

INDICATORS OF
DISASTER RISK
and
RISK
MANAGEMENT

Omar D. Cardona

Technical Director

Program for the Americas

IADB – UNC/IDEA

<http://idea.unalmz1.edu.co>

Disaster Risk Management...

- ✓ needs risk dimensioning, and **risk sizing** signifies to take into account not only the expected **physical damage**, victims and economic equivalent loss, but also **social, and institutional** factors.
- ✓ this means, from the multidisciplinary point of view, we need to consider **hard** and **soft** variables related to the potential impact of the events and the capacity of society to sustain that impact, using evaluation tools such as a **System of Indicators**.

Why a System of Indicators...

- ✓ It is necessary to “**make risk manifest**” in different ways for diverse decision-makers and stakeholders in charge.
- ✓ The **causes** of risk must be identified in order to be able to assess the **effectiveness** of both corrective and prospective mitigation measures.
- ✓ The **follow-up** of risk is an unavoidable step to evaluate the **performance** of risk reduction.

Objectives of the program...

- ✓ *Representation of vulnerability and risk at national level, allowing the identification of key issues of their characterization from an economic and social point of view.*
- ✓ *Risk management performance benchmarking to facilitate access to relevant information by national decision-makers, which facilitates the identification and proposal of effective policies and actions.*

SYSTEM OF INDICATORS

DDI : DISASTER DEFICIT INDEX

LDI : LOCAL DISASTER INDEX

PVI : PREVALENT VULNERABILITY INDEX

RMI : RISK MANAGEMENT INDEX

DISASTER DEFICIT INDEX

-DDI-

Represents country risk from a macroeconomic and financial perspective in case of possible catastrophic events. This requires an estimation of the critical impact during a given exposure time, defined as reference, and of the country financial ability to cope such situation.

DISASTER DEFICIT INDEX

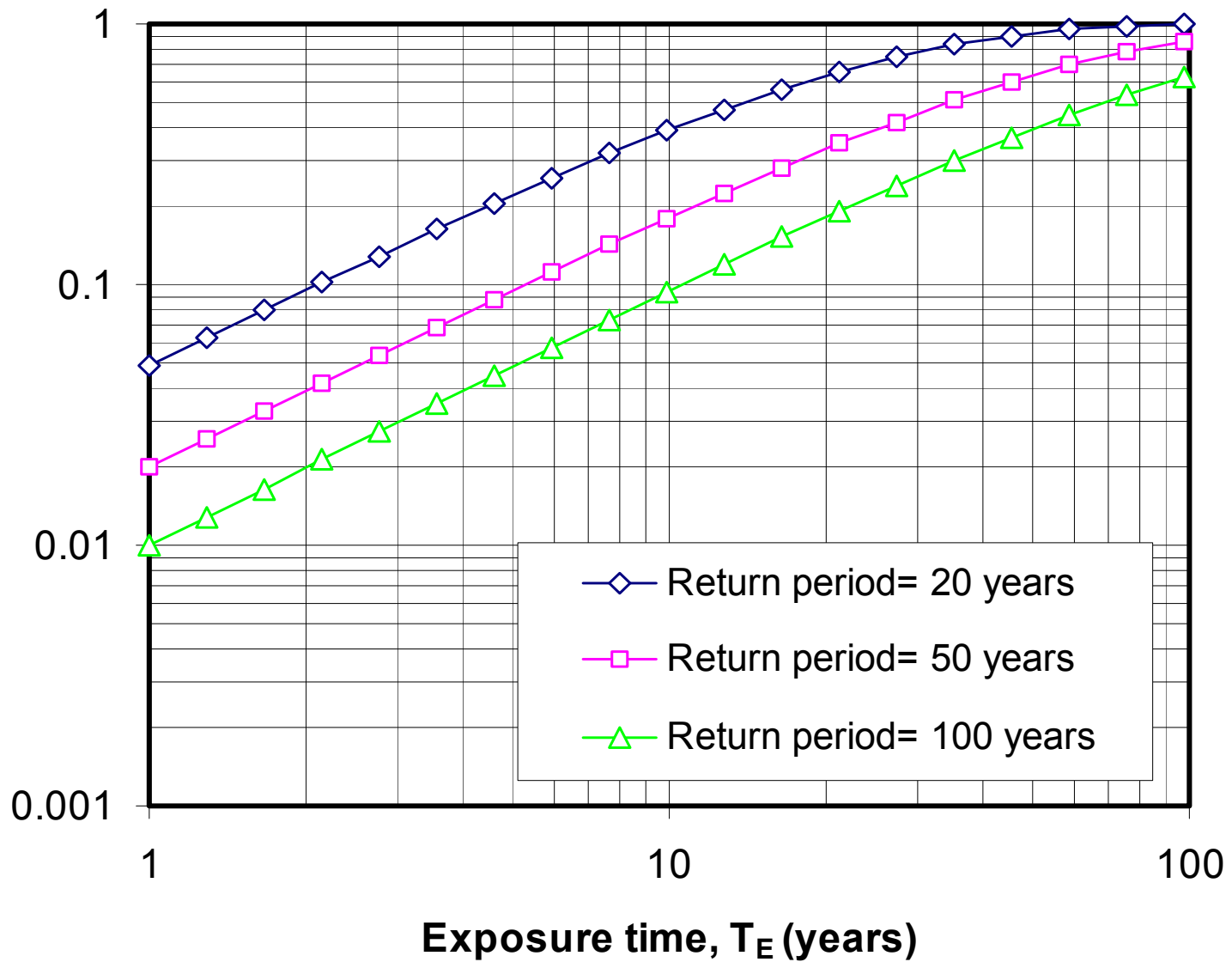
$$DDI = \frac{MCE \text{ loss}}{Economic \text{ Resilience}}$$

