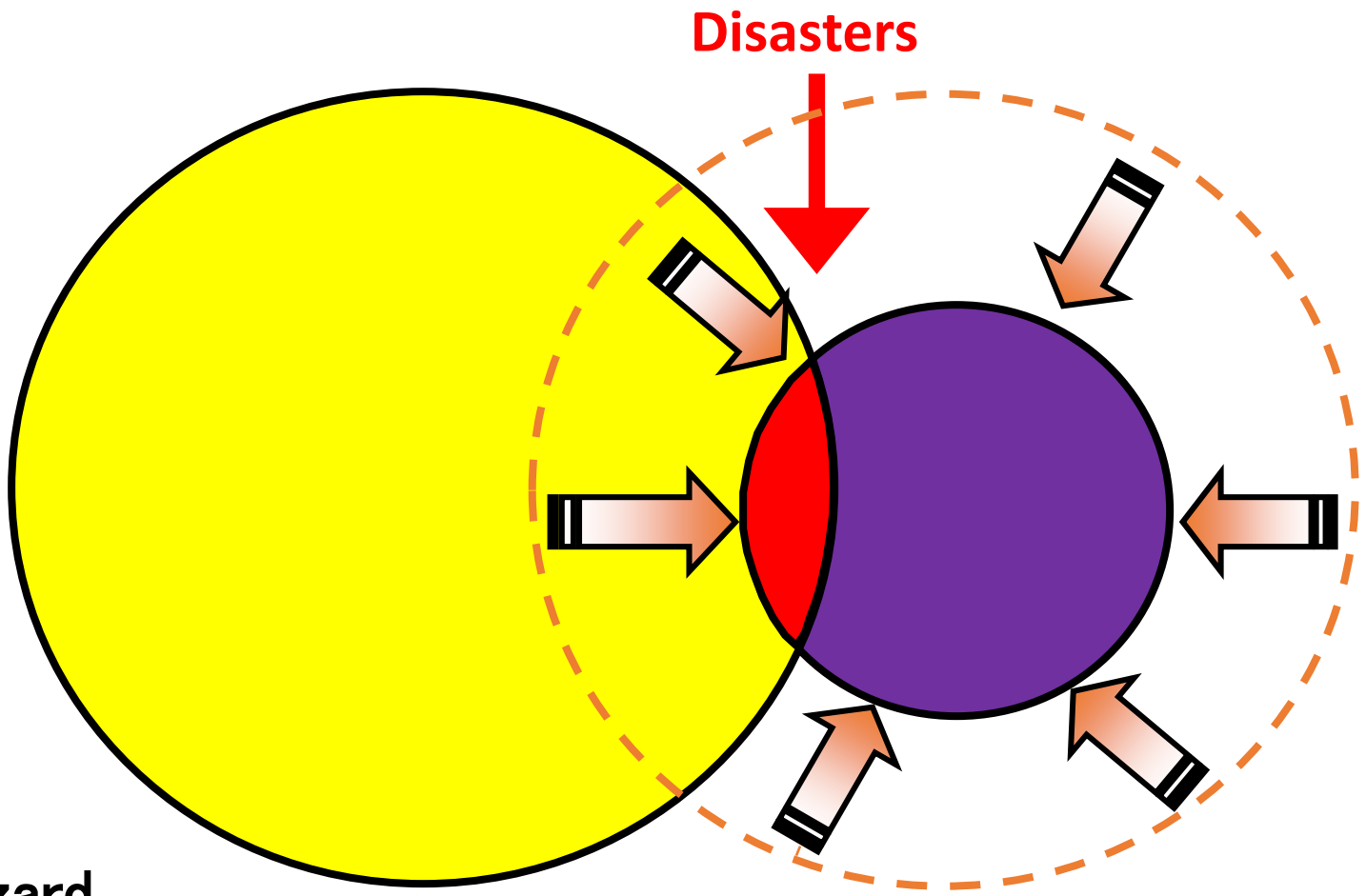
Deadly Earthquakes

Year	Place	Casualties
1976	China Tangshan	242800
1920	China Ningxia	235502
2004	Indonesia Sumatra	227898
2010	Haiti	222500
1923	Japan Kanto	105000
2008	China Sichuan	87587
2005	Pakistan, Afghanistan	86000
1908	Italy Sicily	82000
1927	China Gansu	80000
1970	Peru	66794
	▪ ▪ ▪	
2011	East Japan	18434

Hazards Confronting Vulnerable Communities Cause Disasters



Less Disasters



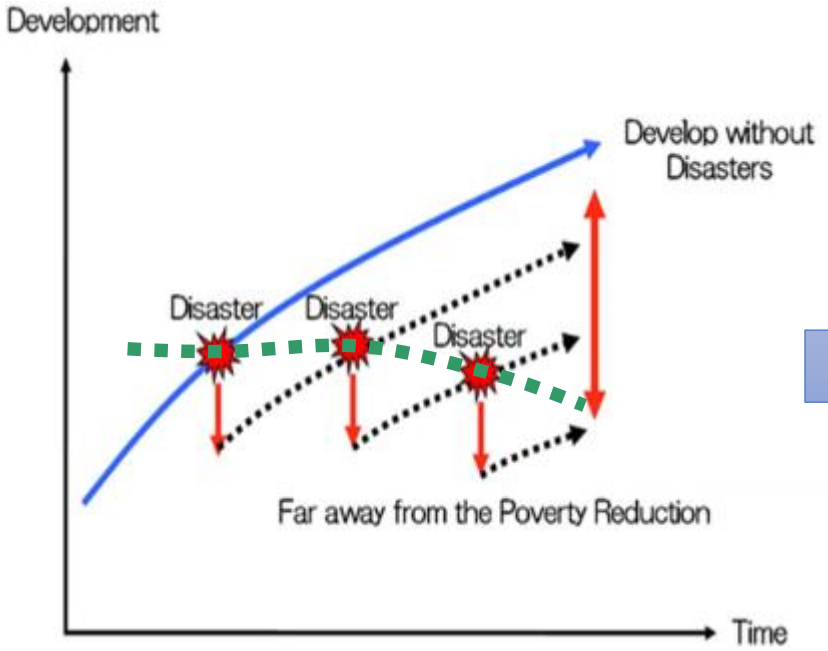
Disasters bring serious damage to economies

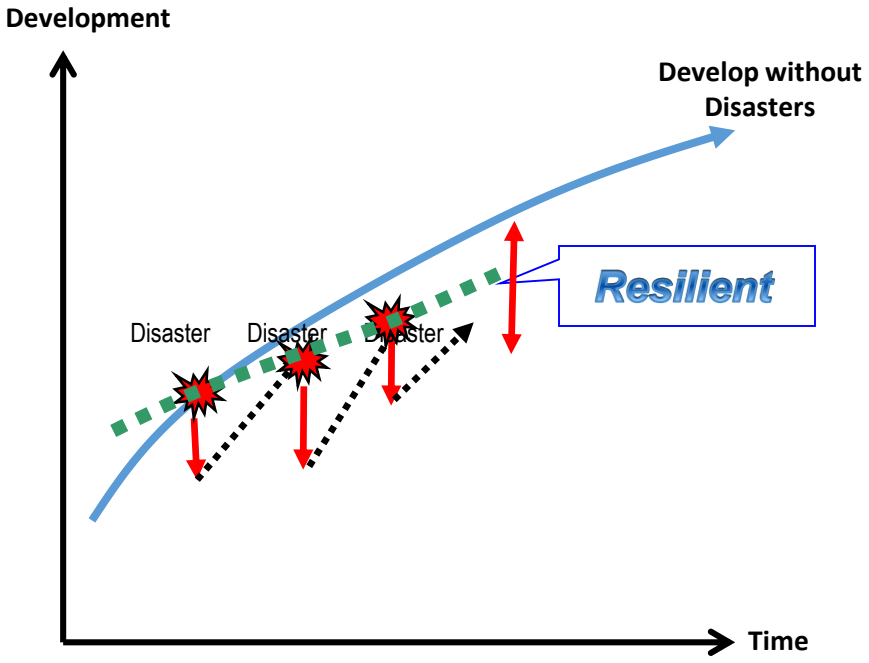
Country	Year	Disaster type	Loss (billionUS$)	Loss/ GDP	GDP of Country (billion US$)	Income level by World Bank
Tajikistan	2008	ExtremeTemp	0.84	23%	3.72	low
Haiti	2010	Earthquake	8.00	123%	6.48	low
Samoa	2012	Cyclone	0.13	20%	0.64	low
Guyana	2005	Floods	0.47	59%	0.79	medium low
Guyana	2006	Floods	0.17	21%	0.82	medium low
Chile	2010	Earthquake & Tsunami	30.00	17%	171.96	medium high
Thailand	2011	Floods	40.00	13%	318.52	medium high

Japan	year	Loss in yen	Loss/GDP	GDP of the year	Fiscal Budget
Great Kanto EQ	1923	5.5billion	40%	13.3billion yen	1.5billion yen
Ise-wan Typhoon	1959	551.2billion	4.2%	13.1trillion yen	1.4trillion yen
Hanshin Awaji EQ	1995	9,600 billion	2%	502trillion yen	51trillion yen
Great East Japan EQ	2011	16,900 billion	3.5%	471trillion yen	92trillion yen

Disaster Reduction and Sustainable Development

Economic Growth *can be Expected*

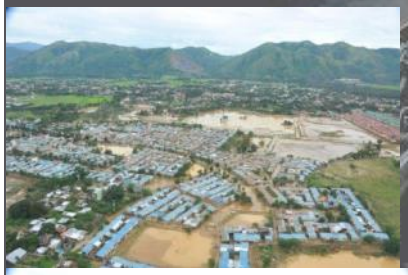




Repetition of Disasters bring Poverty

Disaster Reduction enables Sustainable Development

The Poor Tends to Suffer Worse in the Vicious Cycle ～Disaster Reduction and Sustainable Development～



