スラウェシ島地震災害への復興支援と新たな学問領域への期待

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国連仙台防災枠組み

防災サブスタンスの政府交渉官として国連文書をまとまる

銀河企画


APEC
USA 2011

スラウェシ地震災害の特異性

- 本震
  - 発生日　　2018年9月28日18時02分43秒（現地時間）
  - 震源の深さ　　10.0km
  - 規模　　モーメントマグニチュード(Mw)7.5
  - 津波　　約11.3 m – パル東部[1]
  - 地震の種類　　左横ずれ断層型
  - 最大前震　　M 6.1 – 9月28日15時00分[2]

- 被害
  - 地震の揺れによる被害
  - 津波
    ①海底地すべり、②液状化沈降、③地震断層、④Sloshing
  - 内陸部の液状化と地すべり
  - 海岸沿いの液状化と沈降

津波実写映像

- 湾奥に到達した比較的一様な津波
  - https://www.youtube.com/watch?v=HvZXEV5mh58
  - https://www.youtube.com/watch?v=wgCQhpKHncQ
- 沿岸部の地すべり由来とイメージ出来る局所的津波
  - 飛行機から撮影された Bore
    - https://twitter.com/GerryS/status/1045716841509703680
  - 湾内東西両岸部から発生したと思える津波
    - https://www.youtube.com/watch?v=61ltBglP-YM&feature=youtu.be

津波による海岸沿いの建物被害

- スラウェシ湾最奥部
  - https://www.youtube.com/watch?v=vvkOz_4CsV0

沿岸の津波被害例

・メイン cause は湾口大規模海底地すべりか？

液状化沈降による津波発生原因部？

- パル湾最南端部の海岸沈降 or 状化～流亡？

湾口部の巨大海底地すべりの可能性？

- 湾内の散発的な河川流出土砂の堆積物の地すべり以外に、湾口部の巨大海底地すべり由来を仮定しないと、実現象と合わない？

災害復興へ日本がリードしてきた世界の潮流

- 国連仙台防災枠組み
  Sendai Framework for DRR 2015-2030
  での、 Build Back Better 復興思想の世界標準化
  - ドナーが外部資金を入れる以上、現況復旧で満足させない！
    再度災害を防止する or 被災前より少しでも強靱化を！
  - キャッチフレーズとして Build Back Better を日本から提案

- 再度災害が起こったら同じ支援を外部から投入出来ない
- ドナー支援の大半が発災後、事前防災投資支援は1/4程度
- いつまでたっても、レスポンスと復旧の支援が続く
- 将来は災害の多発化、激甚化、Exposureの増加

Typical Disaster Management Cycle & DRR

- **Reconstruction and Rehabilitation of Infrastructure**
- **Mental Health Care**

Recovery

Mitigation

- **Hazard mapping, evacuation drill**
- **Organization Reinforcement**
- **Establishment of Disaster Management Plan**
- **Development of Early Warning System**

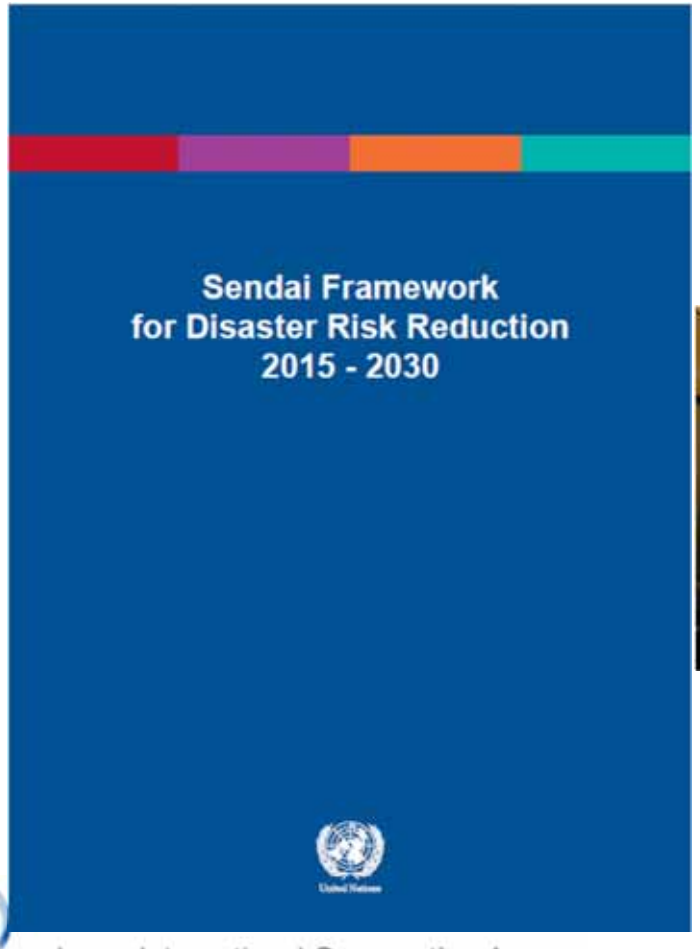
- **Dispatch of Rescue team**
- **Provision of Rescue supply**

Response

Disaster

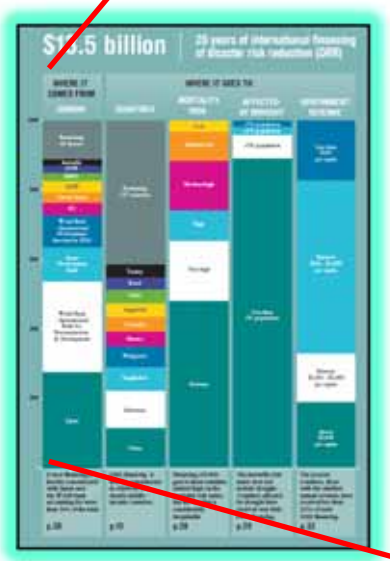
Preparedness

Sendai Framework Negotiation Discussion in Geneva UN/HQ from Aug 2014 – March 2015 Sendai