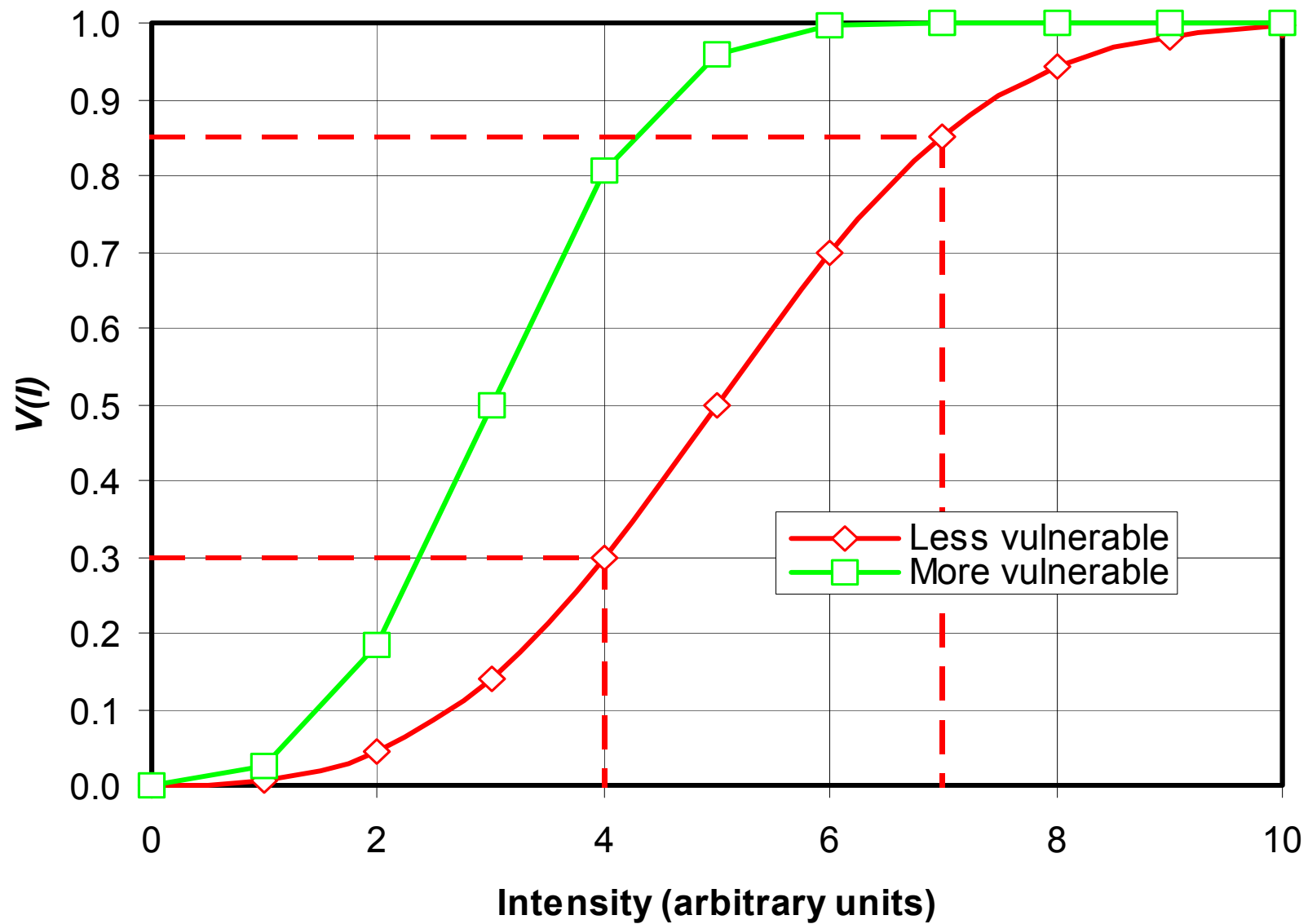






Probability of having at least one disaster
in the next T_E years

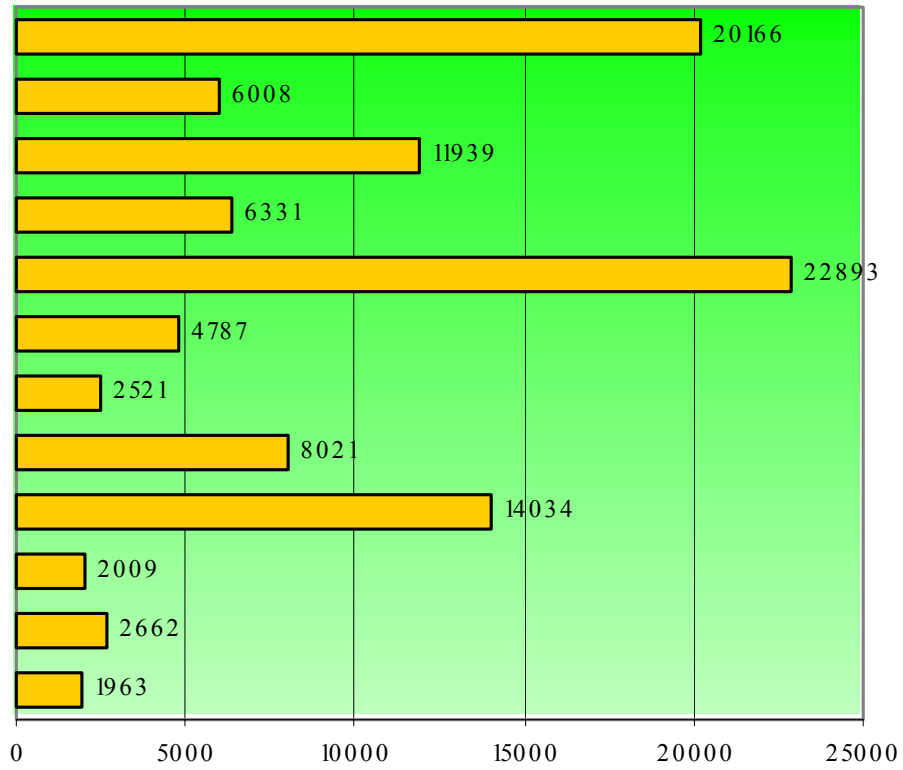




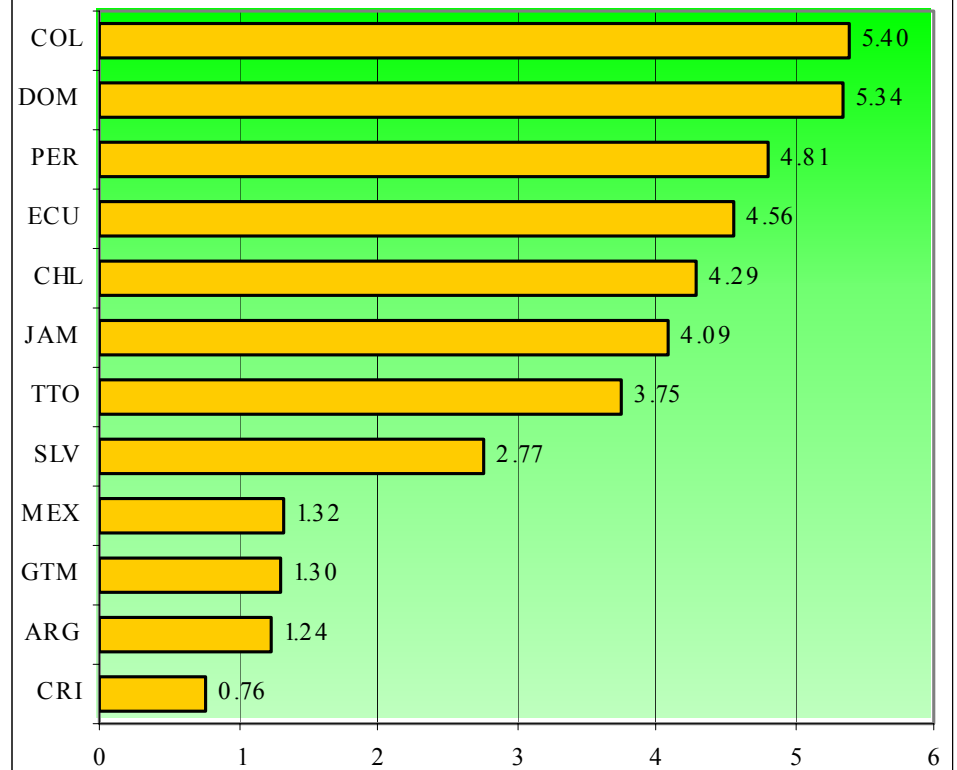
**$\sum F_i^P$: POSSIBLE INTERNAL AND EXTERNAL FUNDS
WICH COULD BE ACCESSED BY GOVERNMENT**

- ◆ F_1^P , insurance and reinsurance payments,
- ◆ F_2^P , availability in funds for disasters
- ◆ F_3^P , aids and donations,
- ◆ F_4^P , possibility of new taxes,
- ◆ F_5^P , margin of budgetary reallocations,
- ◆ F_6^P , potential external credit,
- ◆ F_7^P , potential internal credit.