The Poor live in Cheap = Disaster Vulnerable Areas

Compelled to live in worse locations or even Homeless

Poverty

Chain of Poverty
Minus Growth
Social Unrest

Vicious Cycle to Poverty

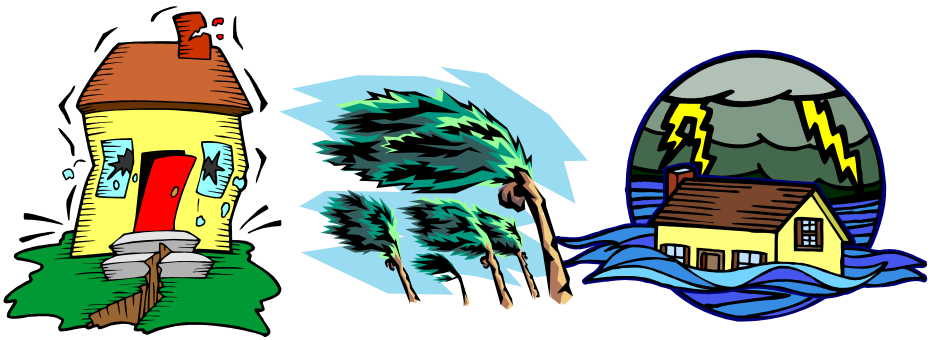
Loss of Assets & Means of Livelihood

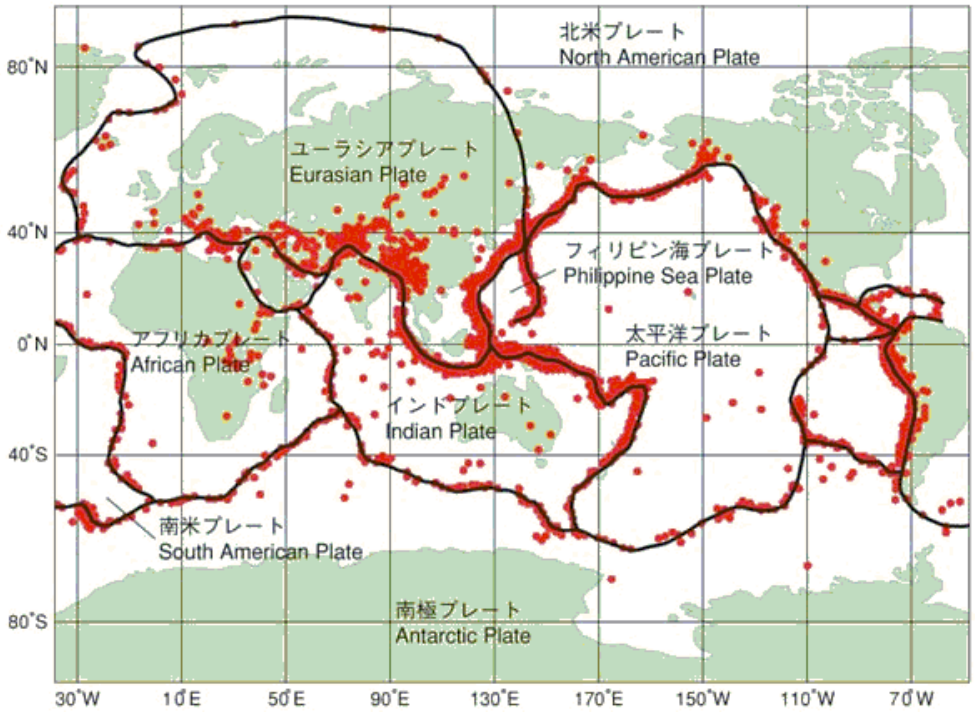
Easily hit by Disaster

Repeatedly hit by Disaster

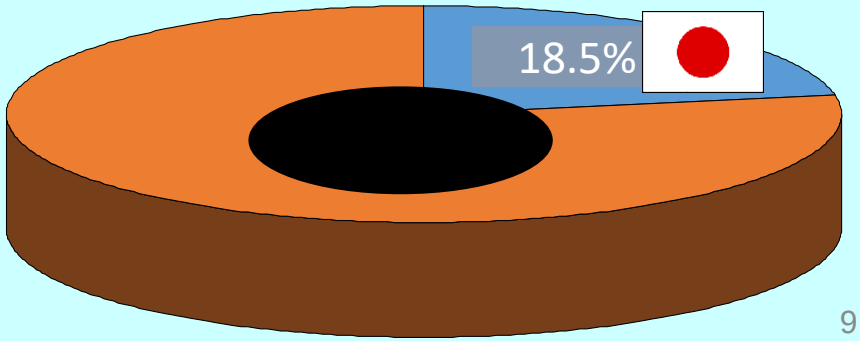
Mother Nature is not Gentle in Japan !

- **Earthquakes**
- **Tsunamis**
- **Volcanic Eruptions**
- **Typhoons**
  (July – October)
- **Heavy Monsoon Rains**
  (May – July)
- **Floods**
- **Landslides**
- **Snow Avalanches**





Number of earthquakes with magnitude of 6.0 or larger (2003-2013) Japan's Unfair Share



Japan's long tradition of coping with natural disasters

- 416A.D. August, Yamato-Kochi Earthquake

The first written record of Earthquake in Japan within "Nihonshoki" the first official history book of Japan, edited in 8th century.

- 684A.D. November, Hakuho-Nankai Tonankai Earthquake (Estimate Magnitude: 8.2-3) & Tsunami

The first written record of Earthquake Tsunami in Japan within "Nihonshoki".

- Most dreadful things historically in Japan for children

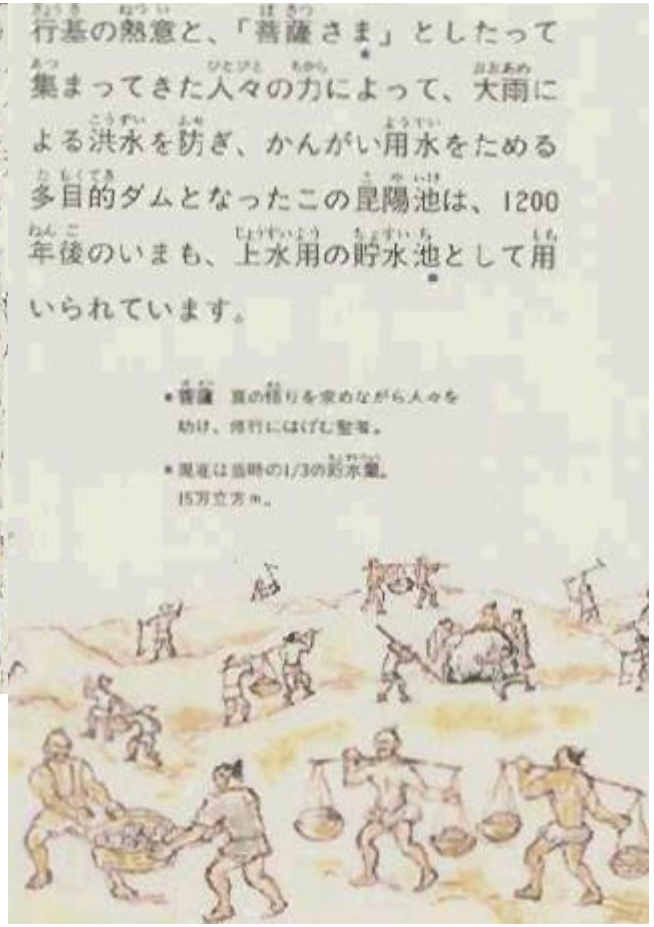
1. Earthquakes, 2. Lightning/Thunder, 3. Fire, 4. father(typhoon)

Jishin Kaminari Kaji Oyaji

Not anymore

7-8th century

The Most Respected Buddhist Priest was the Best Civil Engineer

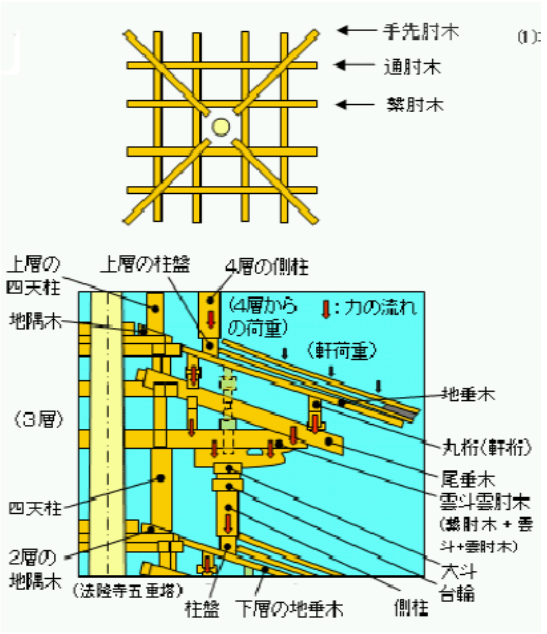


GYOKI the High Priest & his fellow monks built dams for flood control and irrigation.