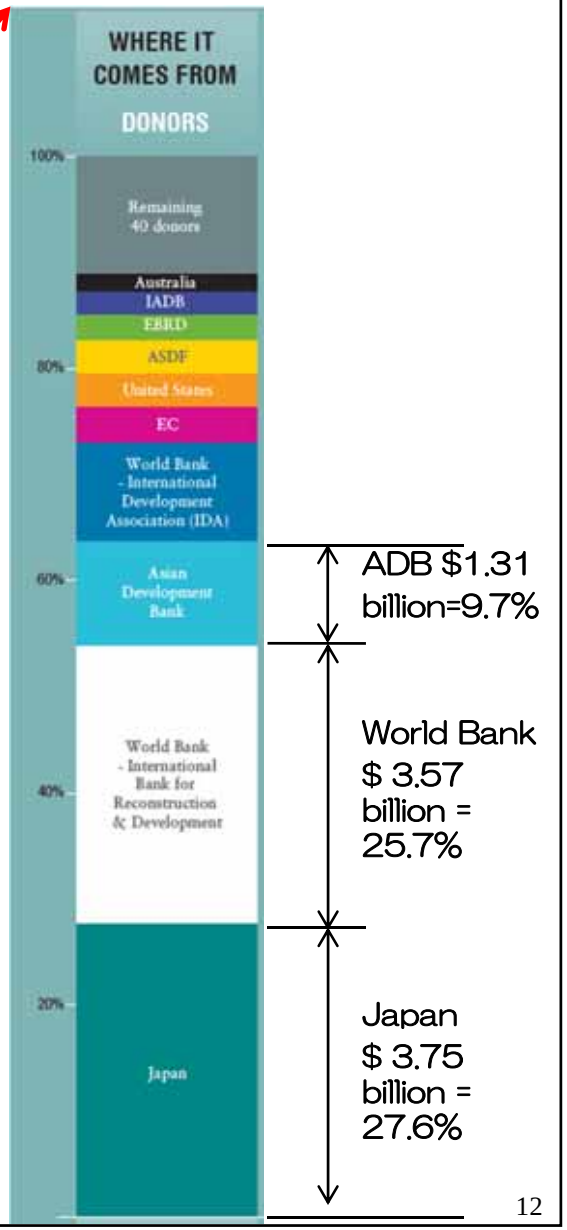


Past Japanese position in the world for DRR

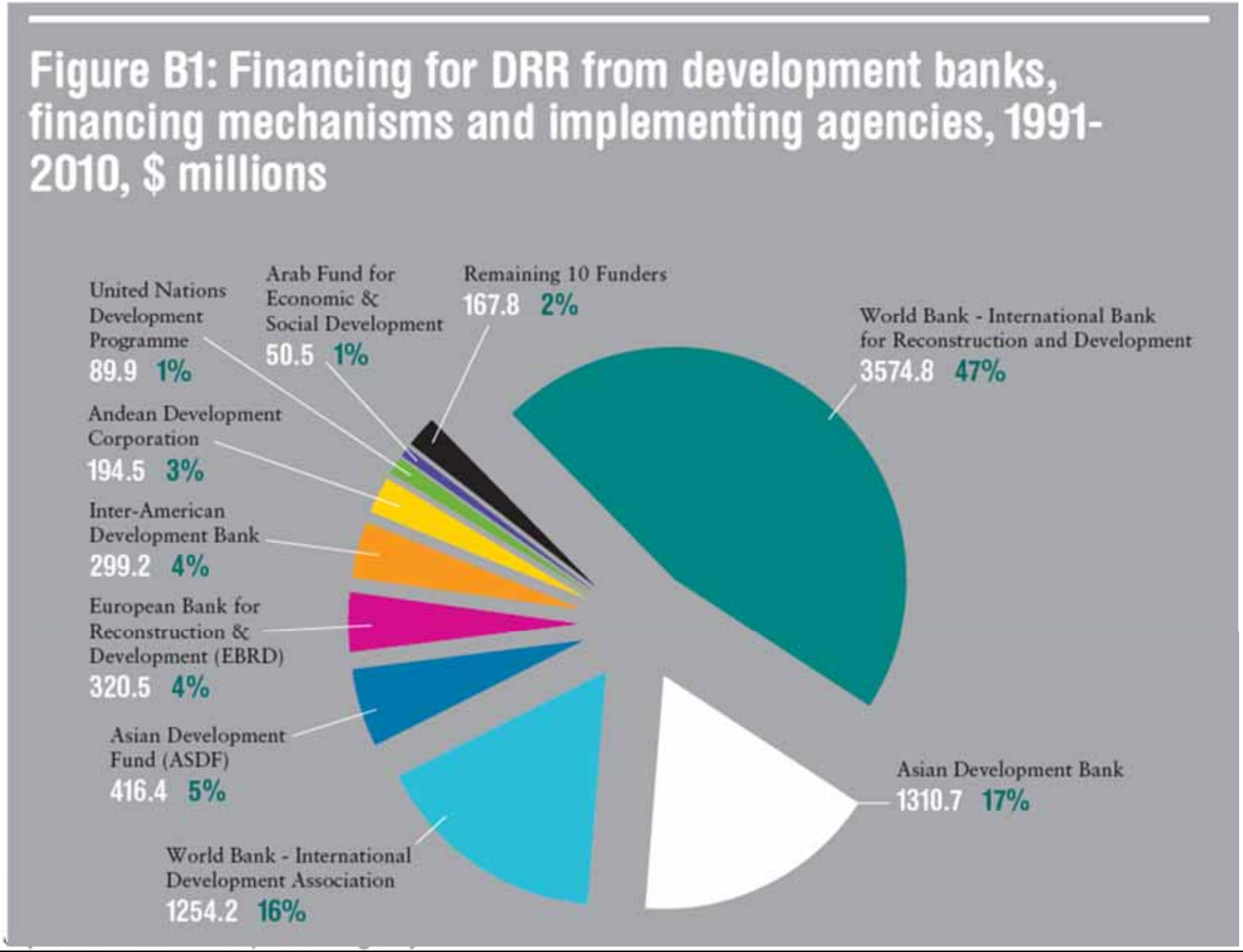
- GFDRR & ODI reports, 20 years of international financing of disaster risk reduction (DRR)
- Donor financing is heavily concentrated with Japan and the World Bank accounting for more than 50% of the total.