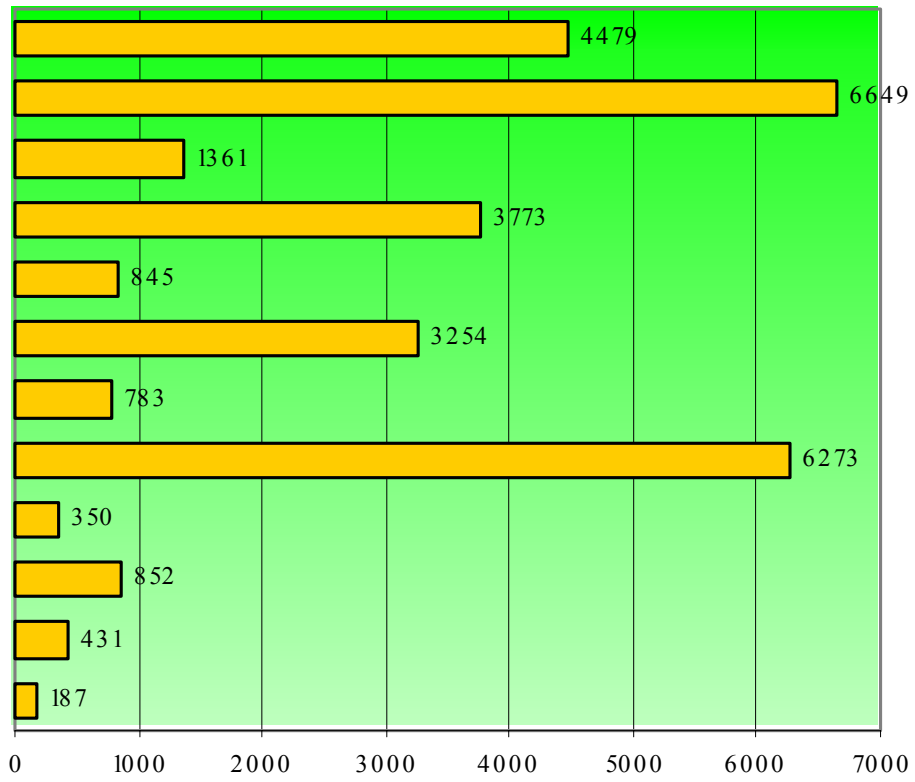
L 500 (US\$ millones), 2000



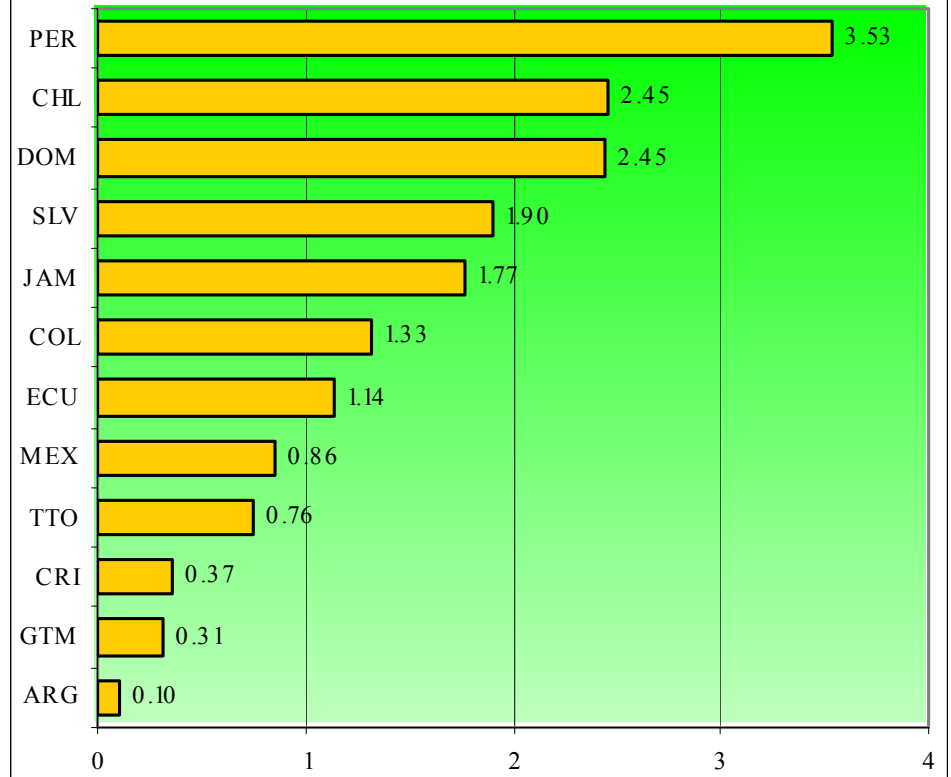
IDD 500, 2000



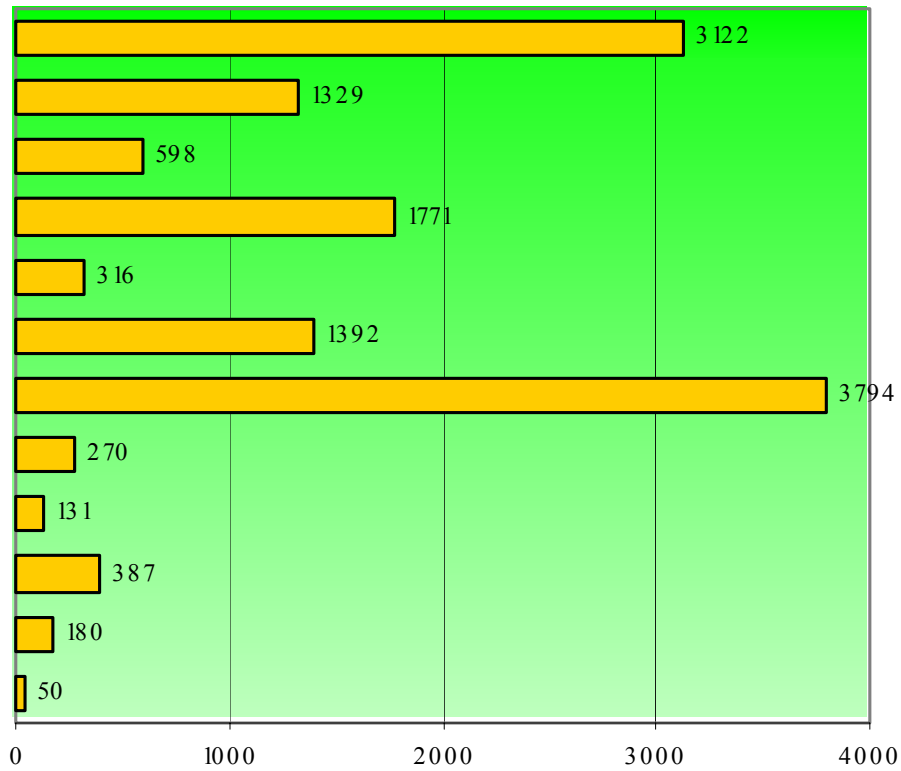
L 100 (US\$ million) 2000



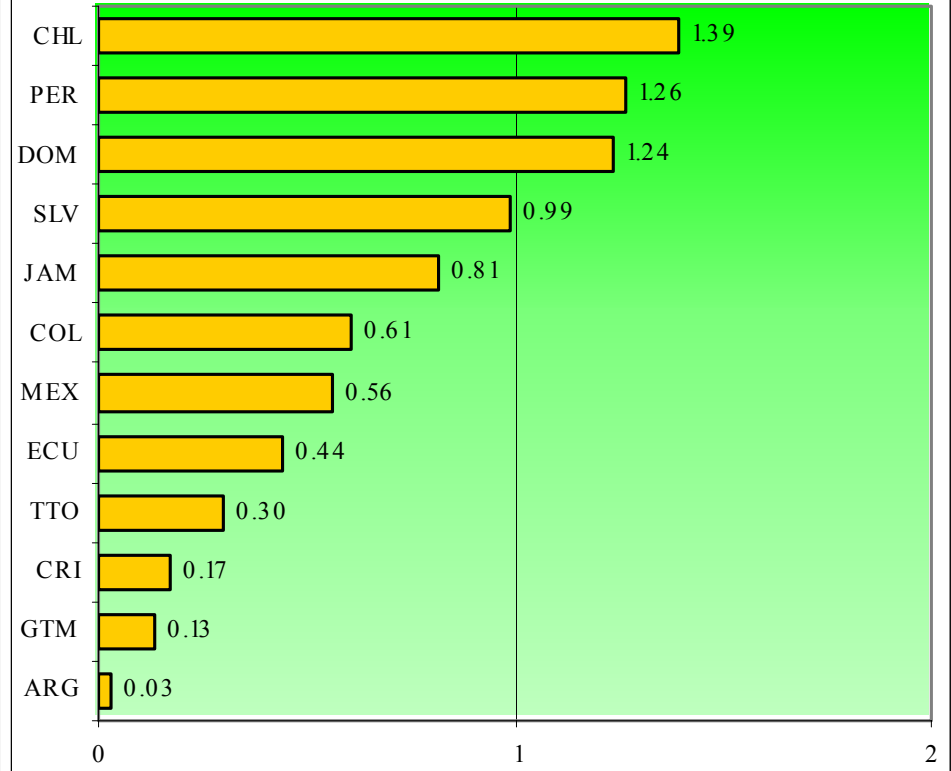
IDD 100, 2000



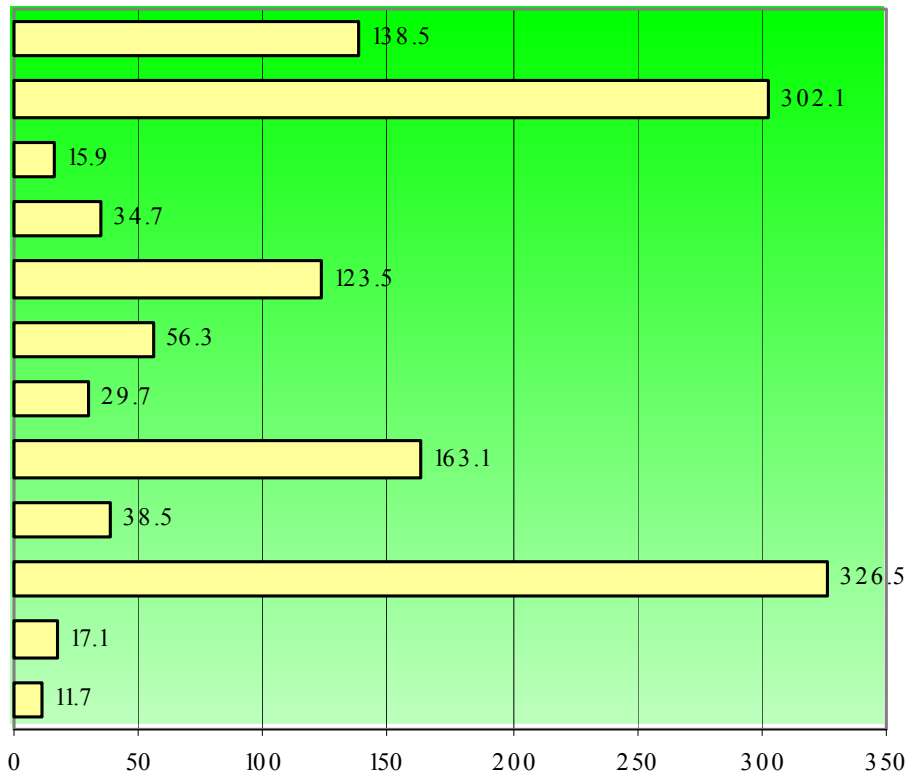
L 50 (US\$ millones) 2000



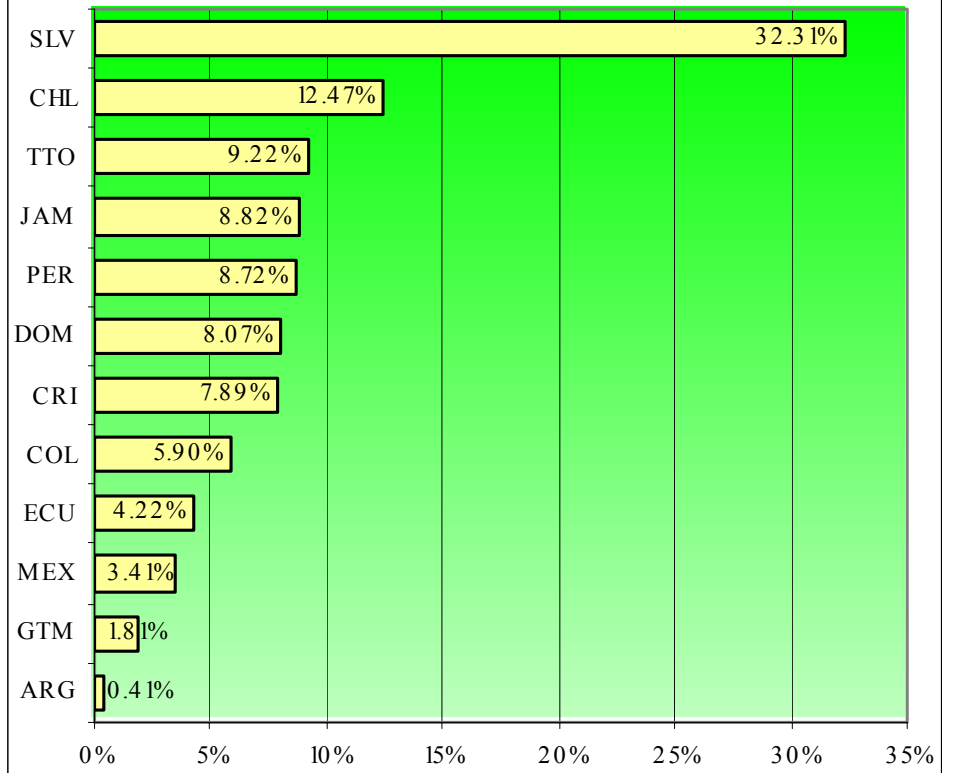
IDD 50, 2000



Ly (US\$ million) 2000



IDD'CE, 2000



Meaning and possible actions...

- ✓ *DDI > 1.0 means economic incapacity of the country to cope extreme disasters. As greater DDI, greater gap. If constrictions for additional debt exist, this situation implies impossibility to recover.*
- ✓ *Economic, financial and planning analysts can evaluate the budget problem and the need to take into account these figures in the financial planning.*
- ✓ *It is evident the need to invest in the physical vulnerability reduction to reduce the potential losses. Property insurance, reserve funds strengthening and the need to negotiate contingency credits are supported to improve resilience.*

LOCAL DISASTER INDEX

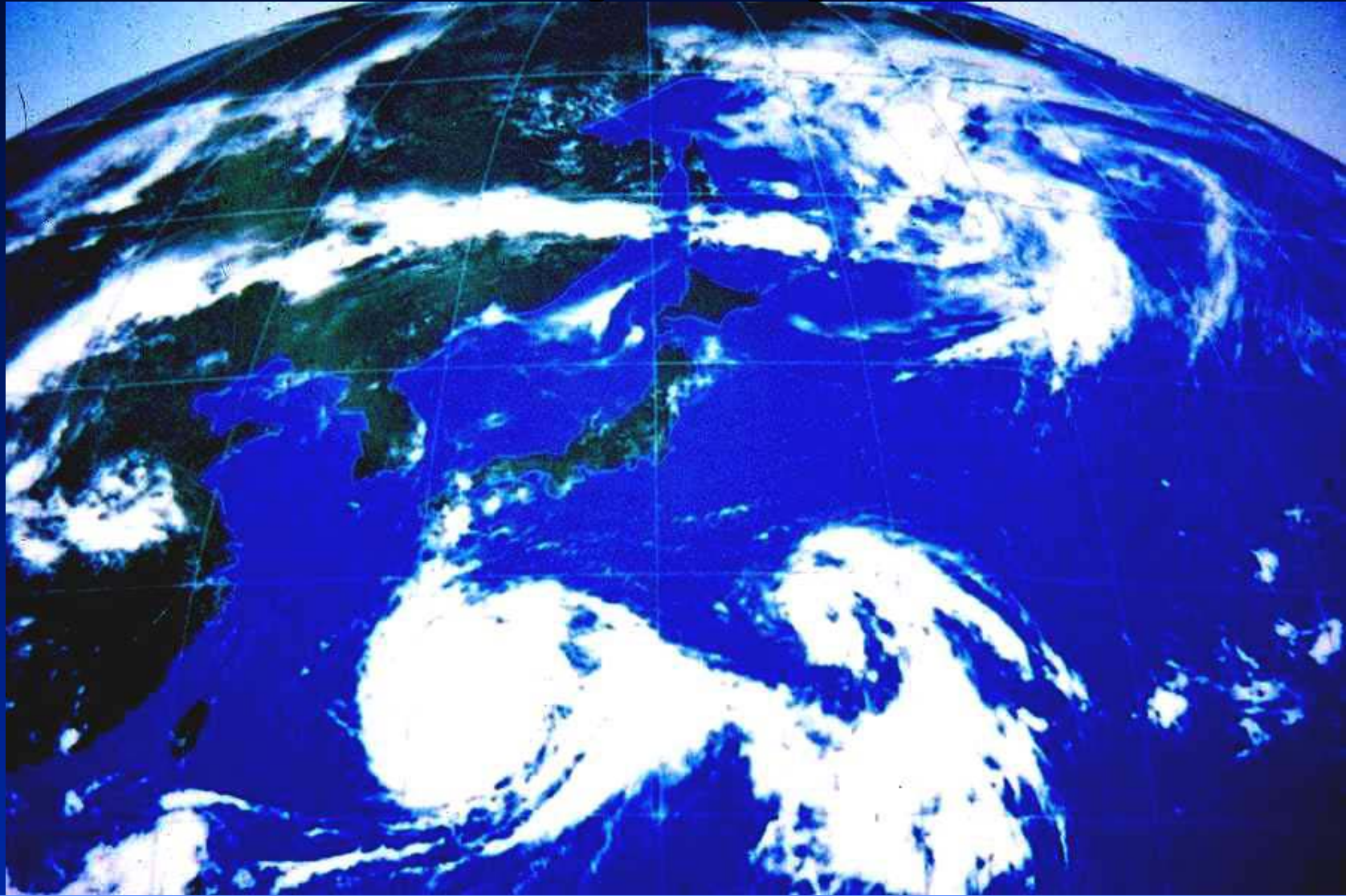
-LDI-

It attempts to capture the social and environmental risk problems as result from frequent small events that affects in a chronic way the sub-national and local levels, particularly the lower income and fragile socio-economic income groups and generating a detriment effect to the country development.

DESINVENTAR (La RED)

- ✓ *Database with records of events and effects at municipal level.*
- ✓ *Approximately 80,000 records for 16 countries of LAC. Where 70% of the events occurred after 1970.*
- ✓ *They were grouped in four types of events, that colloquially will be termed: a) landslides and debris flows, b) seismic-tectonic, c) floods and storms, and d) other events.*

Many events are generated by the climate variability and due to environmental global change processes







Some phenomena are assumed as natural but they may considered as socio-natural due to the environmental degradation.