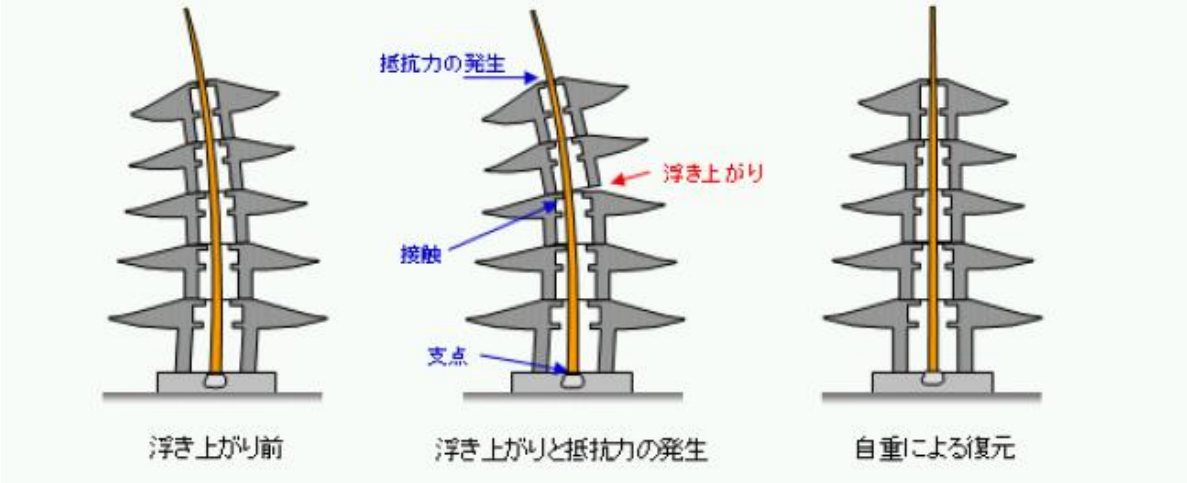
Pagoda of Horyuji Temple built 680A.D.
The Oldest Wooden “High-Rise” Building in Japan withstood numerous Earthquakes over the Centuries

5 layered, 32m high

Combination of semi-flexible timberwork joints and a central wooden pillar disperses and absorbs earthquake shocks



層の構造の詳細



Traditional “UKIYOE” drawing after 1855 October Ansei-Edo Earthquake

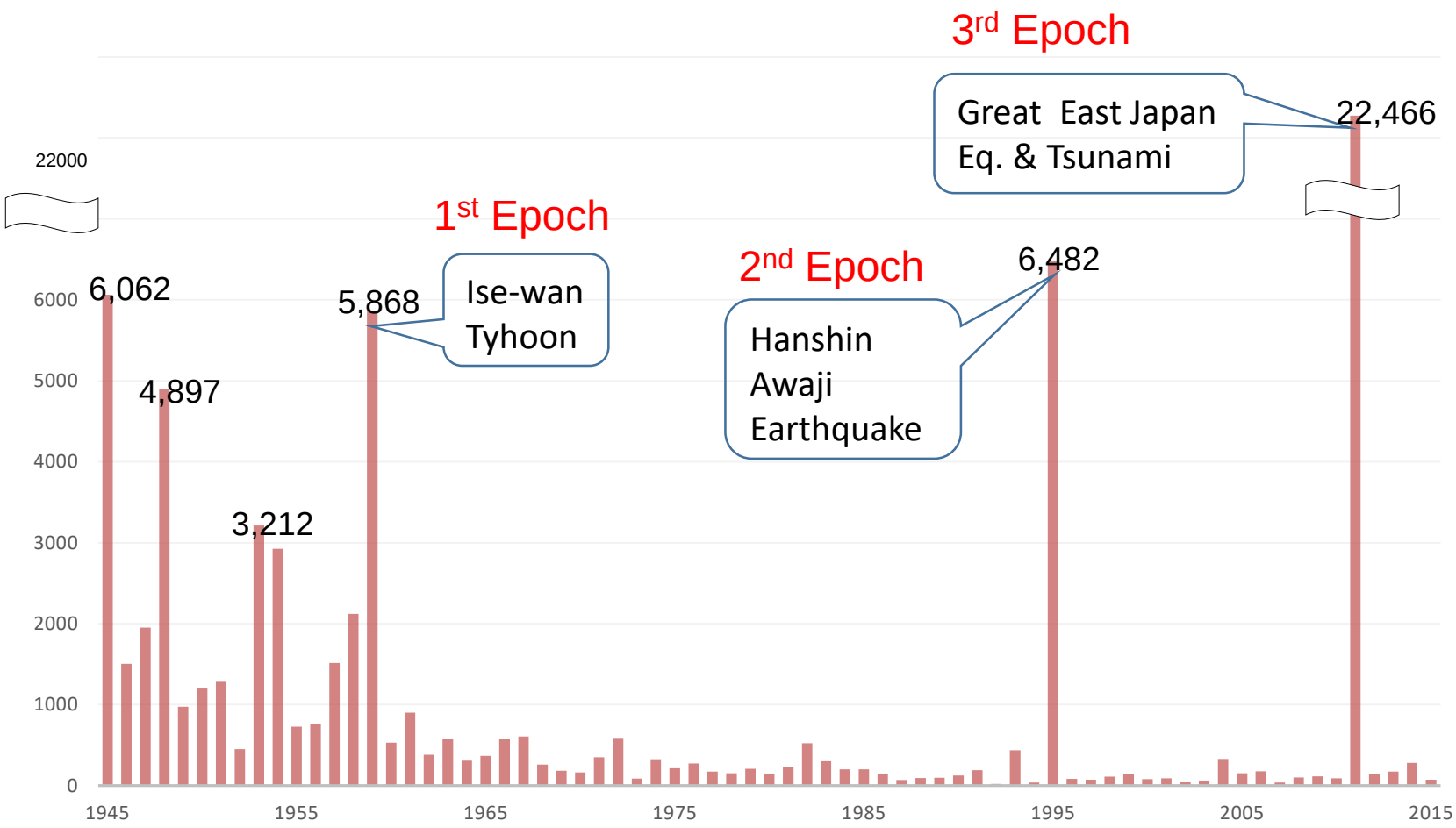
Edo (Old name of Tokyo) citizens beating the legendary Catfish Monster which was believed to cause earthquake

Modern Japan is still full of Tragedies & Lessons Learnt

1896 Meiji-Sanriku
Tsunami killed 22,000

1923 Great Kanto Earthquake
destroyed Tokyo and killed 105,000

Statistics on Casualties by Natural Disasters in Japan 1945-2015



Severe Damage by Series of Typhoons

Year	Typhoon	Death Toll
1945	Makurazaki Typhoon	3,756
1947	Kathleen Typhoon	1,930
1948	Ion Typhoon	838
1950	Jane Typhoon	539
1951	Ruth Typhoon	943
1954	Toyamaru Typhoon (with big ferry shipwreck)	1,761
1958	Kanogawa Typhoon	1,269
1959	**Ise-wan Typhoon**	**5,098**

Ise-wan Typhoon, hit Nagoya 26 Sep.1959

Lowest pressure 894 hPa , Max Wind Speed 75m/s

Photo by MLIT

1959 Ise-Wan Typhoon was the 1st Epoch-Making Turning Point

Ise-wan Typhoon hit Nagoya, the 3rd largest metropolitan area in Japan. 5098 killed.

- Response oriented approach to **preventive approach**
- Individual approach to **comprehensive multi-sectoral approach**
- **Investment** for disaster reduction
- National, Prefecture and Municipal Gov’ts were given **responsibilities**

Disaster Countermeasures Basic Act 1961

Central Disaster Management Council chaired by the **Prime Minister**

National Coordinating Body with all relevant Ministers &
Japanese Red Cross, Public Broadcasting, Semi-Public Sectors
and the Academia **(The National Platform for Disaster Risk Reduction!)**

Institutionalization of Disaster Reduction Actions

- Involvement of Semi-Public Private Sectors
  - Electricity, Gas, Telecom Companies
  - Railway and Bus Companies, Forwarders
  - Broadcasting Companies

Designated Public Organs for Disaster Management

Annual Gov't Official Report on Disaster Countermeasures

The Cabinet must officially report the disaster countermeasures to the National Diet, with
the budget of the next FY and the statements of accounts of previous FY

Formulation of "National Basic Disaster Management Plan for Disaster Prevention"

The Disaster Management Operation Plan (Sectoral)
The Prefecture and Municipal Disaster Management Plan (Regional, Local)

Disaster Countermeasures Basic Act 1961

Enabled Investment for Disaster Prevention

- **Flood Control & Land Conservation, Forest Conservation**
- **Meteorological Observation** Mt. Fuji Rader Site, Meteo-Sats
- **Emergency Telecommunication Systems**