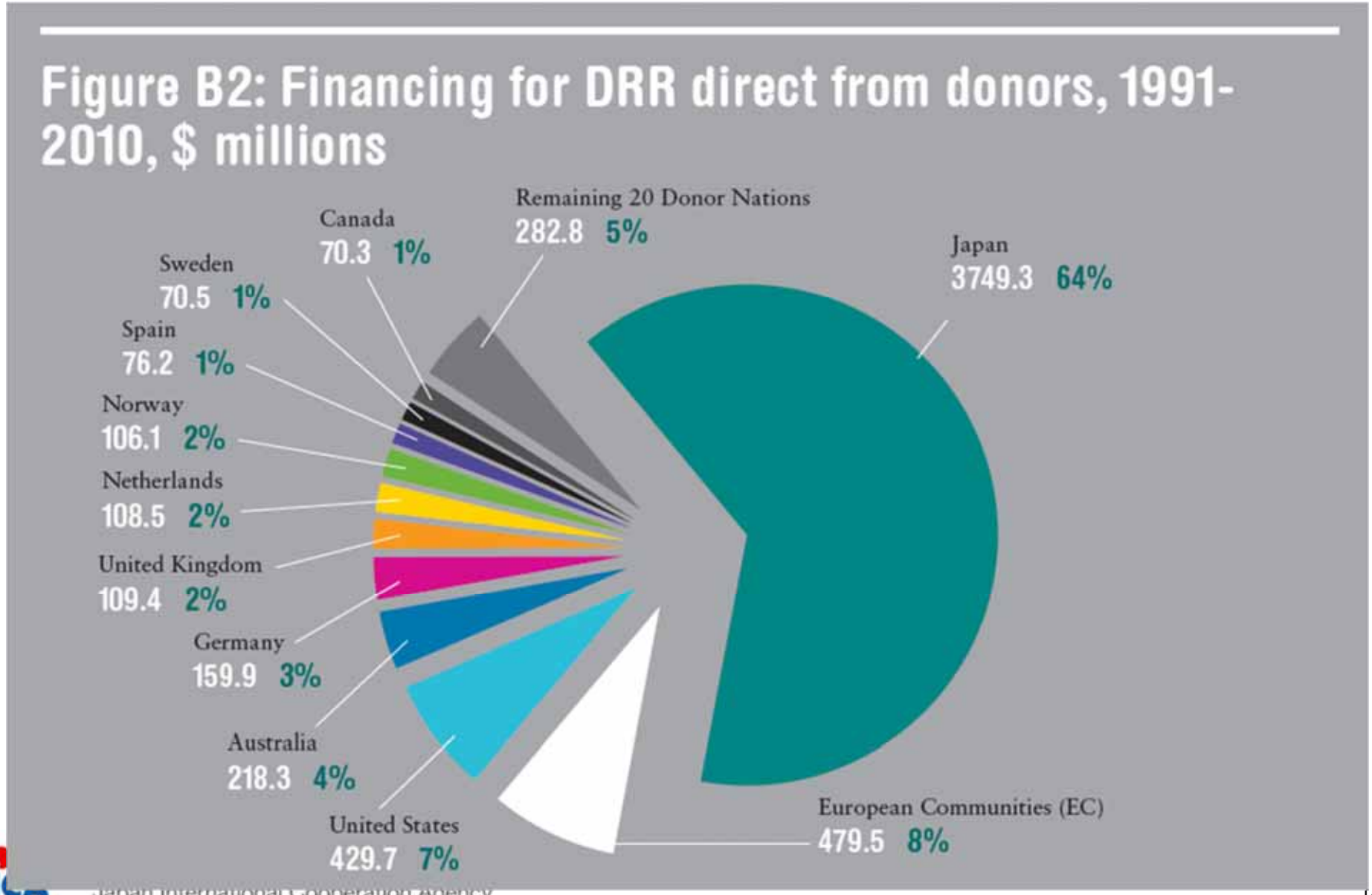
1991-2010



Among Developement Bank

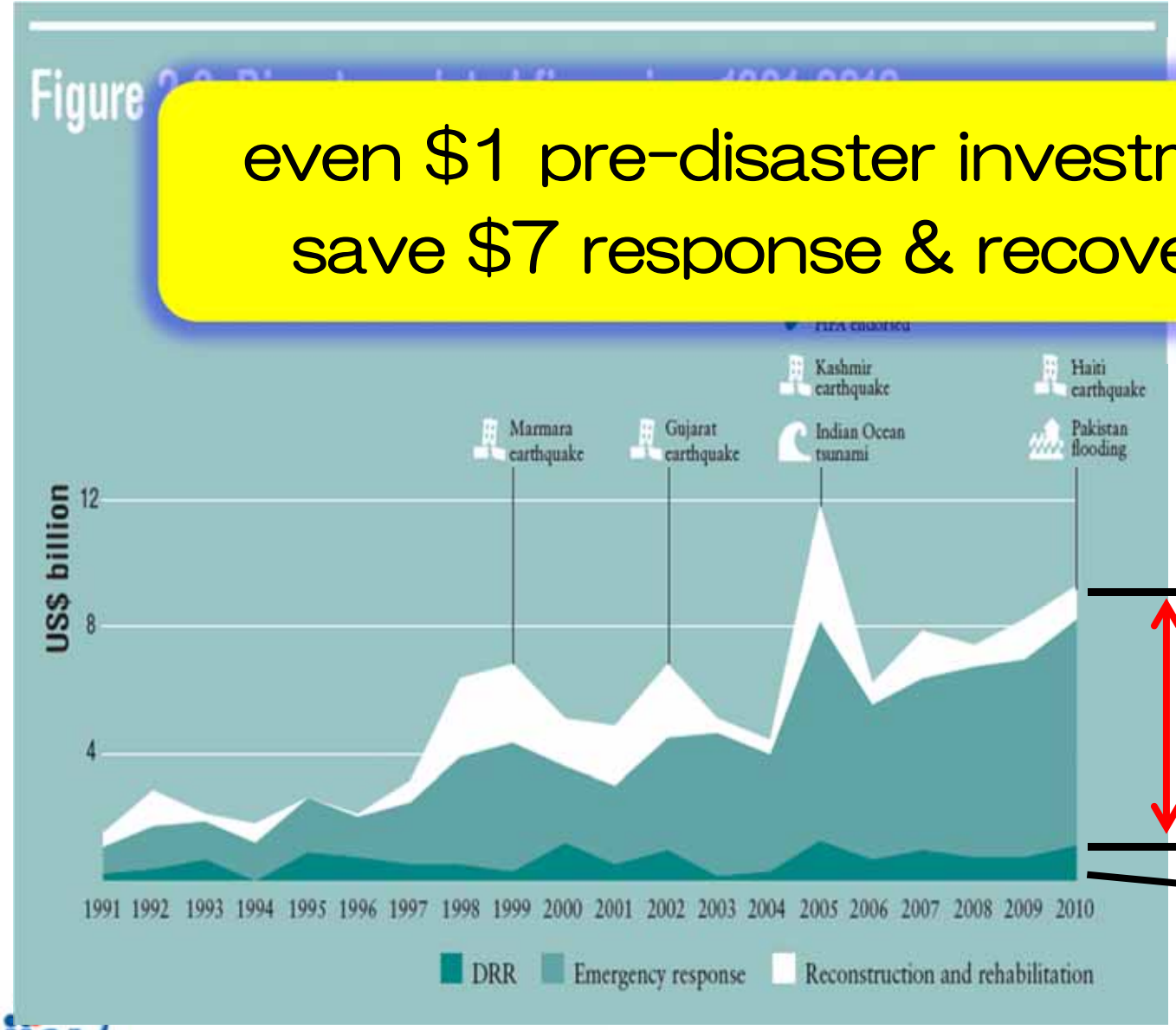


Among bilateral donors



Pre-investment is much Cheaper than recovery cost, but・・・・・・

even $1 pre-disaster investment can save $7 response & recovery cost

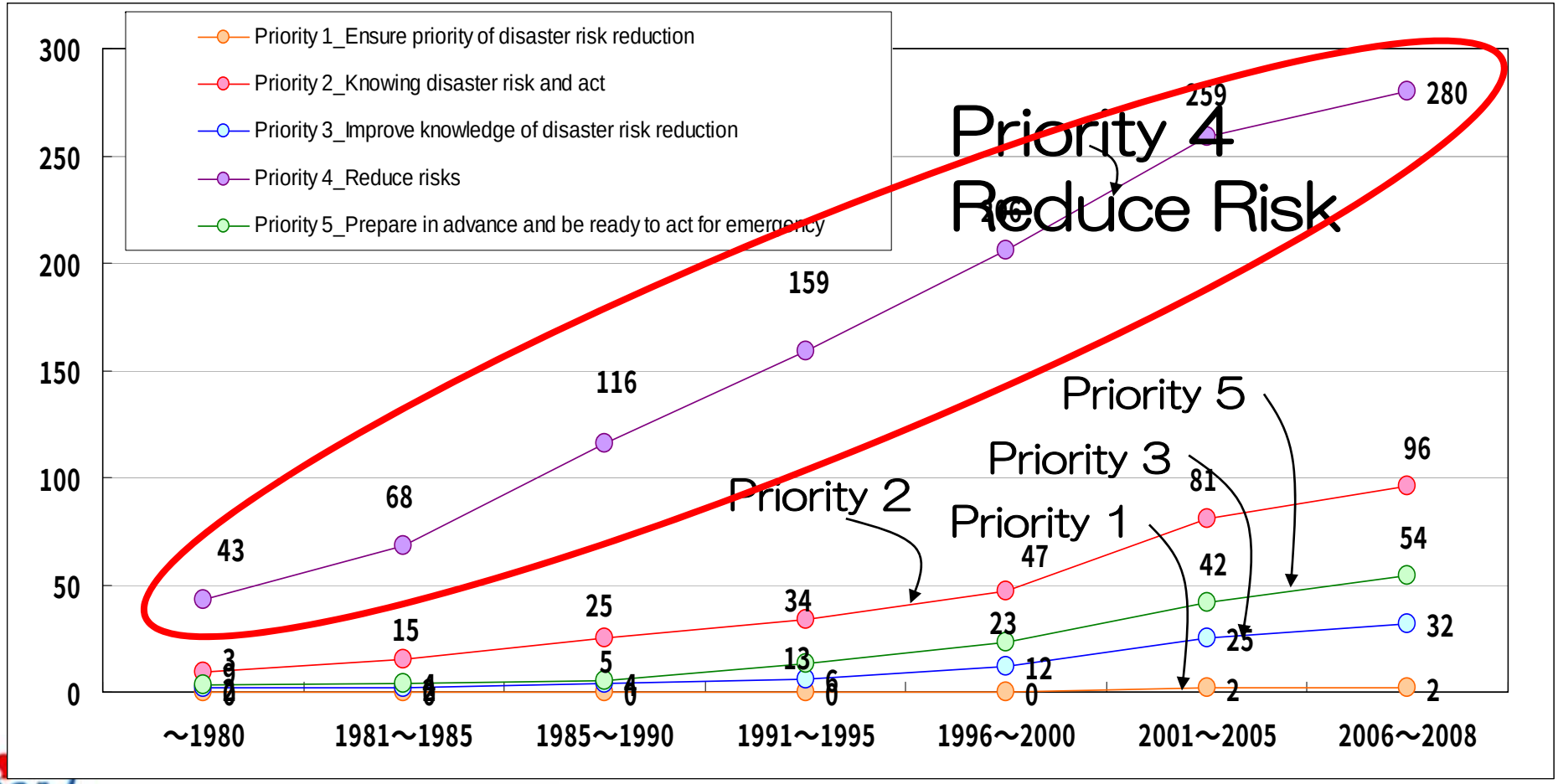


Emergency Response & Recovery

DRR

JICA's Support meet to the HFA Priority Action

- The projects related to priority action 4 are increasing rapidly compared to others.
- It entails the best mix of structural and non-structural measures.