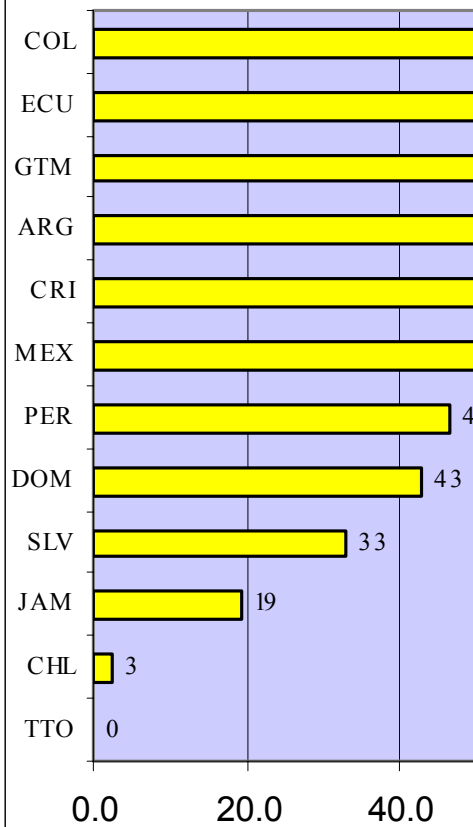


LOCAL DISASTER INDEX

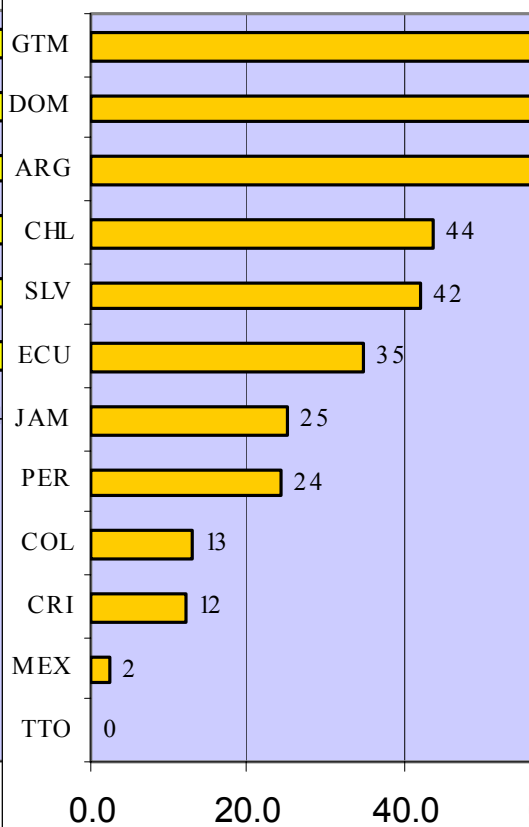
$$LDI = LDI_{Kills} + LDI_{Affected} + LDI_{Loss}$$

*Each LDI depends of
the Indices of Persistency (IP)
of the effects in all municipalities for each
type of event*

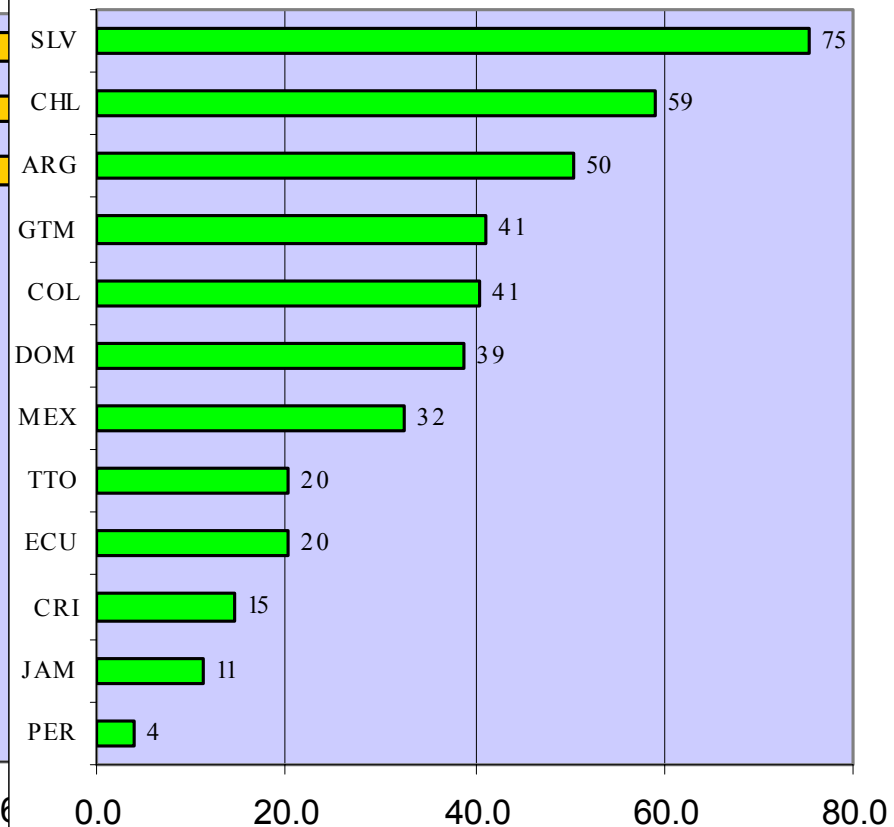
LDI K 19



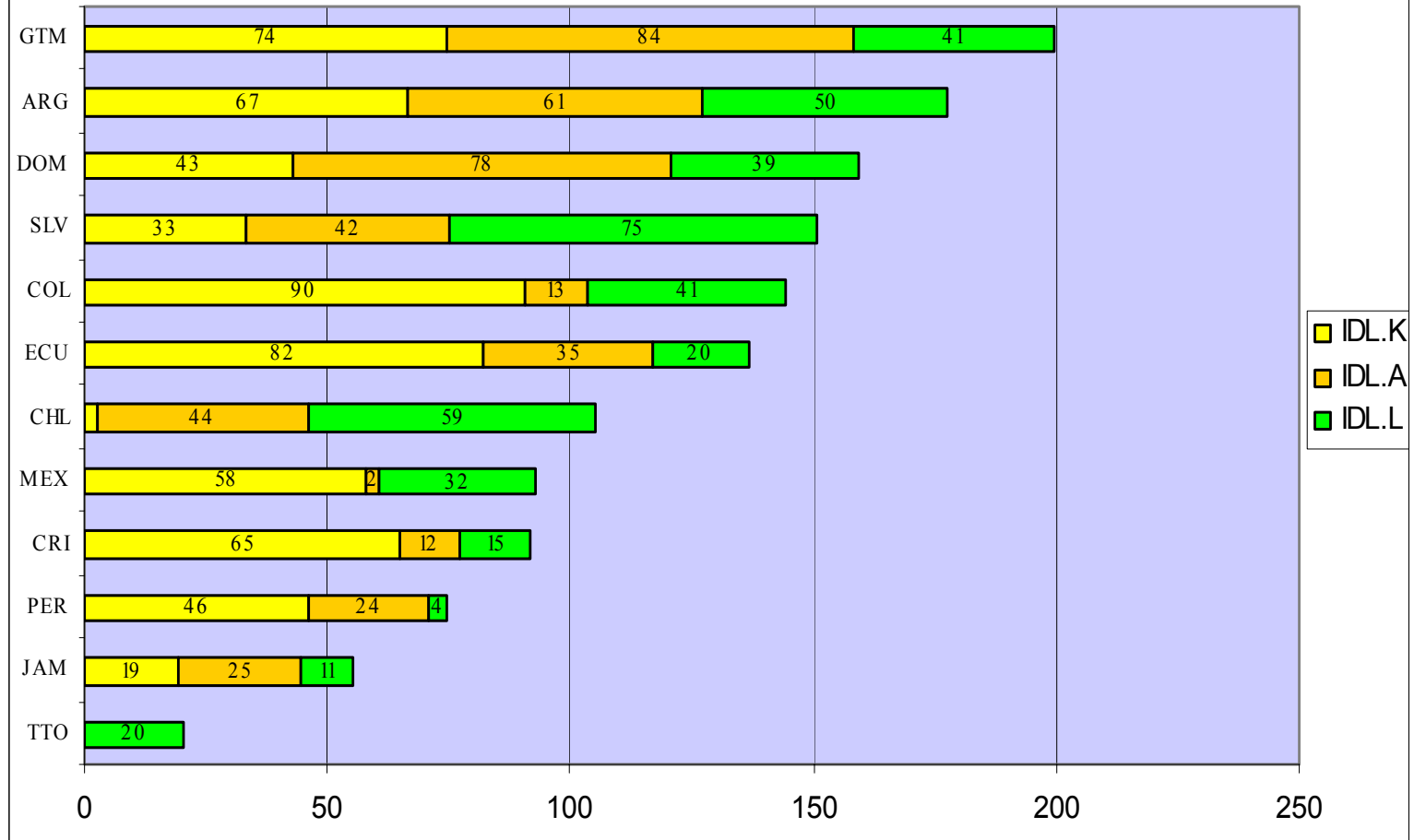
LDI A 1996



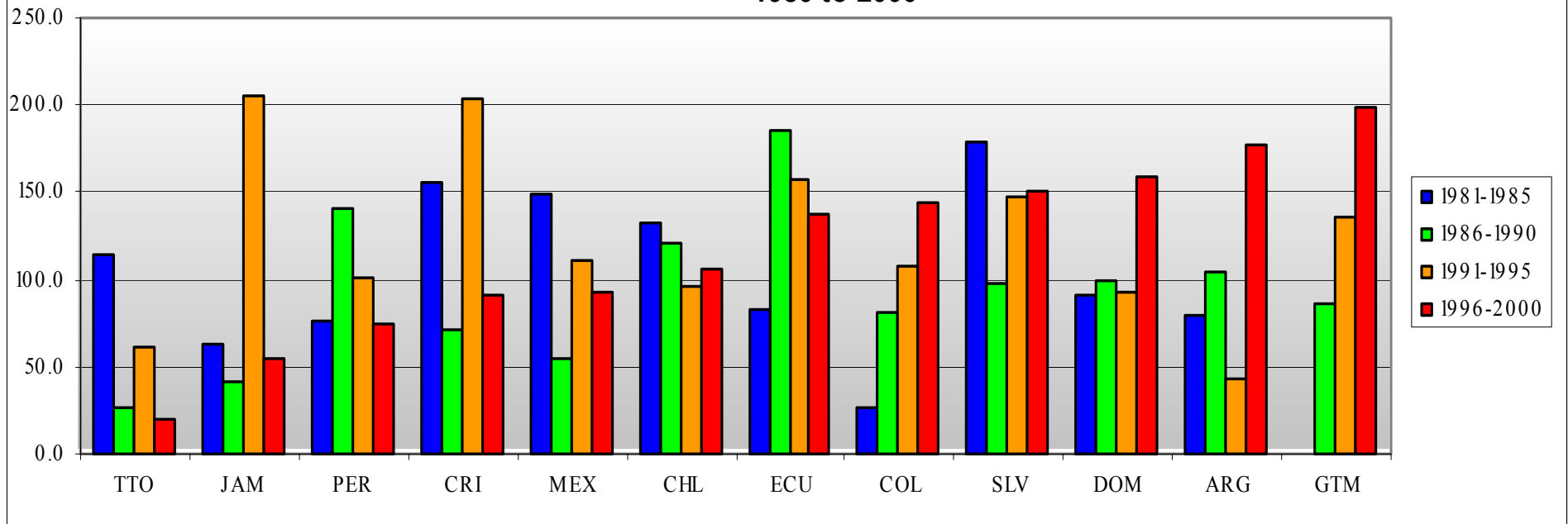
LDI L 1996-2000



LDI 1996-2000



LDI 1980 to 2000



Meaning and possible actions...

- ✓ LDI reflects the persistency of the effects, caused by the different class of events, on livelihoods and local development, perpetuating the poverty.
- ✓ LDI measures the concentration of losses at local level and permits correlating it to the environmental degradation processes.
- ✓ Economic analysts and sectoral officials can detect the persistency and accumulation of effects of local disasters, the importance to consider risk problems in the territorial ordering, and the creation of social security nets.