⋮

Institutionalization of Disaster Reduction Investments

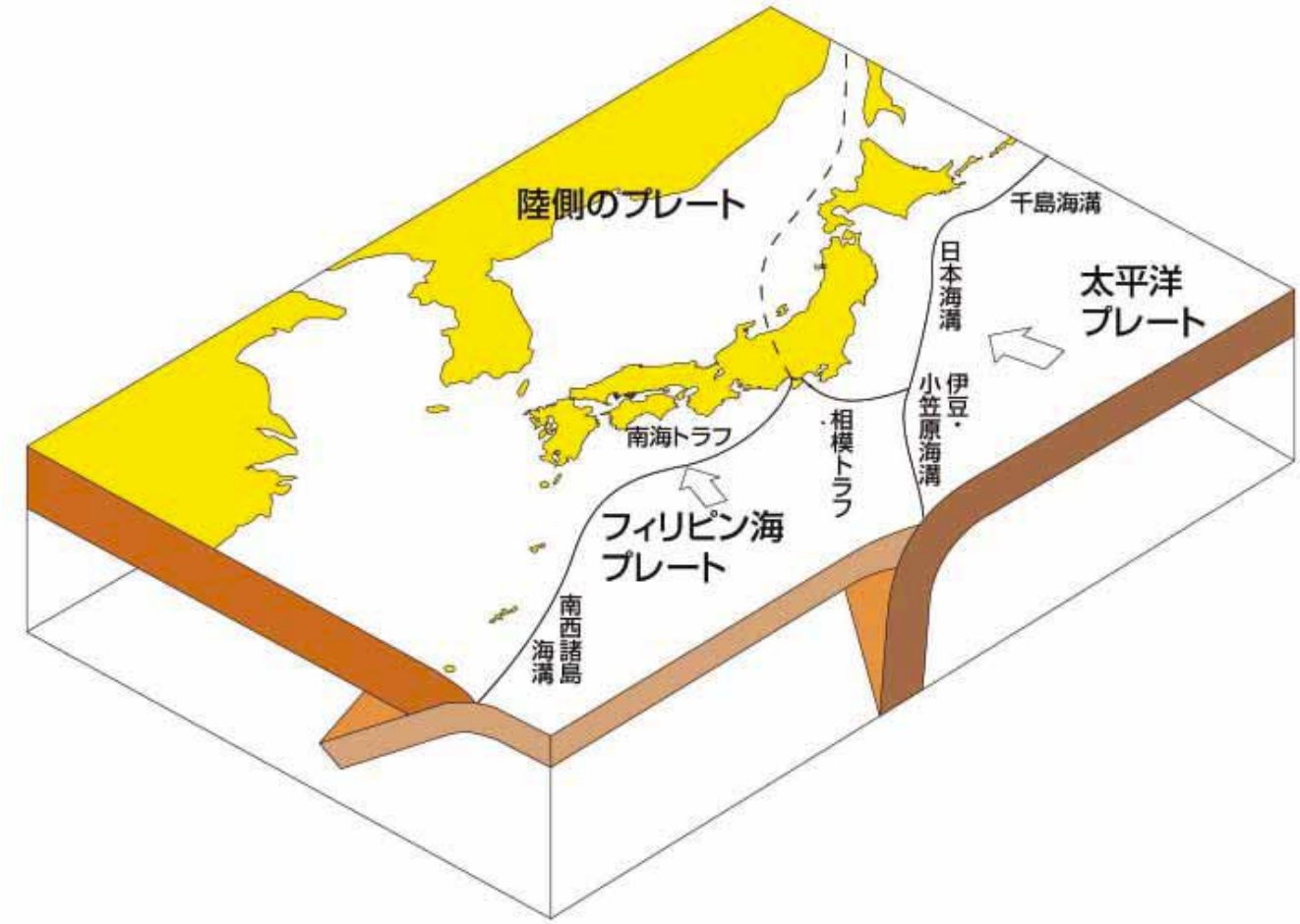
Designation of "Disaster Prevention Day"

Public Awareness Programs, Disaster Drills & Exercises

1 September (Annual Nationwide Event)

Great Success in decreasing Typhoon & Flood Casualties

Tectonic Plates Surrounding Japan



Severe Damage by Earthquakes(1945-1995)

Year	Earthquake (Magnitude)	Death Toll
1945	Mikawa Earthquake (M6.8)	2,306
1946	Nankai Earthquake (M8.0)	1,330
1948	Fukui Earthquake (M7.1)	3,769
1952	Tokachi-oki Earthquake (M8.2)	33
1960	Chile Earthquake & Tsunami (M8.5)	139
1964	Niigata Earthquake (M7.5)	26
1968	Tokachi-oki Earthquake (M7.9)	52
1974	Izu-hanto-oki Earthquake (M6.9)	30
1978	Izu-Oshima Kinkai Earthquake (M7.0)	25
1978	Miyagi-ken-oki Earthquake (M7.4)	28
1983	Nihonkai Chubu Earthquake & Tsunami (M7.7)	104
1984	Nagano-ken Seibu Earthquake (M6.8)	29
1993	Hokkaido Nansei-oki Earthquake & Tsunami (M7.8)	230
1995	**Hanshin-Awaji <Kobe> Earthquake (M7.3)**	**6,437**

Fukui Earthquake(M.7.1) 1948

3,769 casualties

内閣府防災災害教訓報告書

福井県資料

Wooden houses collapsed caught fire

Tokachi-oki Earthquake(M7.9) 1968

52 Casualties

Collapsed RC buildings

Miyagi-ken-oki Earthquake(M7.4) 1978

Sendai City Experience

28 Casualties

Crashed concrete block wall

school children crushed to death

Pancake-collapsed building

Evolution of Japan's Anti-Seismic Building Code

1923 The Great Kanto Earthquake (M7.9: Tokyo devastated 105,000 dead)
1924 First Seismic Building Code
1948 Fukui Earthquake (M7.1: 3,769 dead)
1950 Building Standard Law
1968 Tokachi-oki Earthquake (M7.9: 52 dead)
1978 Miyagi-ken-oki Earthquake (M7.4: 28 dead)

1981Revision of Building Standard Law requirements:

- No damage against medium scale (JMA scale 5+) earthquakes,
- To be able to continue use after these medium earthquakes.
- No collapse & safety of people inside against large scale(JMA scale 6+ to 7) earthquakes

1995 Hanshin-Awaji(Kobe) Earthquake (M7.3: 6,347 dead)
1995 Revision of Building Standard (encourage metal reinforcement to wood joints)
2000 Revision of Building Standard (ground strength check made mandatory)

JMA scale 5+ ⇒ almost equivalent to Mercalli scale VII
JMA scale 6+ to 7 ⇒ almost equivalent to Mercalli scale VIII to IX

1995 Hanshin-Awaji (Kobe) Earthquake (M7.3)
was the 2nd Epoch-Making Turning Point

Fire in a city center

Collapsed houses

Damaged office building

Damaged railway track

Collapsed viaducts of an expressway

6,437 Casualties

Kobe Municipal Government Headquarter

1995 Hanshin-Awaji (Kobe) Earthquake (M7.3)

5520 Direct Deaths

Old timber structure with heavy tile roofs collapsed, crushing residents to deaths, Blocked the streets.

Old RC structure condominiums built before 1981 collapsed

- Collapse of houses not only kills people inside,
- Loss of shelter,
- But also debris blocking streets & reconstruction
- Existence of debris depress the affected population.

Collapse of old houses built before 1981 standard was the main cause of death

5,520 direct deaths (+917 relevant deaths)

total 6,437 victims

83% immediately killed by building collapse

surgeon general's autopsy report

Prevention & Mitigation

Preparedness

Ensure Building Safety !

Public Awareness

Disaster Manager's Proper Action

1995 new Act on Promotion of Seismic Retrofit of Buildings

Public awareness campaign on housing seismic safety

Public campaign on affixing furniture and room safety

Act on Promotion of Seismic Retrofit of Buildings

Formulated and Revised based on bitter lessons from Deadly Earthquakes

1995 Hanshin-Awaji Earthquake ⇒1995 New legislation

2004 Niigata Chuetsu Earthquake ⇒2006 1st revision:

National Gov't to indicate policy target for seismic retrofitting, Local Gov'ts to formulate their own seismic retrofitting policy/plans

Enabled Sendai City to formulate Earthquake Resilience Policy in 2008

2011 Great East Japan Earthquake ⇒2013 2nd revision:

Mandatory Earthquake Resistance Analysis & Disclosure of Large Commercial & Public-use Buildings

Paradigm shift after 1995 Hanshin-Awaji (Kobe) Earthquake

Most of the initial search & rescue done by family members and neighbors.

→ How can we encourage disaster preparedness at community level?

Importance of building safety re-recognized.

→ Who owns the houses and buildings?
Who can take care of safety inside the house or in the office?

Business Continuity Planning is important for reducing economic loss.

→ Who decides on BCP of companies?

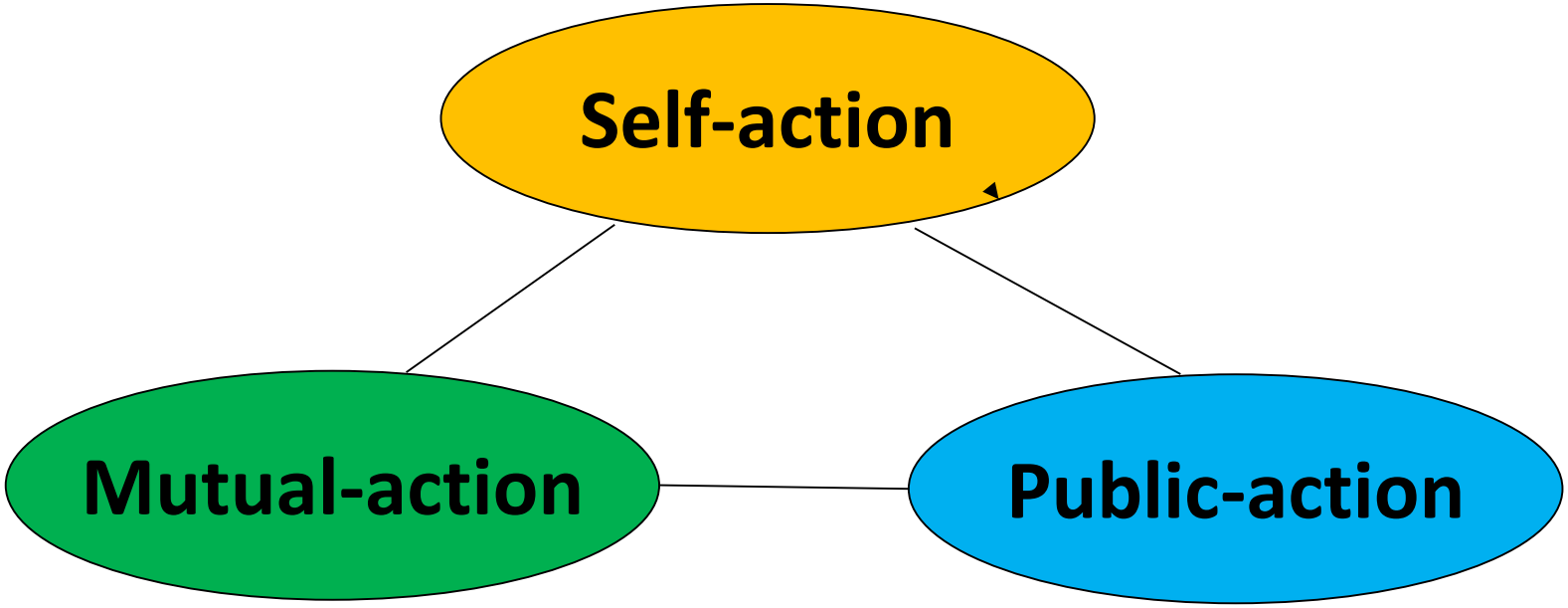
Importance of Pre-disaster measures re-recognized.