The importance of pre-disaster DRR investment Global Assessment Report P-87

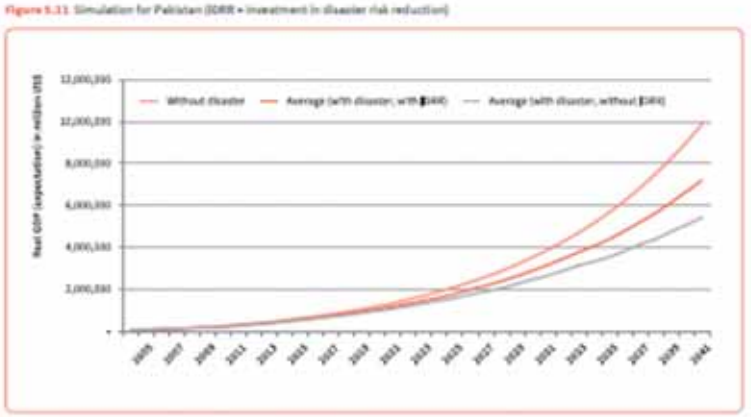
GAR

Global Assessment Report on Disaster Risk Reduction

2013

From Shared Risk to Shared Value:
The Business Case for Disaster Risk Reduction

United Nations



more resilient than smaller economies, heavily dependent on single economic sectors (UNISDR, 2009 and 2011; Gencer, 2012). In less resilient economies, the wider impacts of disasters are more likely to be pervasive.

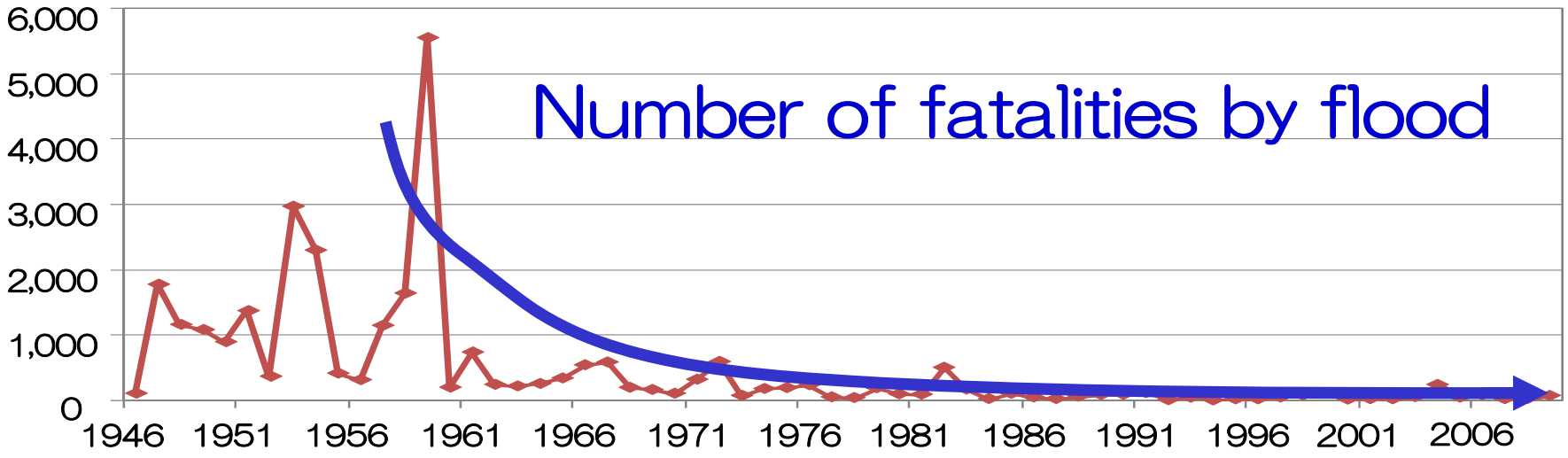
Although further research is required to reconcile the results from different economic models, recent studies show that in the medium (Hochrainer, 2009) or long term (Hsiang and Jina, 2012), countries that have experienced intensive disasters may never recover this lost growth. For example, countries affected by tropical cyclones experience lower GDP growth in the 15 years that follow compared with the estimated growth that would have occurred without cyclone impacts. In countries with frequent severe cyclones—such as Madagascar and the Philippines—and large fiscal gaps, growth will be lower over several decades (see Figure 5.10). Countries with less frequent and severe cyclones—such India or the United States of America—also experience lower growth, but the divergence is far less.

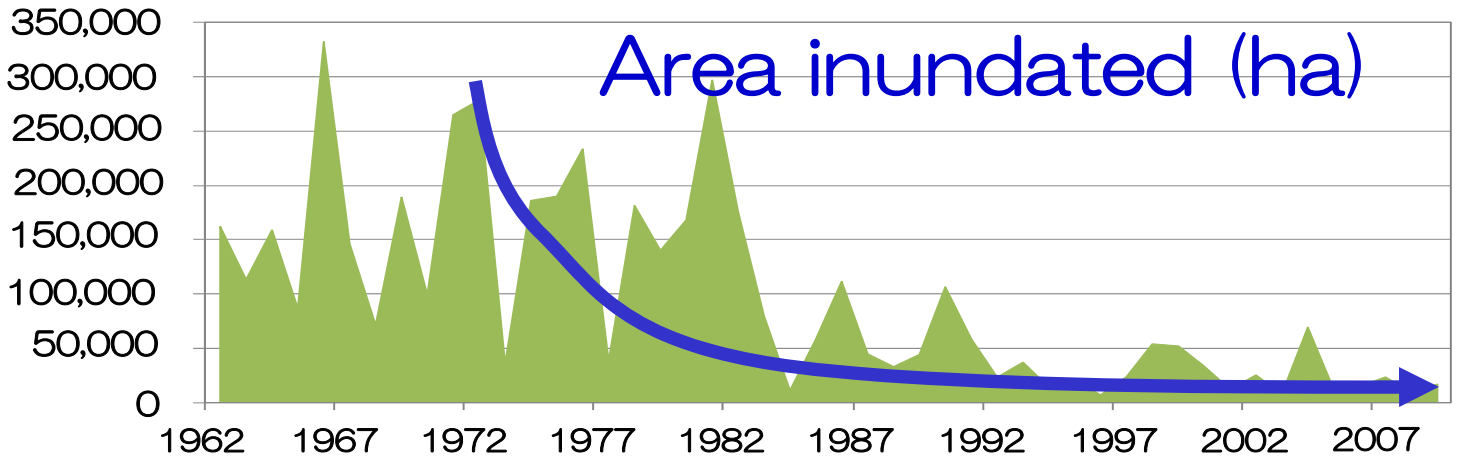
New simulations of the impact of disaster risk reduction measures on economic growth also show useful results. In Pakistan, for example, an analysis of economic growth projections shows that although real GDP growth would be impacted by a major disaster event, investments in disaster risk reduction could significantly curtail this impact (Figure 5.11).

The impacts of disasters on economic growth over time can be understood when assessing potential mid- to long-term macroeconomic impacts. In Honduras, a one-in 100 year event could produce direct losses amounting to 33 percent of its GDP. Given its limited ability to finance this loss, the government also would have to prepare for further cumulative consequences over time, estimated at up to almost 24 percent of GDP over a period of 5 years (Figure 5.12).

Currently, national accounting does not adequately measure disaster impacts. On the contrary, accounting systems usually report reconstruction and relief spending, adding to GDP figures. Disaster risk may be included in new approaches to wealth accounting at the national level such as adjusted savings,[1] to improve risk management and financing strategies in the future (Mechler, 2009).