PREVALENT VULNERABILITY INDEX

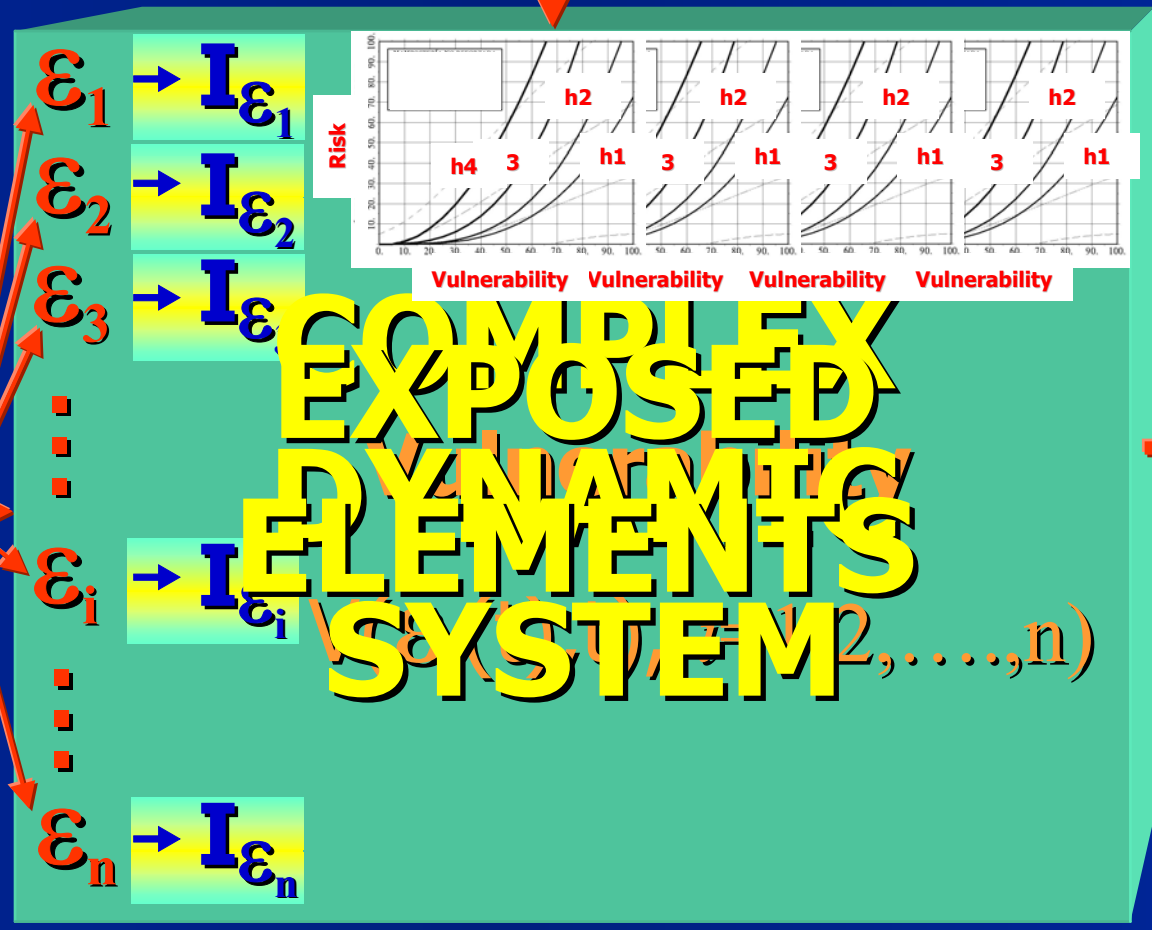
-PVI-

This indicator attempts to characterize a situation or pattern of the country. Three composite indices are proposed based on a set of indicators, that in case of the materializing of hazard events, favors the direct impact (exposure/susceptibility) and the indirect and intangible impact (socio/economic fragility and the lack of resilience).

PREVALENT VULNERABILITY INDEX

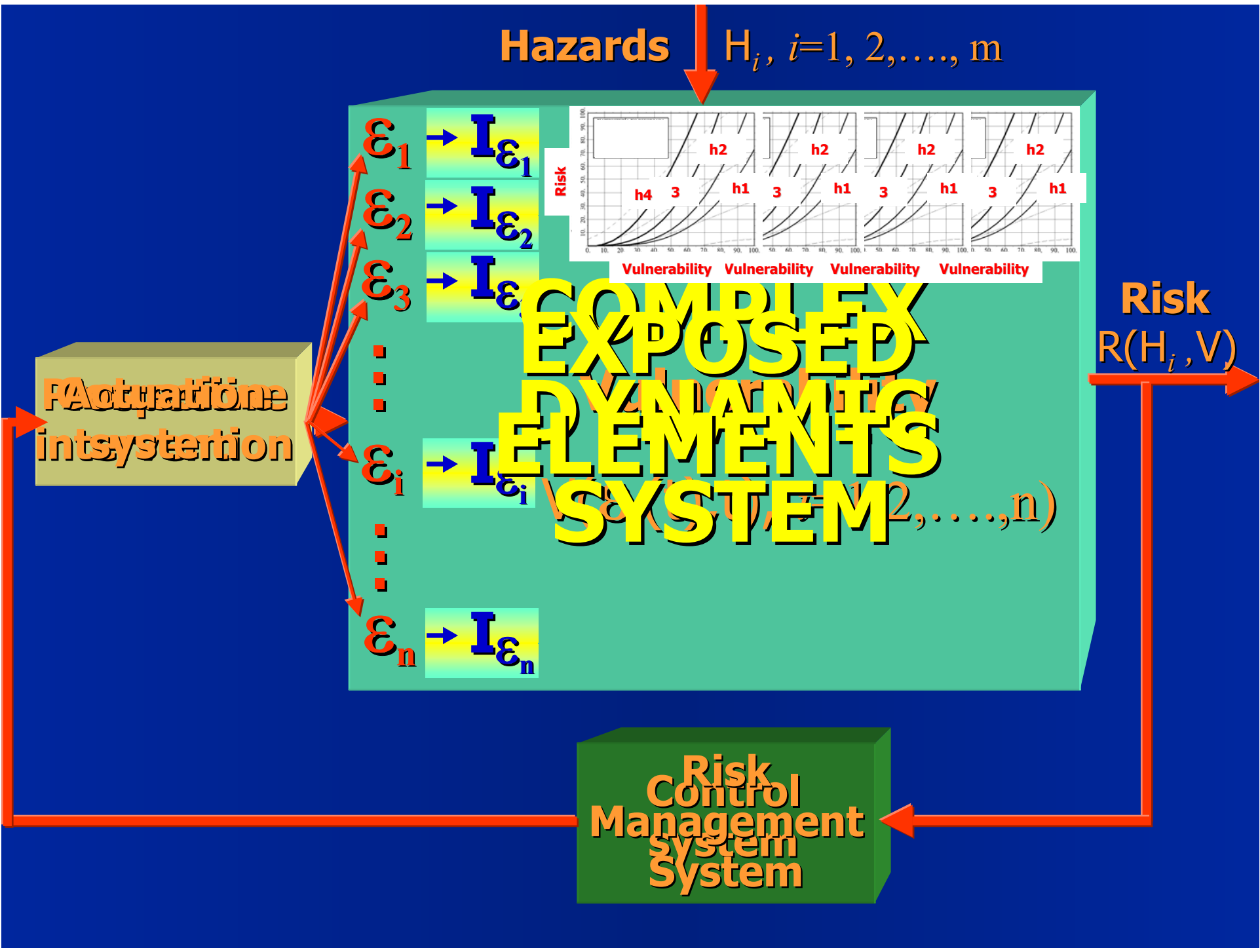
$$PVI = PVI_{Exposure} + PVI_{Fragility} + PVI_{Lack\ of\ Resilience}$$