→ Pre-assessment for each possible large scale earthquakes & floods.
Disaster reduction strategy based on pre-assessments.

Government centered disaster reduction → Multi-stakeholder approach to disaster risk reduction

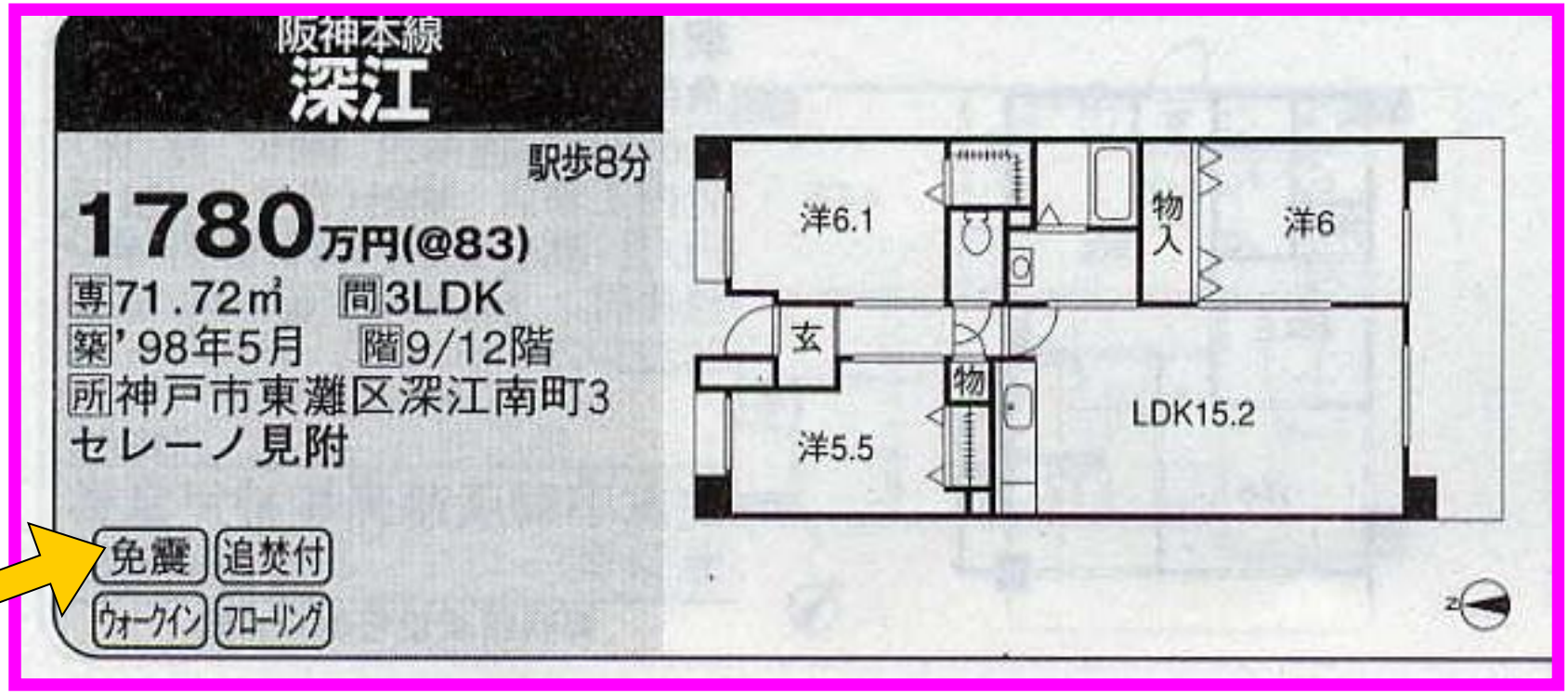
Paradigm shift after 1995 Hanshin-Awaji (Kobe) Earthquake

Call for a Nation-Wide Movement for Disaster Reduction Actions



Self-help action by individuals, families and companies
Mutual-help action at neighborhoods and local communities
Public-action by governments

Consumer's Awareness changes Advertisement of Condominium



"This condominium has seismic base isolation structure"

One of the 4 important sales points!

Recent Ad of Seismic House Retrofit in Japan

Seismic Strength Joints

Vibration Control Damper

Lightweight & Tough Roof Tiles

Durable Outer Wall

Anti Termite Base Structure

Anti-Seismic Systematic Retrofit to withstand 6+ Scale Earthquake

People's Demand for Earthquake Safety Creates New Supply of Affordable Engineering Methods

2004 Niigata-Chuetsu Earthquake (M6.8)

Epicenter was shallow 13km => Strong Ground Motion

40 Direct Deaths

Reminded the necessity of seismic retrofit of buildings

Numerous landslides

Collapse of houses built before 1981

Baby boy rescued after 5 days

Case of Miyagi-ken Earthquakes

Reduced

1978/06/12	2003/05/26	2005/08/16
Magnitude : 7.4	Magnitude : 7.0	Magnitude : 7.2
Focal depth : 40 km	Focal depth : 71km	Focal depth : 72km
Max. JMA seismic intensity : 5	Max. JMA seismic intensity : 6 lower	Max. JMA seismic intensity : 6 lower
Deaths : 28	**Deaths : 0**	**Deaths : 0**
Injured : 1,325	**Injured : 174**	**Injured : 91**
Collapsed houses : 1,183	Collapsed houses : 2	Collapsed houses : 1
Half-collapsed houses : 5,574	Half-collapsed houses : 21	Half-collapsed houses : 0
Partly damaged houses : 60,124	Partly damaged houses : 2,342	Partly damaged houses : 856

Case of Miyagi-ken Earthquake

1978/06/12

28 Casualties

Crashed concrete block wall

school children crushed to death

Pancake-collapsed building

Case of Miyagi-ken Earthquake

2003/05/26

No Casualties

Fallen outside wall

Cluttered room

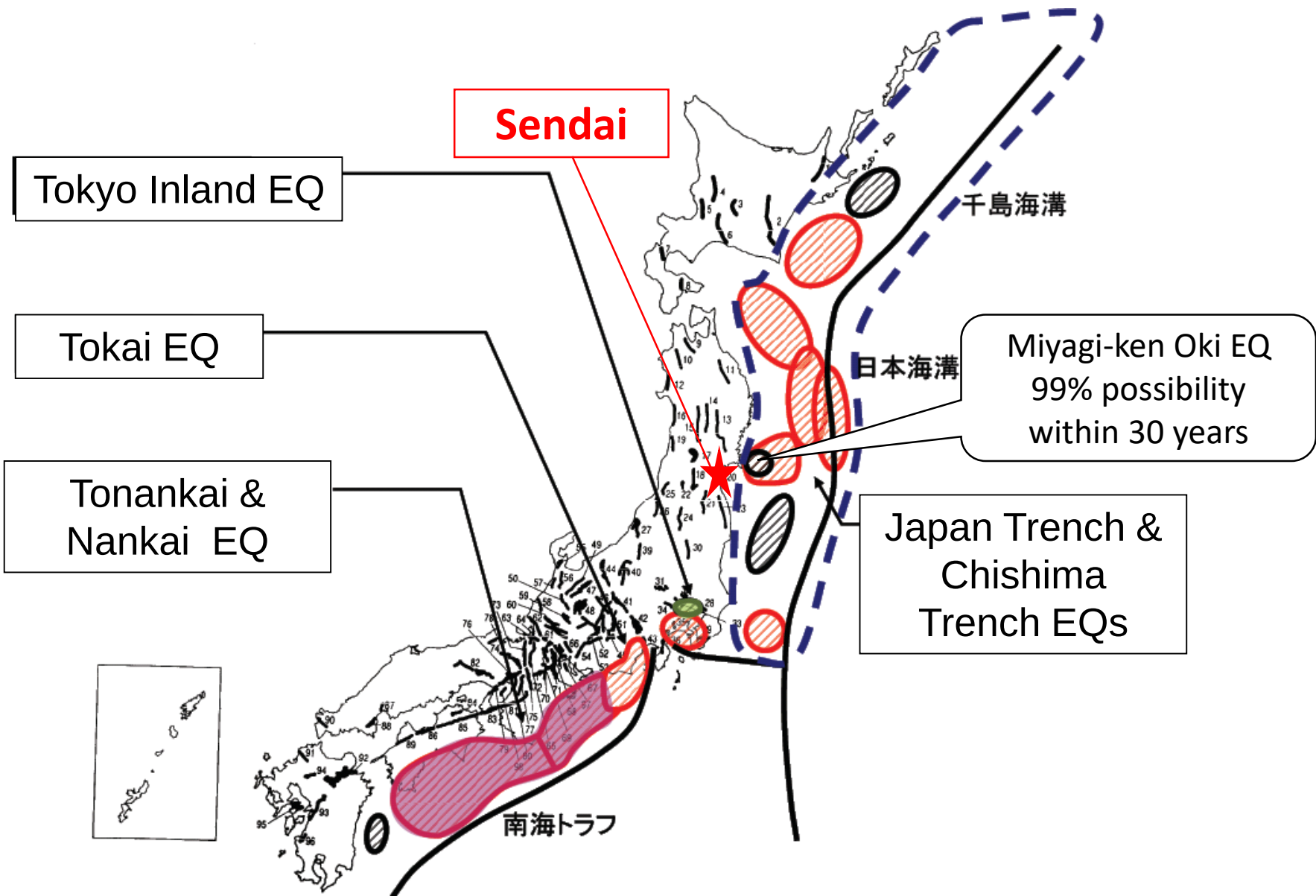
Case of Miyagi-ken Earthquake

2005/08/16

No Casualties

Fallen inner ceiling of indoor swimming pool

Recognized Possibilities of large-scale M8 earthquakes and tsunamis in Japan (pre-2011)



Risk Assessment of Miyagi-ken Oki EQ (M7.6-M8.2) published in 2006

	damage estimates
Buildings heavily damaged/collapsed	14,000 ~21,000 buildings
Road damage/blockage	30
Water supply interruption	250,000 households
Electricity stoppage	520,000 households
Gas supply stoppage	170,000 households
Casualties	90~290 deaths

Risk Assessment showed that such damage may come within 30 years with 99% possibility

2011 Great East Japan Earthquake (M9.0)

The 3rd Epoch-Making Turning Point

写真出典仙台市復興五年記録誌

Tohoku was prepared for a Miyagi-ken Oki EQ of M7.6-M8.2,
but what came was M9 EQ & Tsunami

Energy of M9 earthquake is 32 times stronger than M8 earthquake

Enormous Destruction by the Tsunami !