Reduction of flood damages in Japan by continuous investment





Number of fatalities and inundation area have dramatically been reduced in Japan due to continuous investment in and efforts for flood mitigation.

Source: Water Disaster Statistics, Ministry of Land, Infrastructure Transport and Tourism

The importance of pre-disaster DRR investment
Global Assessment Report

Chapter 5

The Resilience Challenge

5.3 Macroeconomic effects

Disasters can negatively impact the economic development of any country, but for smaller economies that are heavily dependent on single economic sectors, these impacts are likely pervasive. Direct and indirect losses can result in macroeconomic effects that cumulate over time.

The importance of pre-disaster DRR investment
Global Assessment Report P-87

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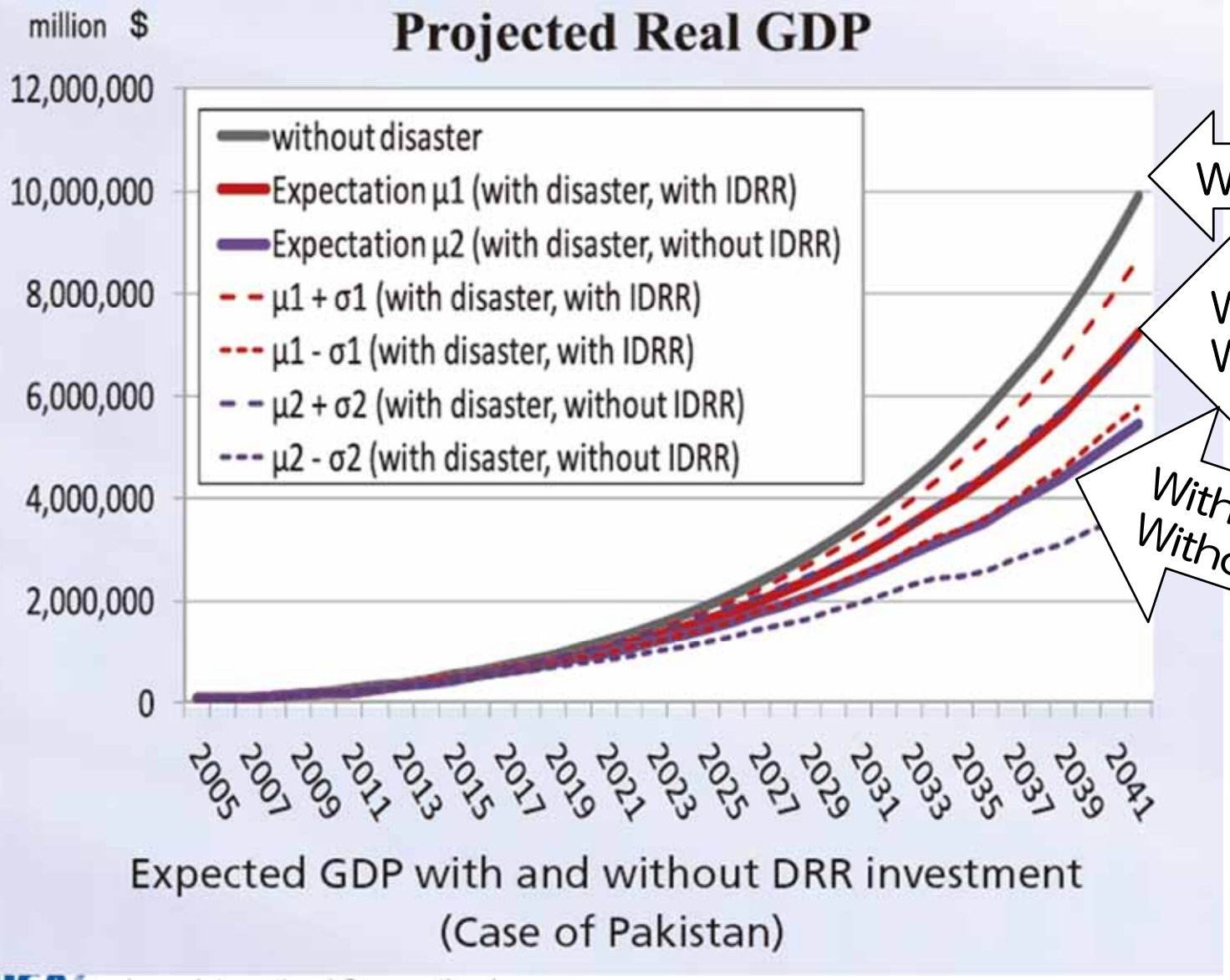
Pakistan case for 2042
GDP will 25% down without DRR investment



Expected GDP with and without DRR investment
(Case of Pakistan)

Japan Investment case as a success case in UNISDR Global Assessment Report 2015

GAR

Global Assessment Report on Disaster Risk Reduction

2015

Making Development Sustainable:
The Future of Disaster Risk Management

United Nations

extensive risk layers. In Japan, for example, continued investment in flood protection—together with regulation—has resulted in a dramatic reduction in the areas flooded and in mortality (Figure 6.3).

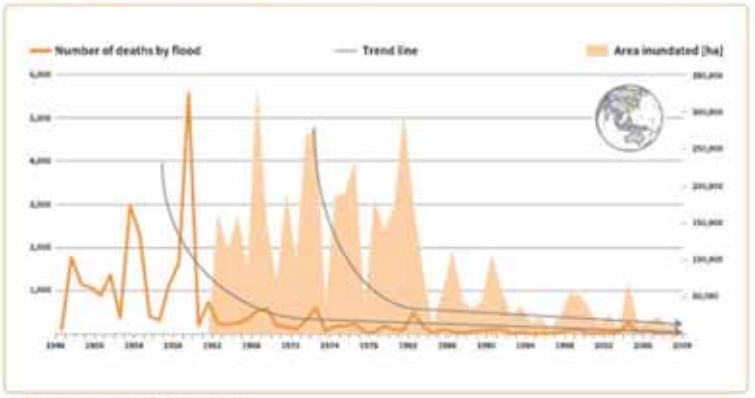
In contrast, many low and middle-income countries lack the necessary regulatory quality for norms and standards to be applied effectively. In many such countries, weak accountability of local to central government, of government to citizens, and across government sectors has undermined the effectiveness of norms, standards, laws and policies (Coskun, 2013). For example, while most disaster risk reduction laws provide some kind of mandate for the involvement of women and vulnerable groups, these often consist of general aspirational statements without specific mechanisms for implementation (IFRC and UNDP, 2014).

As a consequence, the adoption of improved building codes or environmental regulations in lower-income countries may lay a veneer of disaster risk management over the surface of relentless risk accumulation (Wamsler, 2006). In particular, where a significant proportion of economic and urban development takes place informally (either in an informal sector *per se* or due to corruption and lack of compliance in the formal sector), instruments such as building codes and zoning plans are only effective in strictly limited areas and sectors, typically in higher-income enclaves and strategic economic sectors. Most building outside of these enclaves and sectors is non-engineered, most urbanization is unplanned and local governments have weak capacities to promote or enforce standards.

In addition, the adoption of inappropriately strict codes and standards may have the opposite effect of driving more development into the informal sector, as low-income households and small businesses are unable to afford the costs of building to code in areas zoned for residential or commercial use.

Finally, the responsibility of those taking the decisions with regard to urban development, the application of building codes or land-use planning is not always clear-cut, as seen in the legal

Figure 6.3 Successful flood reduction in Japan



(Source: UNISDR with data from Takeya Kimiji, JICA.)