Hazards $H_i, i=1, 2, \dots, m$

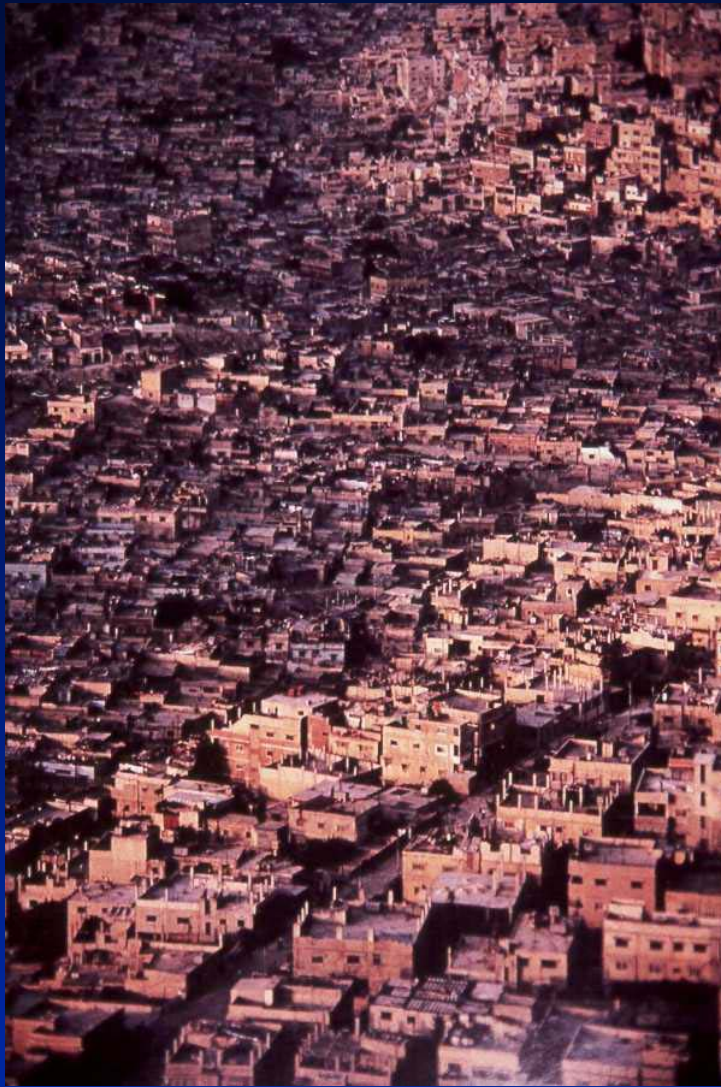


Actuation
intention

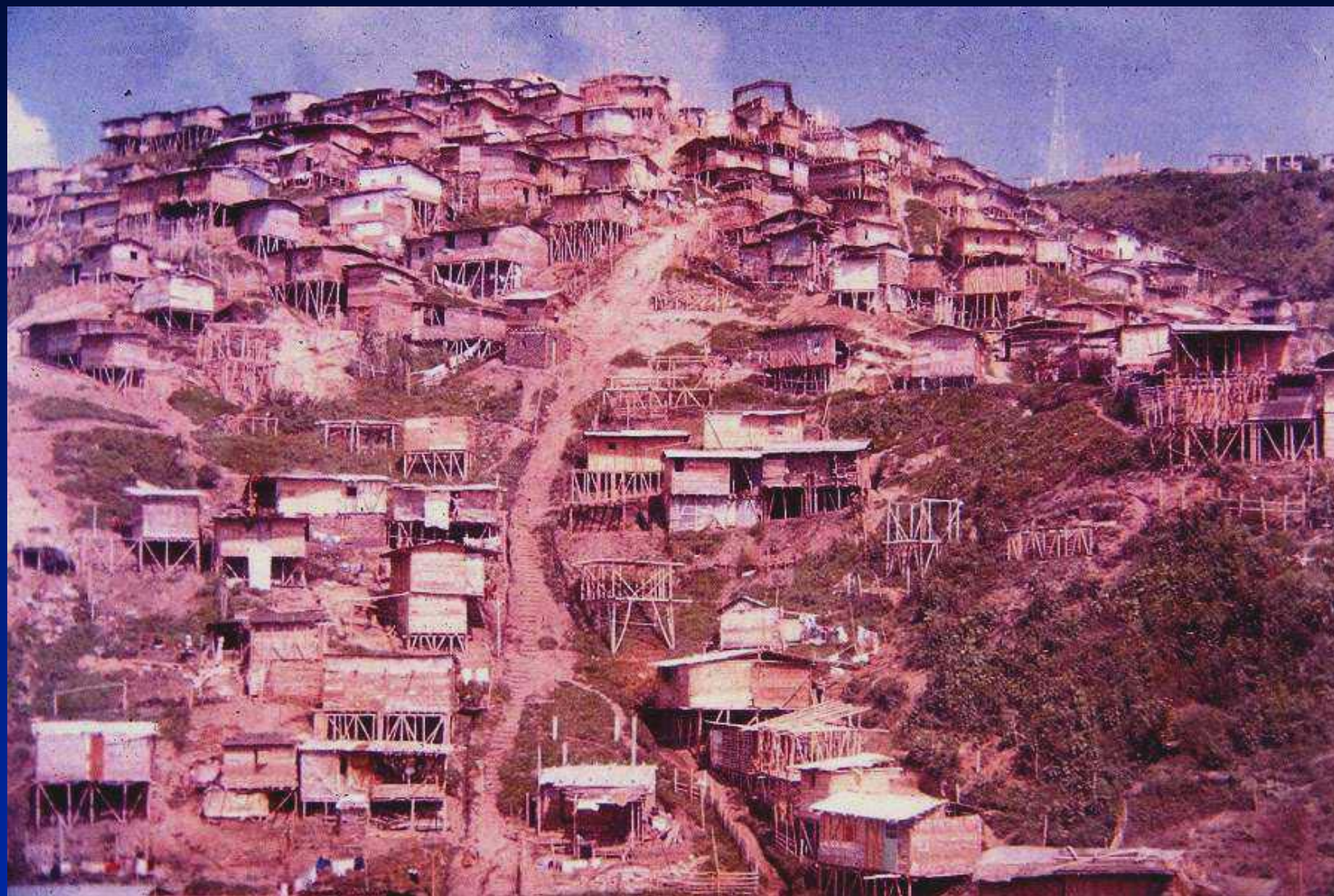
Risk
Control
system
System



Inappropriate urban growth, without control, and densification of unsafe housing represent vulnerability conditions.



Poverty and social segregation are factors of vulnerability



INDICATORS OF EXPOSURE/SUSCEPTIBILITY

- ◆ ES1. Population growth, avg. annual rate (%)
- ◆ ES2. Urban growth, avg. annual rate (%)
- ◆ ES3. Population density, people/5 Km²
- ◆ ES4. Poverty-population below US\$ 1 per day PPP
- ◆ ES5. Capital stock, million US\$ dollar/1000 km²
- ◆ ES6. Imports and exports of goods and services, % GDP
- ◆ ES7. Gross domestic fixed investment, % of GDP
- ◆ ES8. Arable land and permanent crops, % land area.

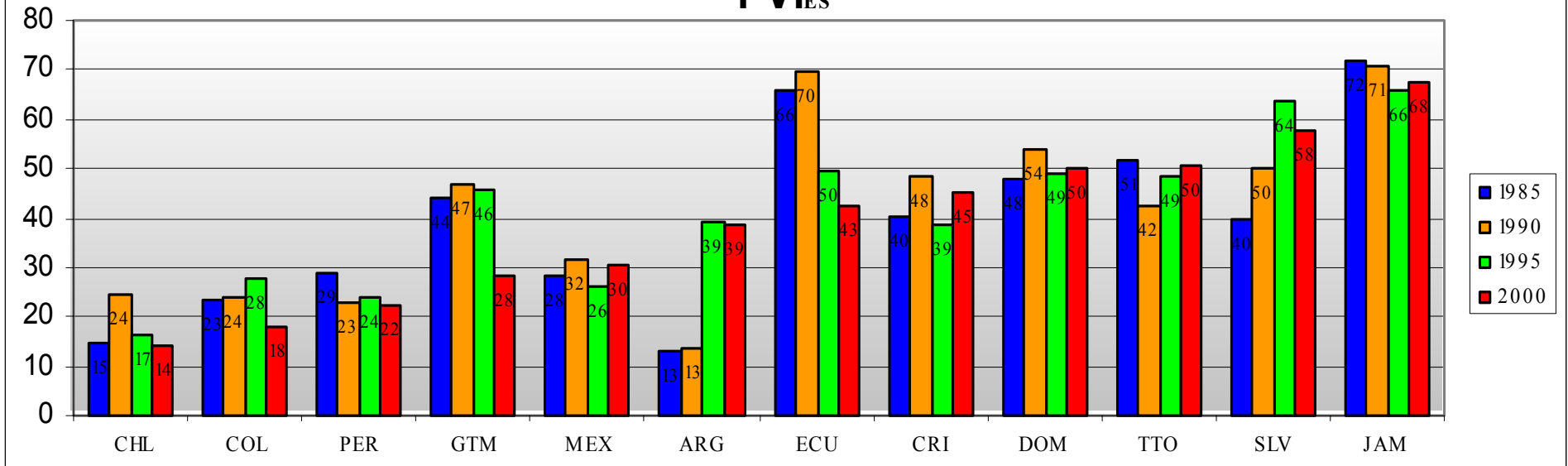
INDICATORS OF SOCIO-ECONOMIC FRAGILITY

- ◆ SF1. Human Poverty Index, HPI-1.
- ◆ SF2. Dependents as proportion of working age population
- ◆ SF3. Social disparity, concentration of income measured using Gini index.
- ◆ SF4. Unemployment, as % of total labor force.
- ◆ SF5. Inflation, food prices, annual %
- ◆ SF6. Dependency of GDP growth of agriculture, annual %
- ◆ SF7. Debt servicing, % of GDP.
- ◆ SF8. Human-induced Soil Degradation (GLASOD).

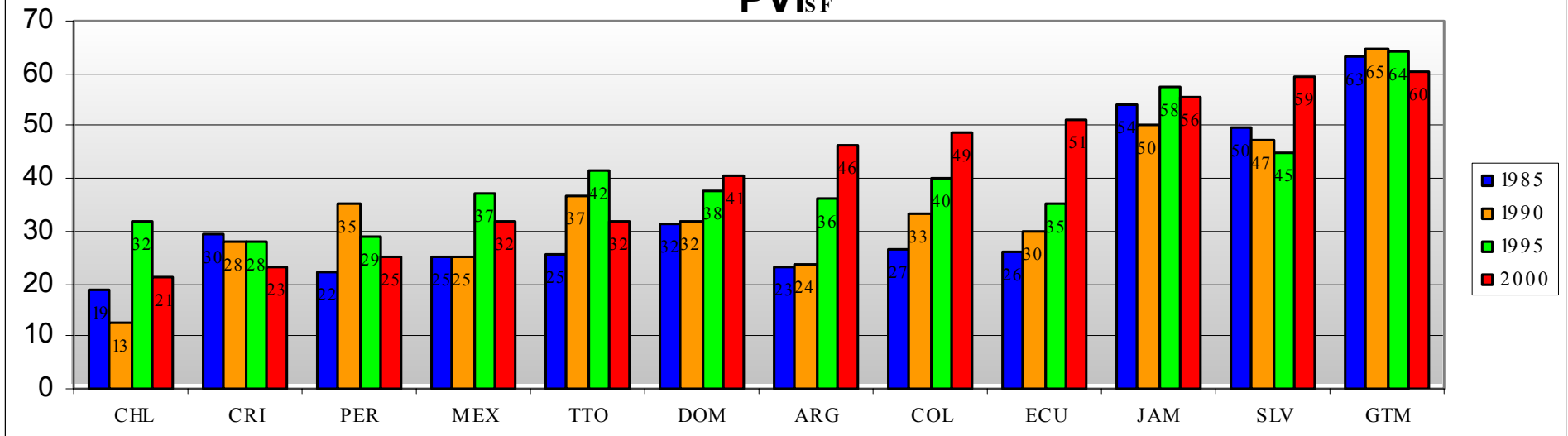
INDICATORS OF RESILIENCE (lack of)

- ◆ LR1. Human Development Index, HDI [Inv]
- ◆ LR2. Gender-related Development Index, GDI [Inv]
- ◆ LR3. Social expenditure; on pensions, health, and education, % of GDP [Inv]
- ◆ LR4. Governance Index [Inv]
- ◆ LR5. Insurance of infrastructure and housing, % of GD [Inv]
- ◆ LR6. Television sets per 1000 people [Inv]
- ◆ LR7. Hospital beds per 1000 people [Inv]
- ◆ LR8. Environmental Sustainability Index, ESI [Inv]

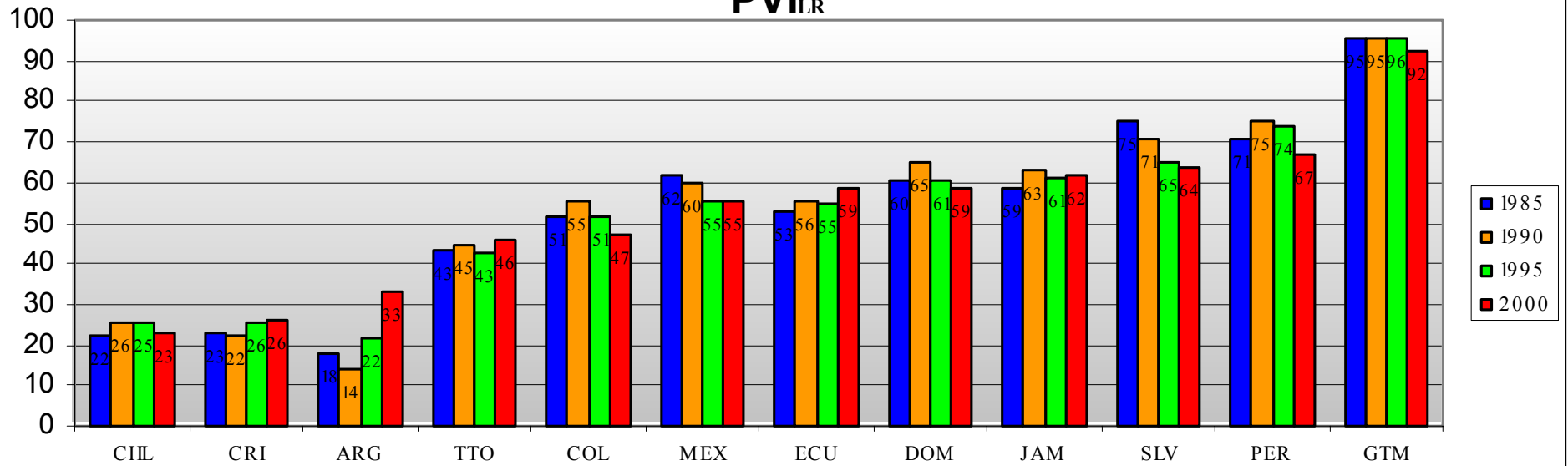
PVI_{ES}



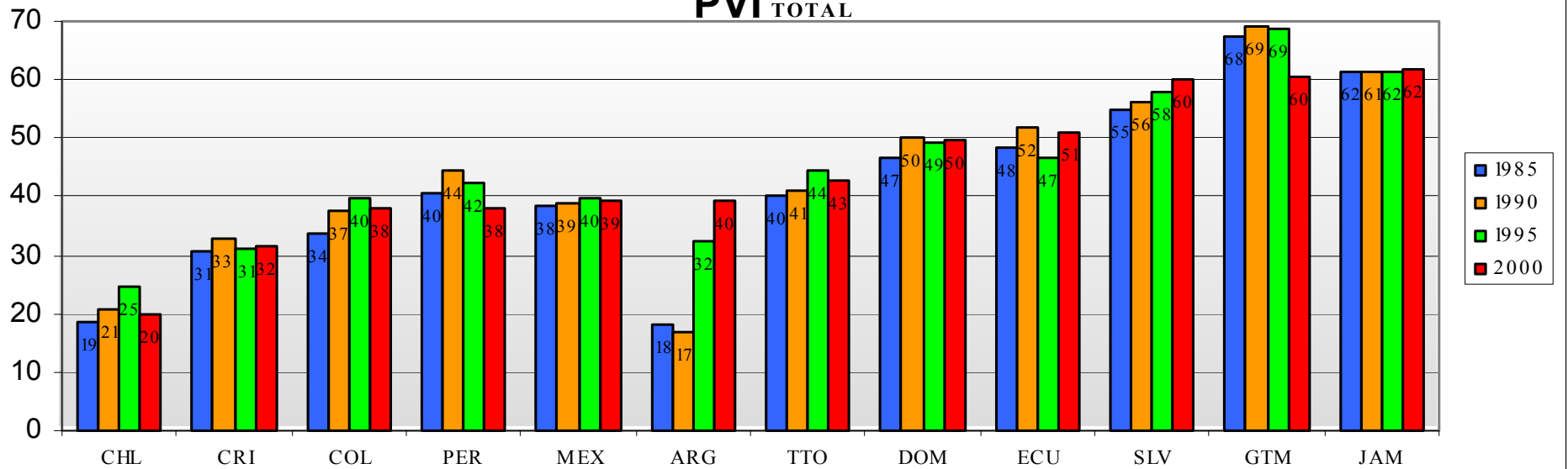
PVI_{SF}



PVI_{LR}



PVI_{TOTAL}



Meaning and possible actions...