Massive Evacuation !

Emergency Sirens for Tsunami Warning

Approx. 500,000 people in the Tsunami inundated area. Majority escaped.

But 20,000 did not make it!

Elementary School on hilltop

Signs of Tsunami Evacuation Building

Photos by ADRC

Mortality rate of Tsunami Inundated area

2004 Indian Ocean Tsunami: 40%

2011 Great East Japan EQ&Tsunami: 4% Difference comes from preparedness

Lessons from Disasters

What went wrong with pre-disaster countermeasures ?

What went right with pre-disaster countermeasures ?

It is no use crying over spilt milk,
but
We must make best of the lessons learnt.

SFDRR priority 3
“Investing in disaster risk reduction for resilience”

How to make effective investment beforehand ?

Risk was identified! ⇒ What Next?
Hints from the Sendai Experience.

Sendai City : population 1,046,000 (2010 census)
Previous experience of 1978(M7.4), 2003(M7.0), 2005(M7.2) earthquakes
Probability of another Miyagi-ken Oki EQ estimated as 99% within 30 years !

Risk is imminent! ⇒ Policy & Action by Sendai City

Nov. 1999 "Sendai City Building Assets Seismic Safety Target"
Sept. 2005 "Sendai Disaster Reduction Expo" with Cabinet Office of Japan
April 2008 "Sendai City Earthquake Resilience Policy"

Examples of Action

- Seismic Retrofit of Schools
- Seismic Retrofit of Sendai City Hall
- Seismic Retrofit of Fire Stations
- Subsidy to Earthquake Resistance Analysis of Private Housing
- Subsidy to Earthquake Retrofitting of Private Housing & more

Based on 2006 Revised Act on Promotion of Seismic Retrofit of Buildings

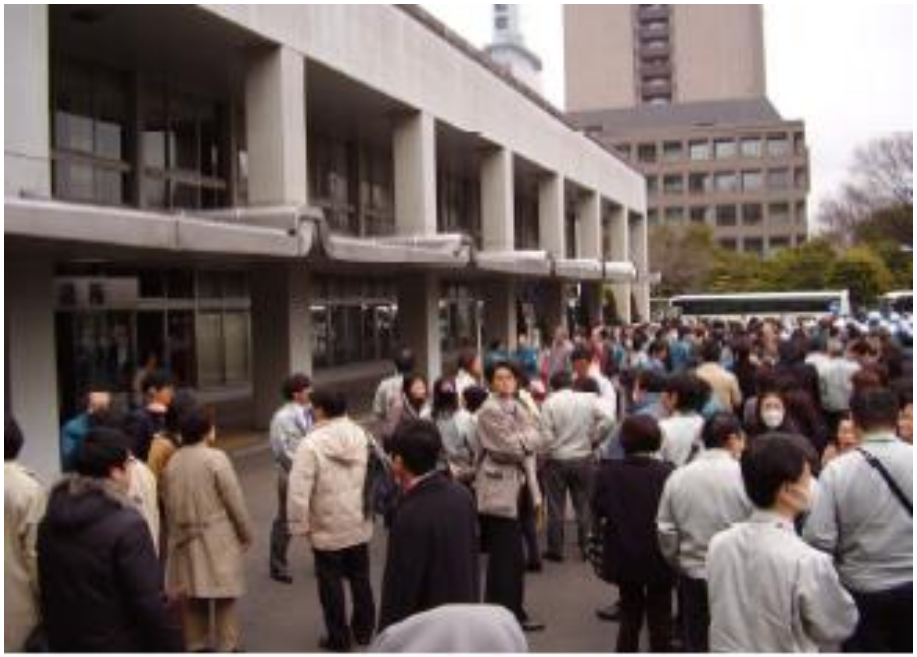
Minimized human casualties by the Great East Japan EQ (M9.0)

Hanshin-Awaji (Kobe) Earthquake (M7.3) 1995

Collapsed Kobe City Hall old building
Kobe water department was in the crushed 4th floor.

The Great East Japan Earthquake(M9.0) 2011

Sendai City Hall temporary evacuated for safety check.
Safety confirmed in 1 hour and resumed functions.



Sendai City carefully examined the lessons learnt of Kobe 1995

Seismic Retrofit of Schools

Seismic retrofit of schools based on Sendai City Earthquake Resilience Policy April 2008

Progress of school seismic retrofitting : 99.6% done by April 2010

M9 Earthquake Came ! 11 March 2011

No structural damage to Sendai schools.
Not a single child killed in Sendai school.

Seismic Retrofit of Sendai City Hall

Sendai City Hall built in 1965 (before the 1981 seismic standard)
Earthquake Resistance Analysis done in 1996 ⇒necessity for seismic retrofit
Seismic retrofit work done in 2007 to 2008

Seismic Brace with vibration damper inserted.

Seismic Brace & Seismometer installed on ground floor hall.

M9 Earthquake Came ! 11 March 2011

Structural safety of City Hall confirmed in 1 hour.
City hall served as temporary shelter for stranded commuters & visitors.

Photo by Tobishima Cooperation

Seismic Retrofit of Fire Stations

Seismic Retrofit of Sendai City Fire Stations based on
Nov. 1999 “Sendai City Building Assets Seismic Safety Target”
April 2008 “Sendai City Earthquake Resilience Policy”

M9 Earthquake Came ! 11 March 2011

None of the Fire Stations structurally damaged by earthquake.
Functioned as Emergency Operation base.

Earthquake Resistance Analysis of Private Housing

In 2008, 17% of private housing stock in Sendai City was below seismic standard of 1981.

Urgent need to improve the earth**q**uake resistance of private housing stock to save lives. ⇒Policy package for Earthquake Resistance of Houses

Policy Target : more than 90% of private housing to be above seismic standard by 2015.

1st Step : Subsidy to Earthquake Resistance Analysis of Private Housing

Private owners of detached wooden structure house built before 1981 can get earthquake resistance analysis with minimal fee (JPY14,580～JPY17,280)

Private owners of condominiums built before 1981 can get earthquake resistance analysis 50% subsidy as a group.

Earthquake Resistance Retrofit of Private Housing

2nd Step : Subsidy to Earthquake Resistance Retrofit of Private Housing

Private owners of detached wooden structure house built before 1981 can get subsidy of 50% earthquake resistance retrofit work.

Private owners of condominiums built before 1981 can get earthquake resistance analysis 50% subsidy as a group.

M9 Earthquake Came ! 11 March 2011

Tsunami Inundated area
647 killed, 26 missing

Non-inundated area,
11 killed
Heavy damage but not so fatal.

Revised Act on Promotion of Seismic Retrofit of Buildings enables Investment for Seismic Safety