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Japan Investment case as a success case in UNISDR Global Assessment Report 2015

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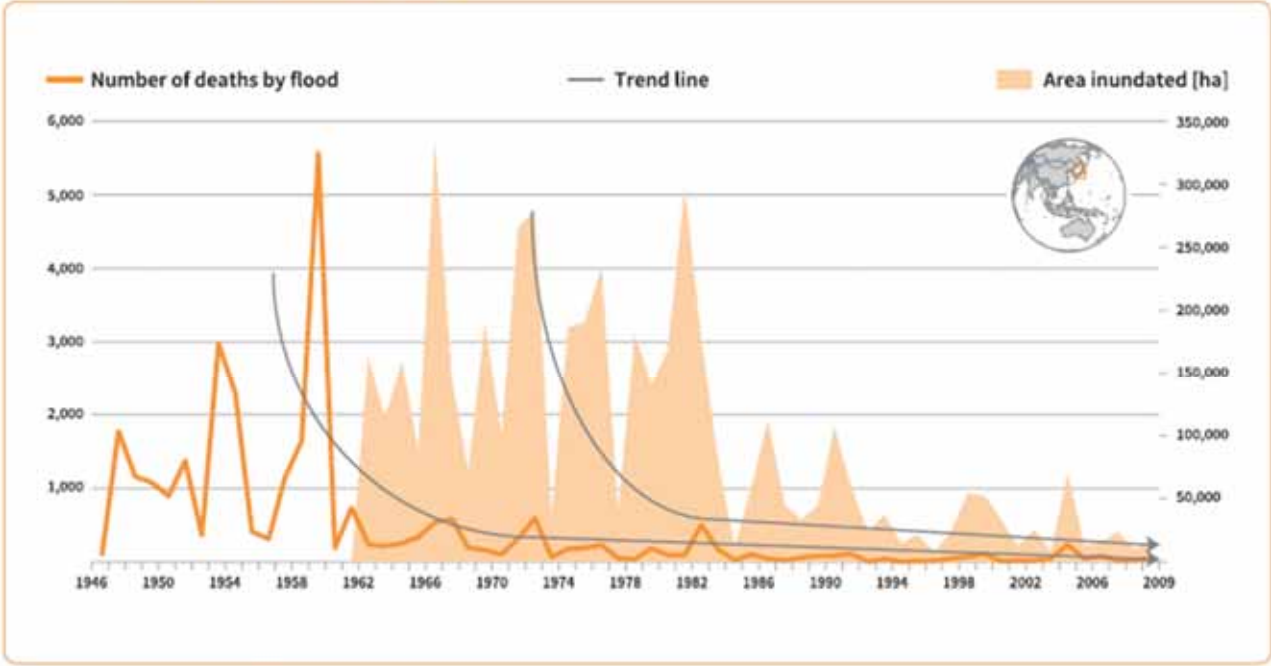
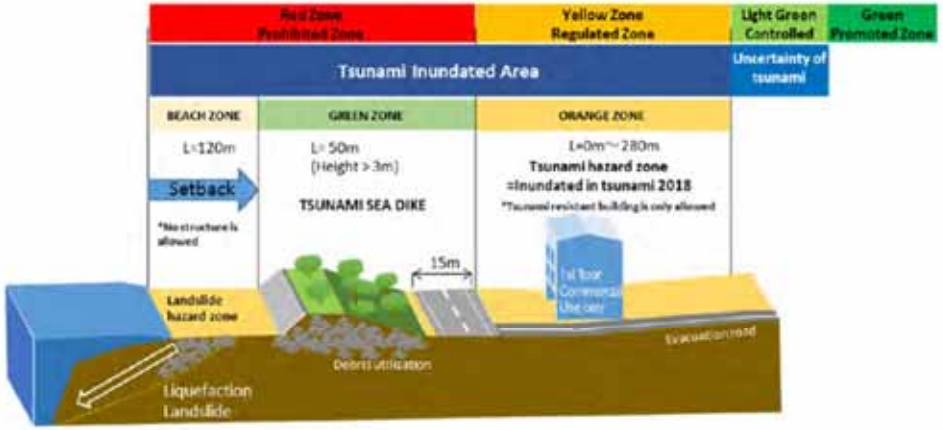


(Source: UNISDR with data from Takyea Kimio, JICA.)


European Commission
UN World Conference on
Disaster Risk Reduction
For every €1
invested in disaster prevention,
€4 to €7
are saved in disaster response.
#Road2Sendai #WCDRR
Source: EU
Humanitarian Aid & Civil Protection
25/02/2015

復興への課題

- インドネシア政府側は性急に復興計画、土地利用計画を立てたがる
- 津波外力を設定
  →構造物対策を想定
  →効果とコストのバランスから土地利用計画を策定

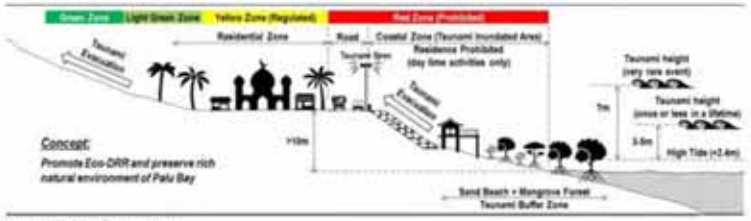


Source: JICA Mission Team

Figure 31 : Palu City Coastal Zone (cross image)

Source: JICA Mission Team

Figure 32 : Palu City Coastal Zone (plan image)



Source: JICA Mission Team

Figure 33 : Palu Bay East and West Coast

Invest for which level?
Target "Risk" is
same for pre-disaster
investment & BBB,
Priority 3 & 4

Risks in Sendai Framework; Risk type 1

Existing Risk

Future Risk
produced by development

Hazard is same, but
bigger exposure by development,
so "Risk" will increase!