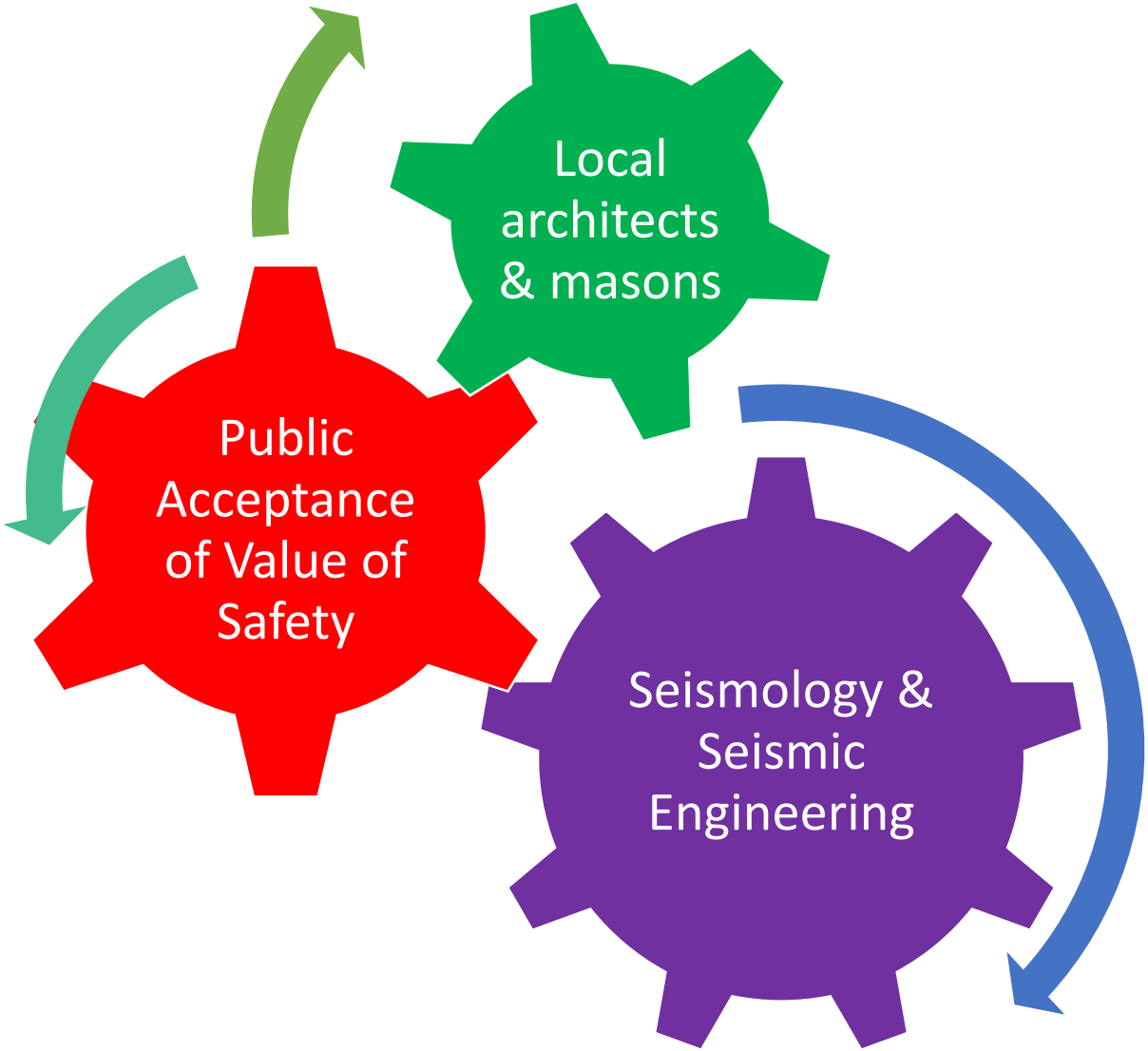
Since 2013, all the Hotels & Department Stores in Japan built before 1981 are obliged to do their Earthquake Resistance Analysis and disclose the results to the public.

Do foreign tourists want to stay in a fragile hotel?
Probably NO.

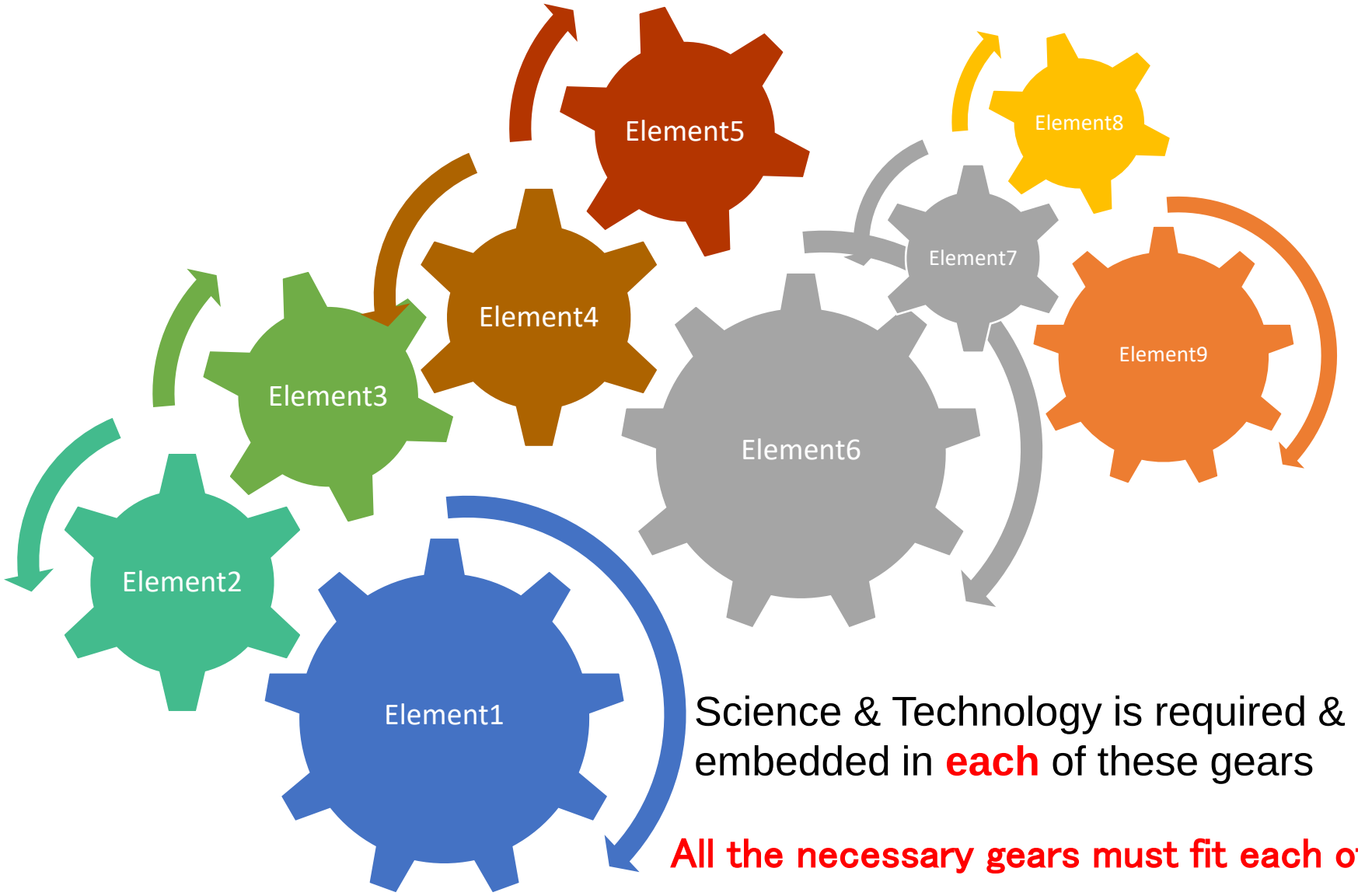
Major Cities have prepared subsidy programs for seismic retrofitting of hotels built before 1981. (incl. Sendai City)

Incentives for Investment in Earthquake Resilience !

Some elements for earthquake safety of housing



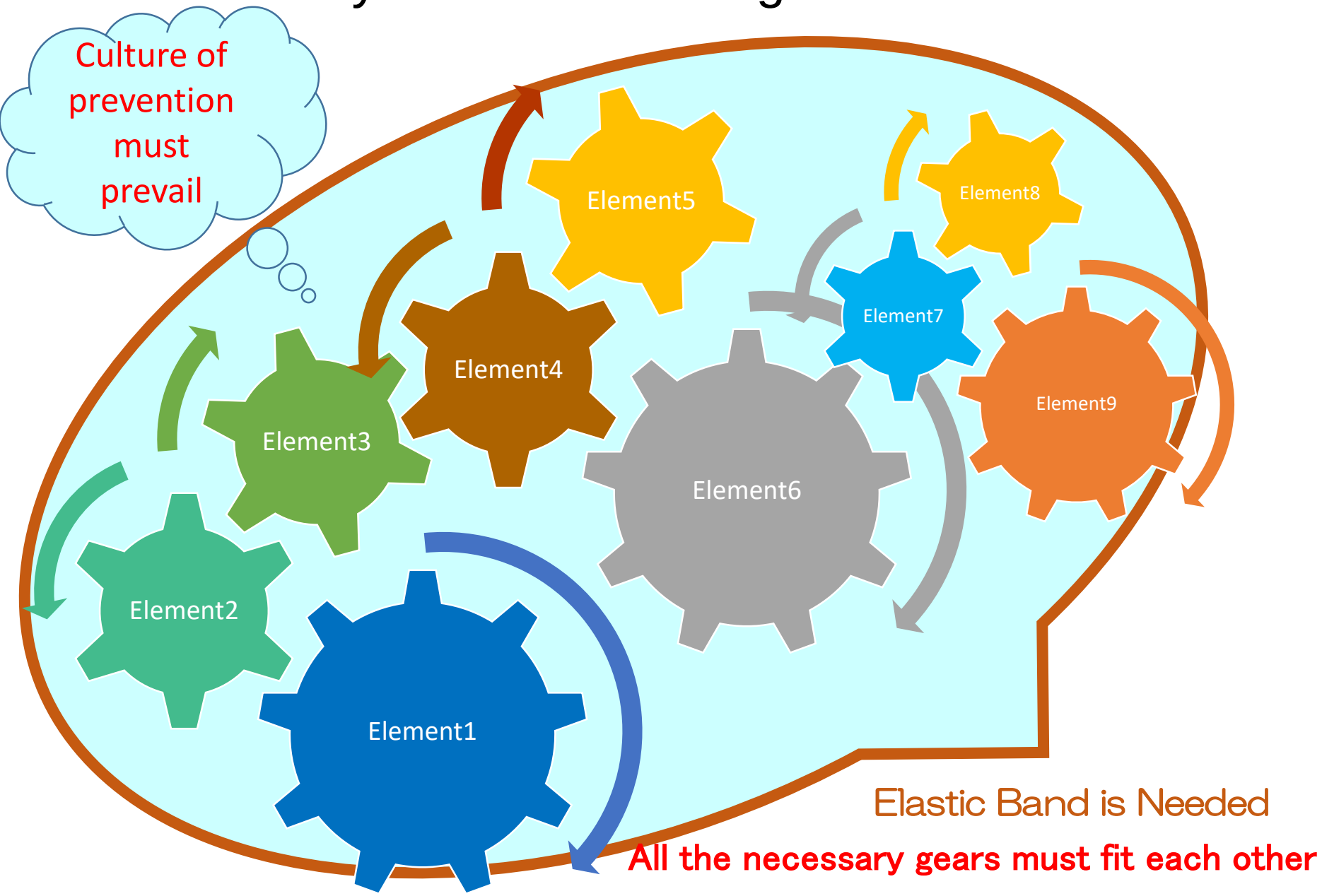
Numerous Efforts are Necessary to Save Lives and Livelihoods



Science & Technology is required & embedded in **each** of these gears

All the necessary gears must fit each other

Somebody Must Bundle Together Various Elements



Elastic Band is Needed

All the necessary gears must fit each other

Institutionalization of Disaster Lessons ⇒ Legislation

This elastic band needs to be resilient against numerous criticisms.