Risks in Sendai Framework; Risk type 2

Magnitude & Frequency

Extensive event,

High frequency happen,
small damage by each
but huge damage by total

Intensive event,

Low frequency but
serious damage by one event

Typhoon Ondoy in Manila 2009

Thai Flood 2011

Variations of Risk types

Impact

Extensive Risk

Intensive Risk

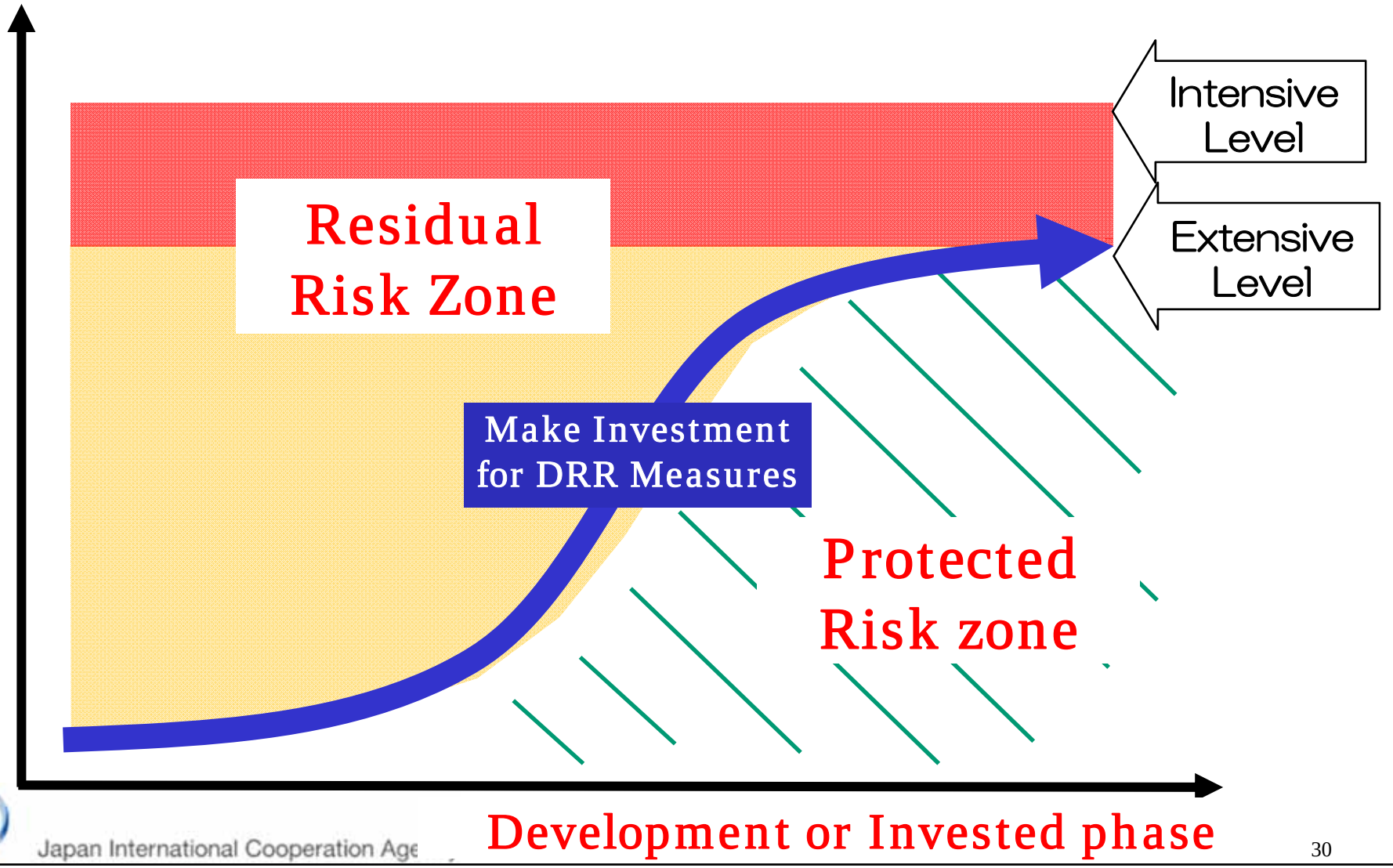
Existing Risk

Future Risk
produced by development

Time span

each states must reduce risks by investment

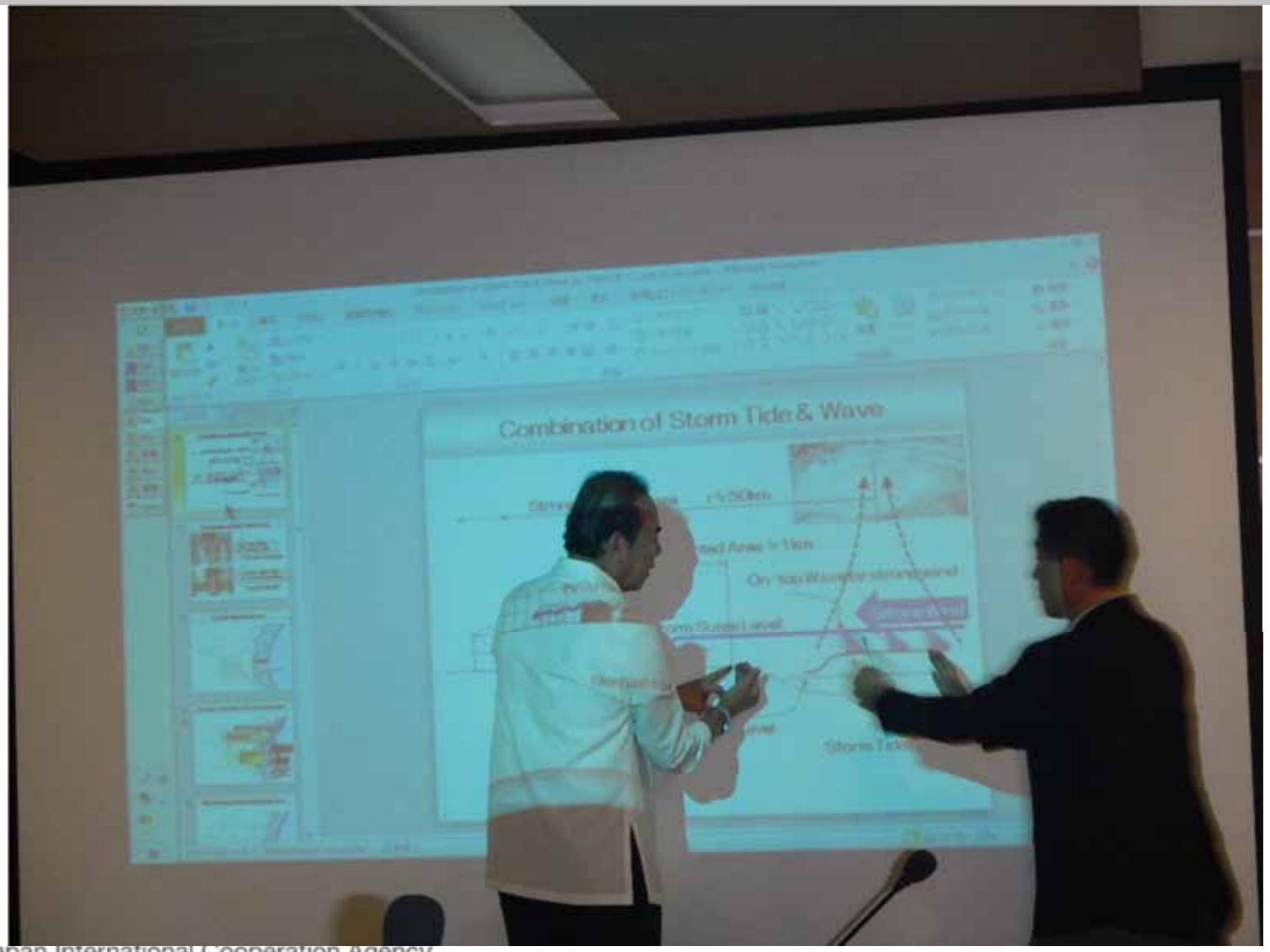
- required civil minimum of safety changes depends on the society economic matured level



JICA's Propose to Philippine Typhoon Yolanda (Hayan) case

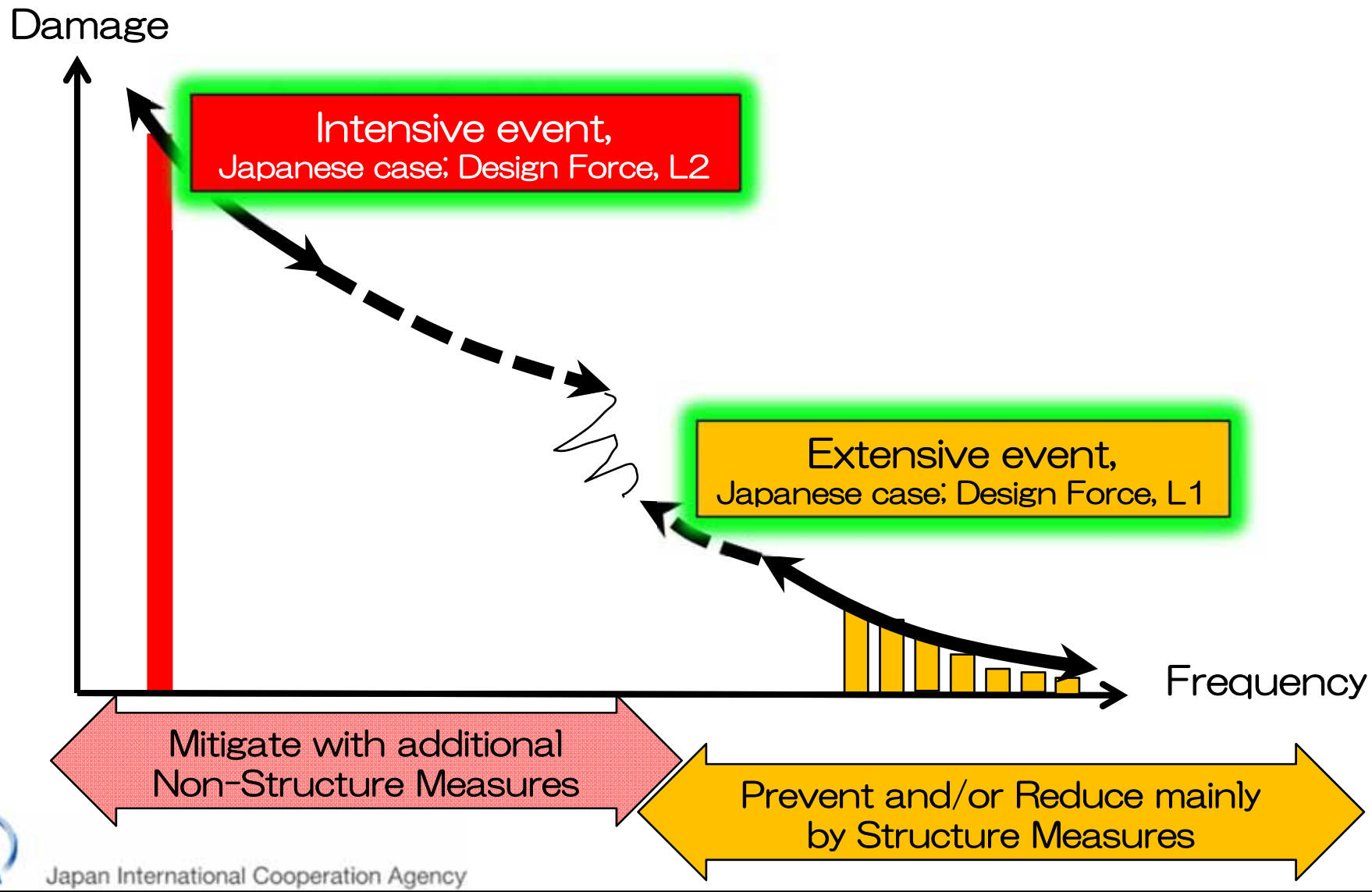
ヨランダ支援；公共事業大臣と直接議論し決定

BBB for Infrastructure

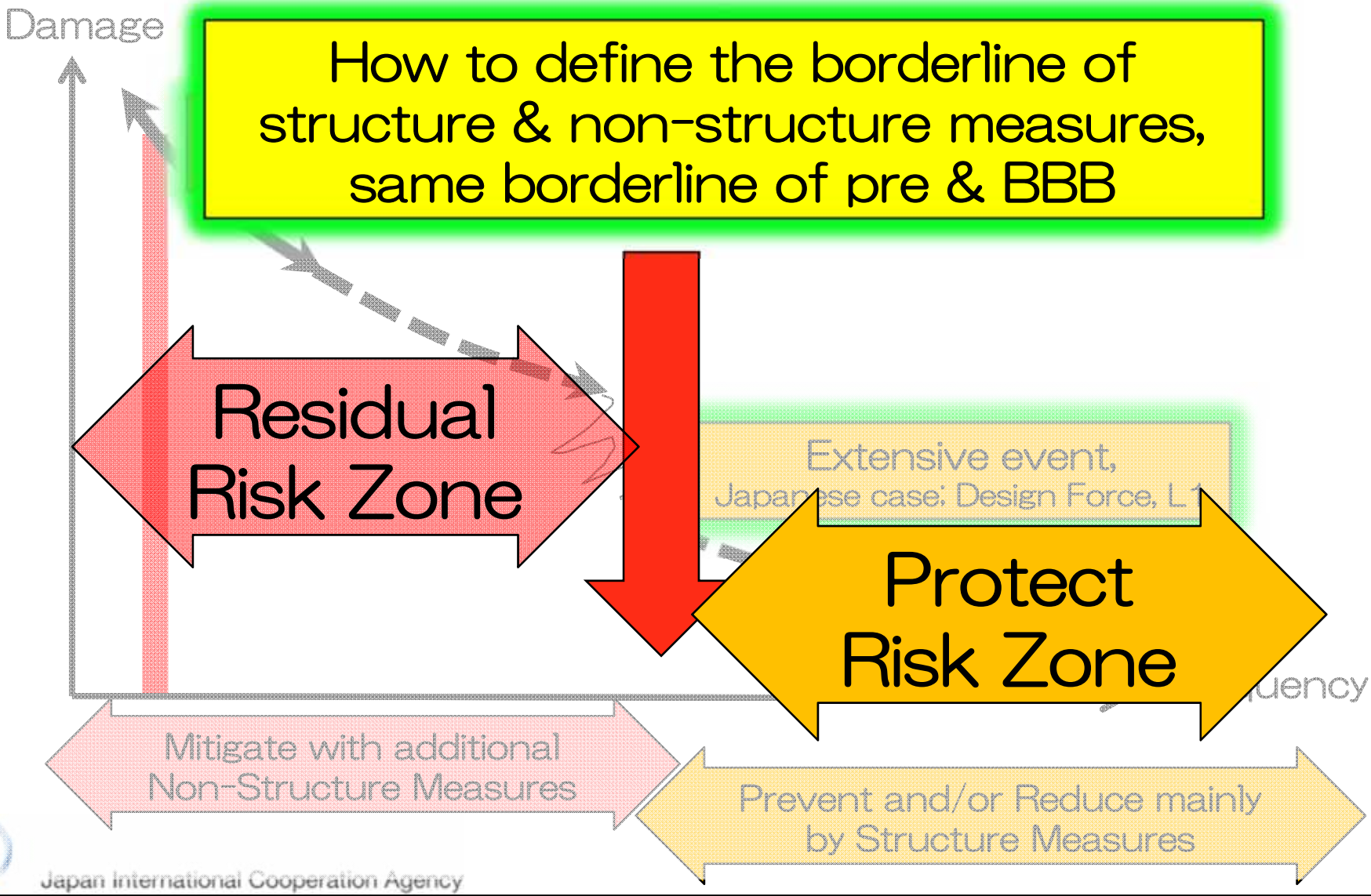


Philippine Yolanda case, similar to L1 and L2

In order to make Investment define design level & residual risks



Risk type-3


Damage
How to define the borderline of structure & non-structure measures, same borderline of pre & BBB
Residual Risk Zone
Extensive event,
Protect Risk Zone
Mitigate with additional Non-Structure Measures
Prevent and/or Reduce mainly by Structure Measures

復興への課題

- 今次津波を将来計画津波と設定して妥当か？
- 湾口部
  - 巨大海底地すべりポテンシャルはなぜ蓄積されたのか？
  - 次に発生する場所と時期は？
- 湾内局所地すべり
  - 不安定地塊は河川からの土砂供給堆積が原因？
  - 海底でも扇状地状の緩い≒不安定地形で発生？
  - 次の地震でも同じ横ずれ断層なら、しばらくすべらないか？
  - そもそも、津波を発生させる規模の不安定土塊の海底地すべりの再現周期はどのくらい？　数十年？　数百年？　数千年？
  - 次のすべりの場所は、同じ or 異なる？
  - 津波外力は湾内で包絡線？　今回最大津波をカバーする？

- 復興計画では計画津波≒想定発生地すべりを決める必要有り

新たな学問領域への期待

- 今次津波から low regret な外力設定を行えるような、この分野の学問領域への期待
  - 巨大海底地すべりとそれによる津波、将来想定
  - 海底河川堆積物由来の地すべりと津波、将来想定
  - 一度すべった場所の再起性と新たな場所の偶発優位性
  - 湾内全域の平均的再起性と設計外力の設定思想
  - インドネシア他地域、他国での同種災害のリスクは？
  - これまでの固定概念、偏見を捨てた new normal 化は必要無いか？
- 新たな学問領域の開拓、知見など、方向性を示唆頂きたい

インドネシアとの共同研究の可能性

- スンダ沖津波を受けて
  大統領が、予知や警報の知見をストックして、警報レベルまで社会実装しろ、と命令
- たまたま、JICAが津波警報システムの補強プロジェクトを立ち上げる段階
- これまでの津波メカニズム論の枠を破って、海底地すべりや火山噴火津波を含めた対応の社会実装が必要
- 本学会の知見を取り入れる、或いは、インドネシアの共同研究なども必要
- 貴学会への期待大！