The Paradox of DRR Administration

How can we sustain DRR efforts at National/Local Levels ?

How can I secure budget for DRR !?

- Justifications are required to negotiate DRR budget with the Ministry of Finance.
- Unless budget for DRR are sustainable, cannot expect sustainable DRR at national and local level.
- Ad-hoc voluntary donations are unstable.
- A sustainable DRR cannot rely on “ad-hoc beauty contest for funding”.

DRR should be seen as Investments not Expenditures !

To justify investment, B/C (benefit per cost) needs to be explained

Basic Disaster statistics

- human casualties
- losses of housing
- physical damage numbers
- economic damage figures

The Annual Official Report on Disaster Countermeasures (White Paper on Disaster Reduction) since 1963 in Japan

The cover picture is the winner of the **Annual Disaster Awareness Poster Competition.**

- **Descriptive report** on individual disaster damage & response
- **Disaster statistics, Official recording**
- Disaster reduction **policies**
- **Measurements** of achievements on risk reduction action
- Reports on **expenditures** of previous F.Y. and action taken **by sector** and **by four phases** of disaster reduction
- **Budget** for the coming F.Y. by sector and by four phases

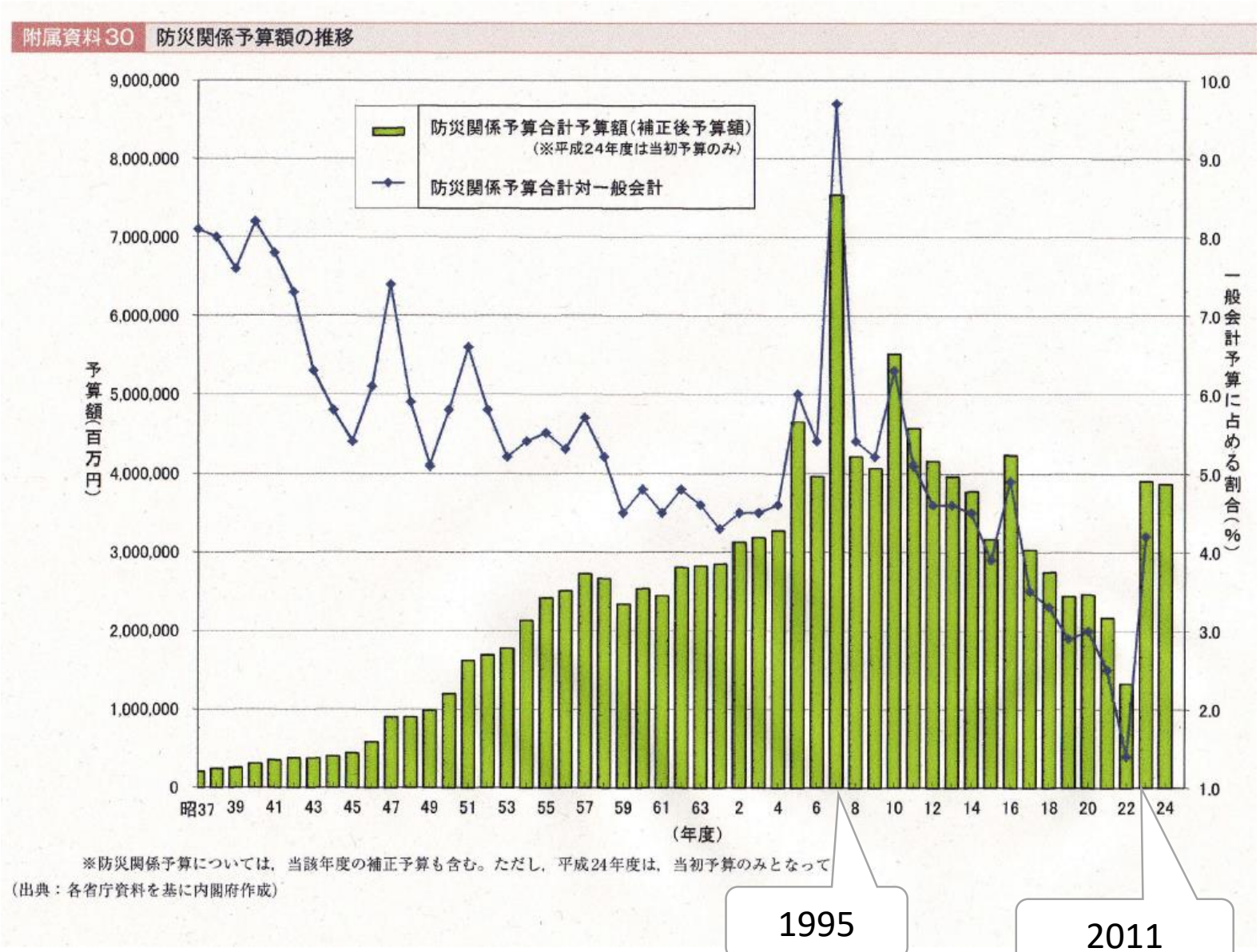
◆**Must** be submitted to the regular annual session of **National Diet**

◆To be discussed in the **Special Committee on Disaster Countermeasures** in **both houses** of the National Diet

a way to table disaster reduction on the national agenda
a way to draw public attention to disasters in "peaceful years"
a way to maintain institutional memories of disaster reduction policies regardless of political changes

Institutionalization for continuous reporting

Budget Figures for Disaster Reduction in Japan



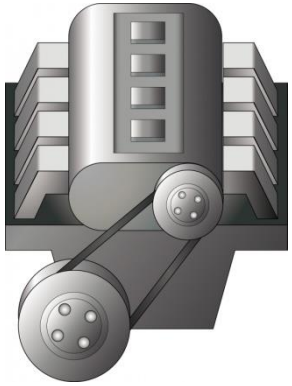
HFA to SFDRR : how can we proceed?

From “Saving Lives” to “Saving Lives & Livelihoods”

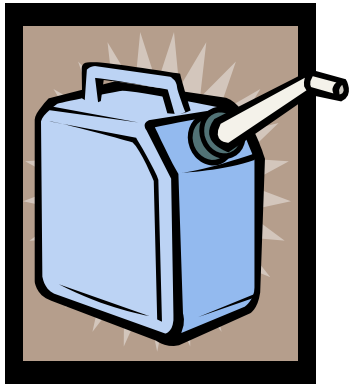
+

We Need

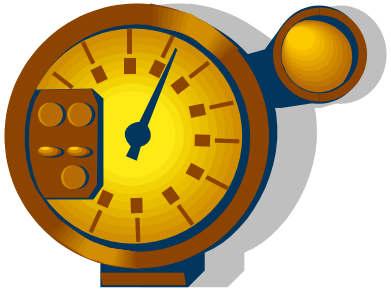
Engines, Fuels and Meters to Drive SFDRR forward



(national mechanism)



(finance & budget)



(statistics and measurements)

(with all stakeholders on board)

Stubborn strong leadership by Fudai village mayor saved his decedents in 2011 tsunami.

Great Watergate of Fudai, 15.5m high, Repelled the tsunami and all villagers inside was safe. Fudai was hit by the 1896 Meiji-Sanriku tsunami and the 1933 Showa-Sanriku tsunami.

The Watergate was constructed in 1984 at the strong initiative of the former village mayor Mr. Kotoku Wamura (1909-1997). At the time of construction he was criticized for this huge project but firmly stated that his descendants should never be killed by tsunami.

<u>His fame is renowned and a explanation board commemorates his firm decision for risk reduction. Also a cultural asset for DRR.</u>

Cultural Assets for Nepal DRR: Reconstruction and Resilience against future EQs

Are people aware of possible Earthquakes in the future ?
Does earth science indicate existence of active faults near major cities ?
Are there archives of past earthquakes ?
How are the historical records inherited among generations ?
Are there plans for publication of official archive document of 2015 EQ ?
How can the culture of prevention be better fostered in Nepal ?

Bhugol Park, New Rd, Kathmandu 1934 Earthquake Monument

How can we better share the lessons learnt ?

November 2013

March 2011

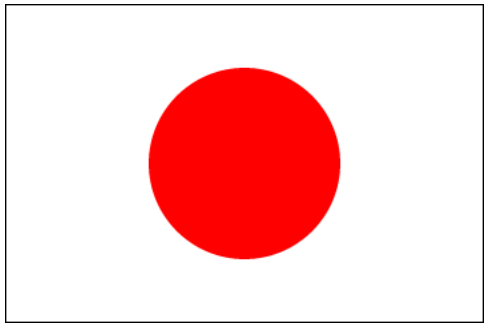
September 2005

Proverb by Japanese Physics Scientist
Dr. Torahiko TERADA (1878-1935)
who investigated the damage by
1923 Great Kanto Earthquake

「天災は忘れた頃にやってくる」

“Natural Disasters will hit us by the Time people have forgotten about it”

How to foster & inherit the Culture of Prevention



Thank you for your attention!

Reference Materials

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