- ✓ PVI reflects social and economic fragility conditions that favor the direct and indirect impact, and it reflects the lack of capacity to absorb the consequences.
- ✓ It is possible to identify issues as targets to guide the actions; aspects that express situations, causes, weaknesses or lacks that favor the potential consequences.
- ✓ It is emphasized the relation between risk and development.

RISK MANAGEMENT INDEX

- RMI -

Composite index that measures the country performance level on risk management, taking into account its organization, development and institutional action to reduce vulnerability, reduce loss in case of hazard events, preparedness for response in case of crisis, and efficient recovery.

Disaster Risk Management - DRM

Involves four different, but related public policies:

- a) Risk identification;*
- b) Risk reduction;*
- c) Disaster management;*
- d) Risk transfer.*

INDICATORS OF RISK IDENTIFICATION

- ◆ *IR1*. Systematic disaster and loss inventory
- ◆ *IR2*. Hazard monitoring and forecasting
- ◆ *IR3*. Hazard evaluation and mapping
- ◆ *IR4*. Vulnerability and risk assessment
- ◆ *IR5*. Public information and community participation
- ◆ *IR6*. Training and education on risk management

INDICATORS OF RISK REDUCTION

- ◆ *RR1*. Risk consideration in land use and urban planning
- ◆ *RR2*. Hydrographic basin intervention and environmental protection
- ◆ *RR3*. Implementation of hazard-event control and protection techniques
- ◆ *RR4*. Housing improvement and human settlement relocation from prone-areas
- ◆ *RR5*. Updating and enforcement of safety standards and construction codes
- ◆ *RR6*. Reinforcement and retrofitting of public and private assets

INDICATORS OF DISASTER MANAGEMENT

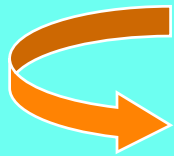
- ◆ *MD1*. Organization and coordination of emergency operations
- ◆ *MD2*. Emergency response planning and implementation of warning systems
- ◆ *MD3*. Endowment of equipments, tools and infrastructure
- ◆ *MD4*. Simulation, updating and test of inter institutional response
- ◆ *MD5*. Community preparedness and training
- ◆ *MD6*. Rehabilitation and reconstruction planning

INDICATORS OF GOVERNANCE AND FINANCIAL PROTECTION

- ◆ *PF1*. Interinstitutional, multisectoral and decentralizing organization
- ◆ *PF2*. Reserve funds for institutional strengthening
- ◆ *PF3*. Budget allocation and mobilization
- ◆ *PF4*. Implementation of social safety nets and funds response
- ◆ *PF5*. Insurance coverage and loss transfer strategies of public assets.
- ◆ *PF6*. Housing and private sector insurance and reinsurance coverage

RISK MANAGEMENT INDEX

$$RMI = RMI_{RI} + RMI_{RR} + RMI_{DM} + RMI_{FP}$$



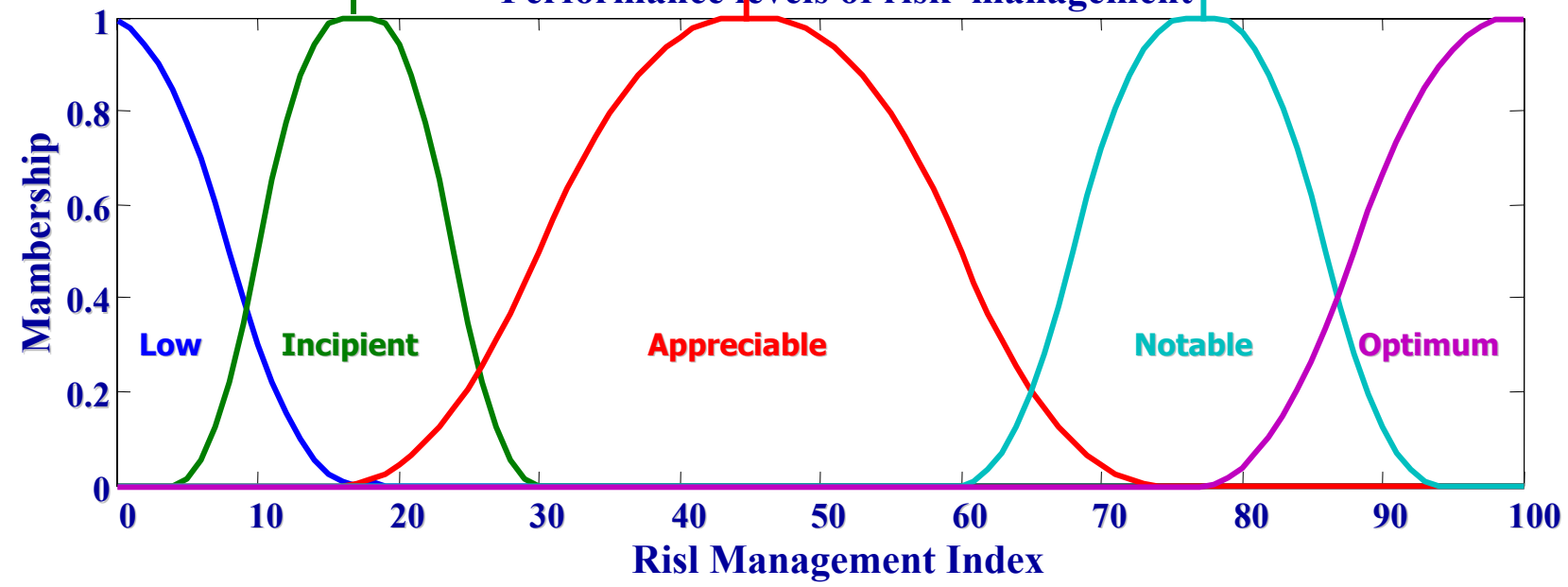
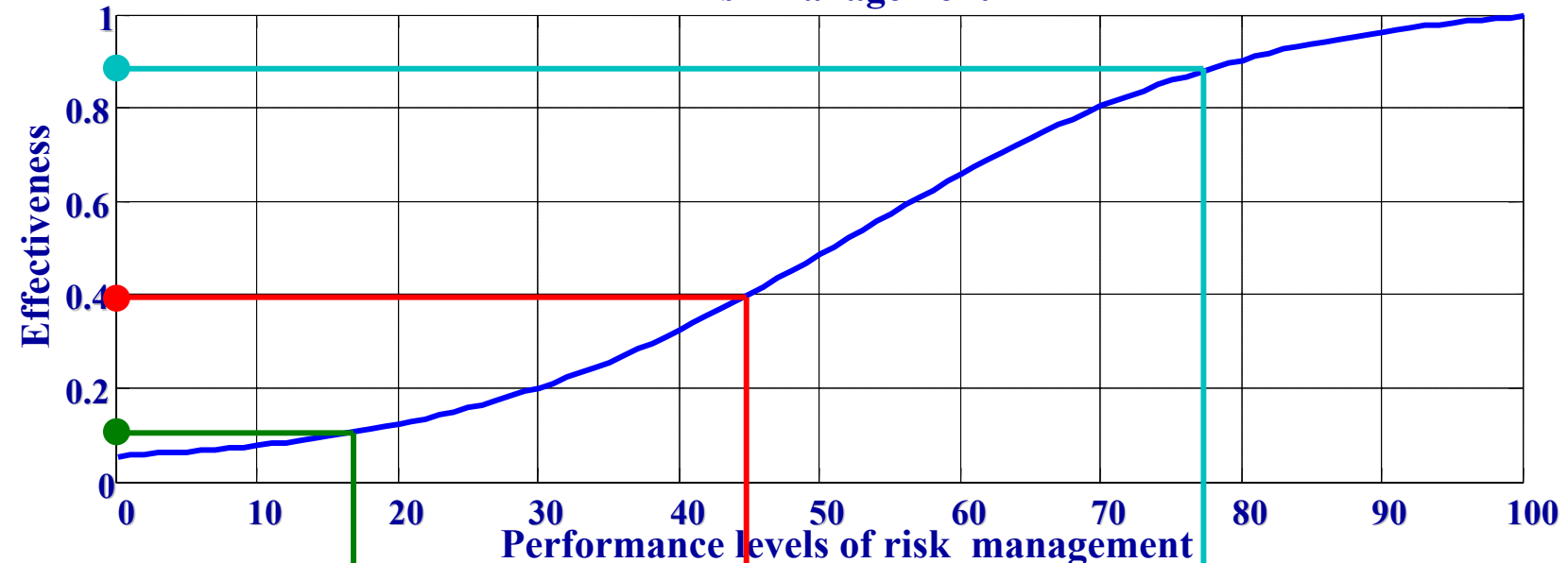
$$RMI_{c(RI,RR,DM,FP)}^t = \frac{\sum_{i=1}^N w_i I_{ic}^t}{\sum_{i=1}^N w_i} \Big|_{(RI,RR,DM,FP)}$$



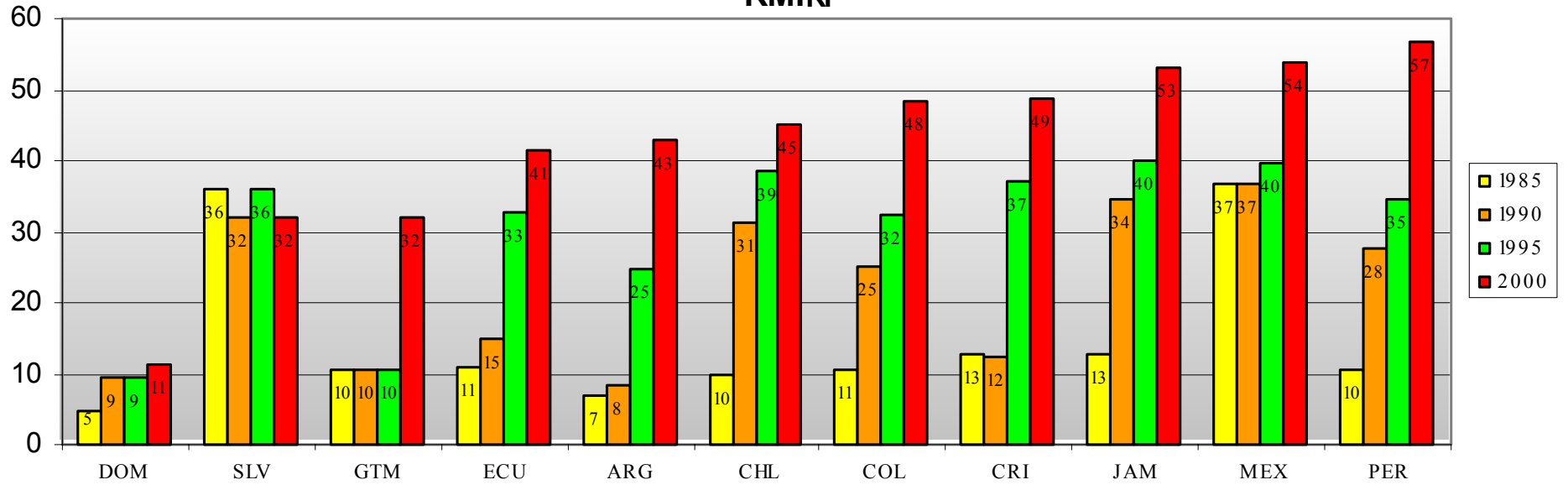
Using linguistic variables for qualification:

Low, incipient, appreciable, notable and optimum

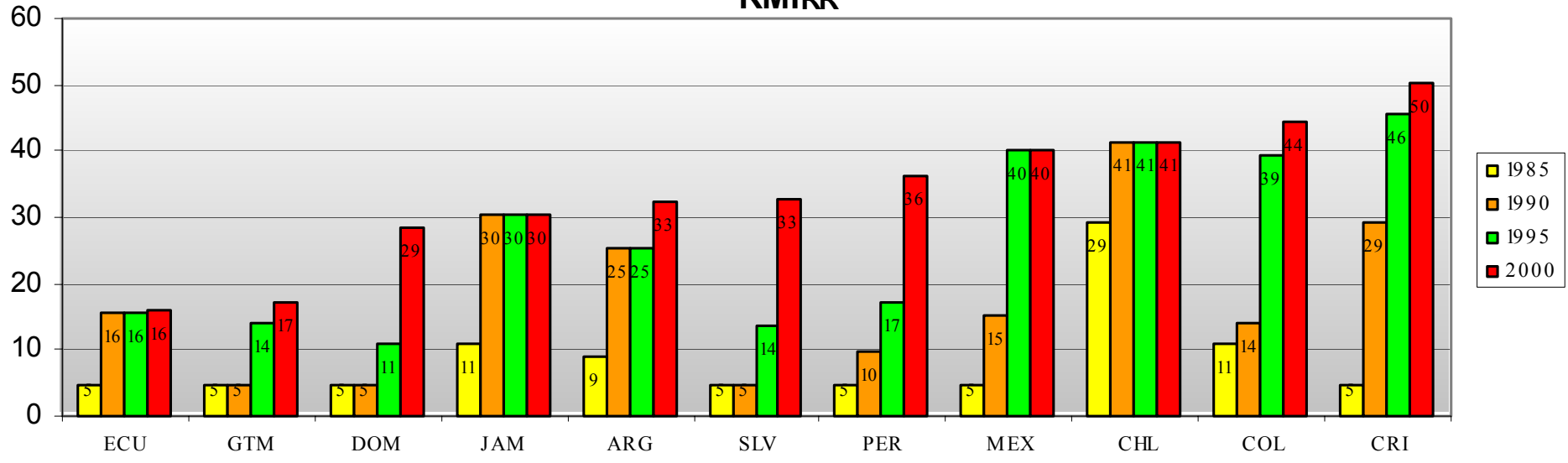
Risk management



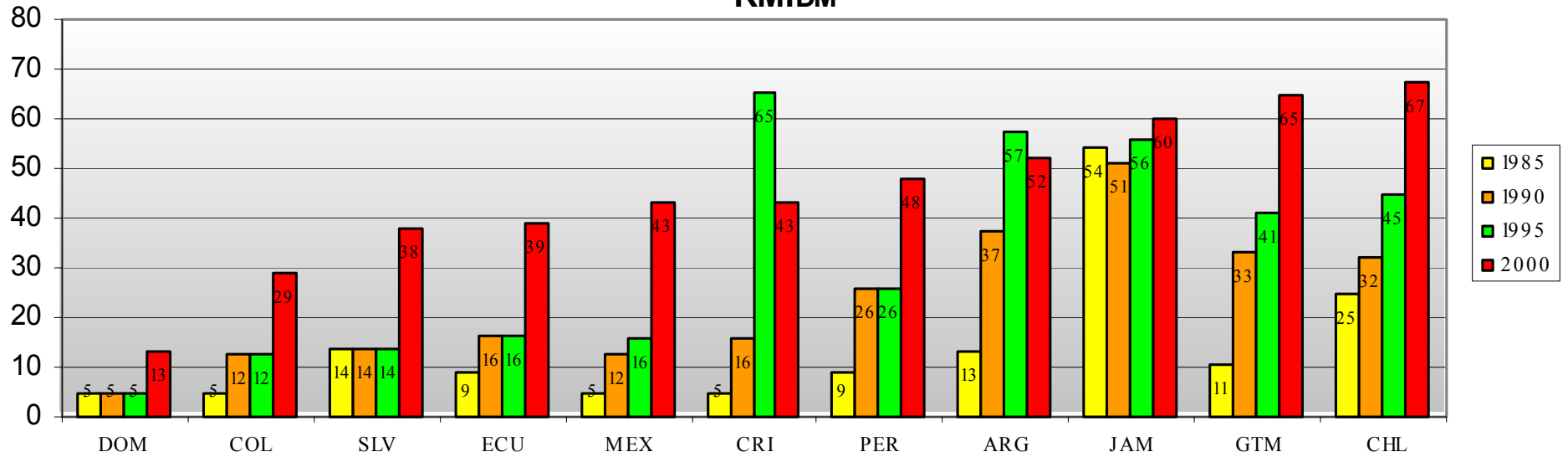
RMIRI



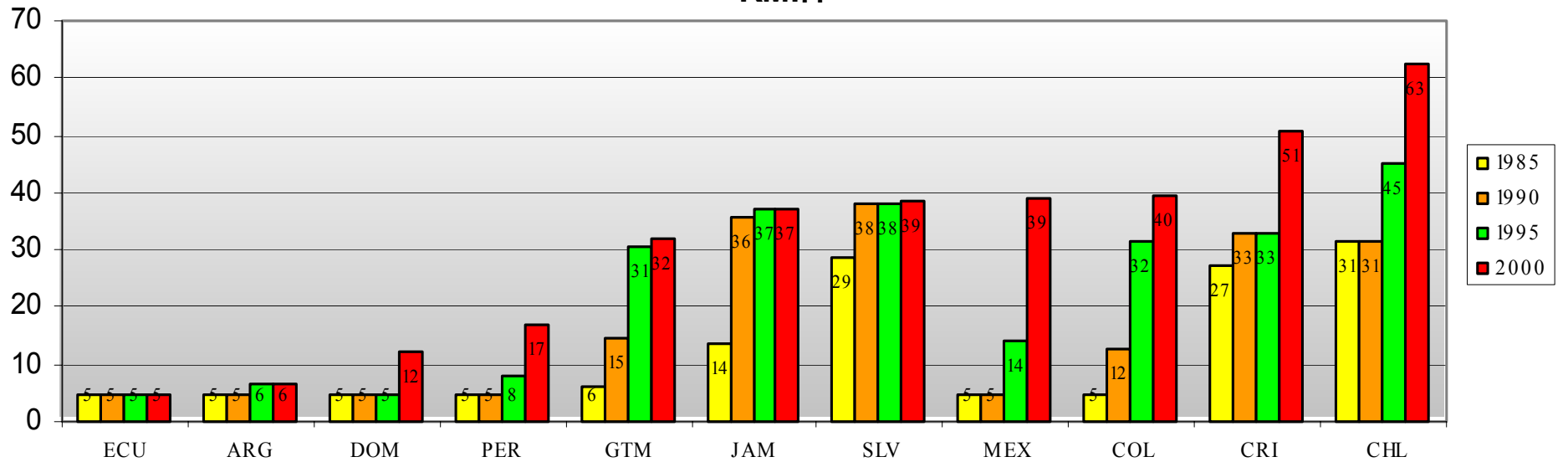
RMIRR

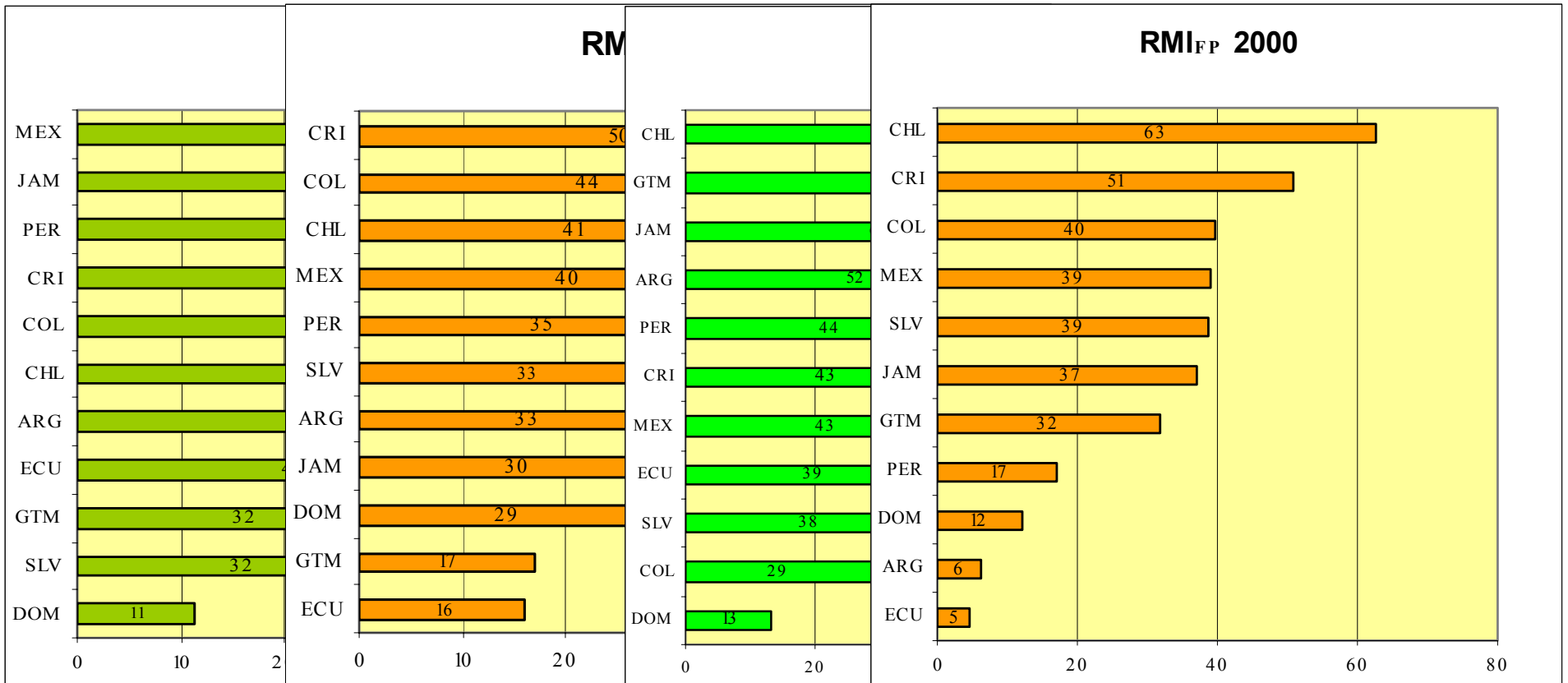


RMIDM

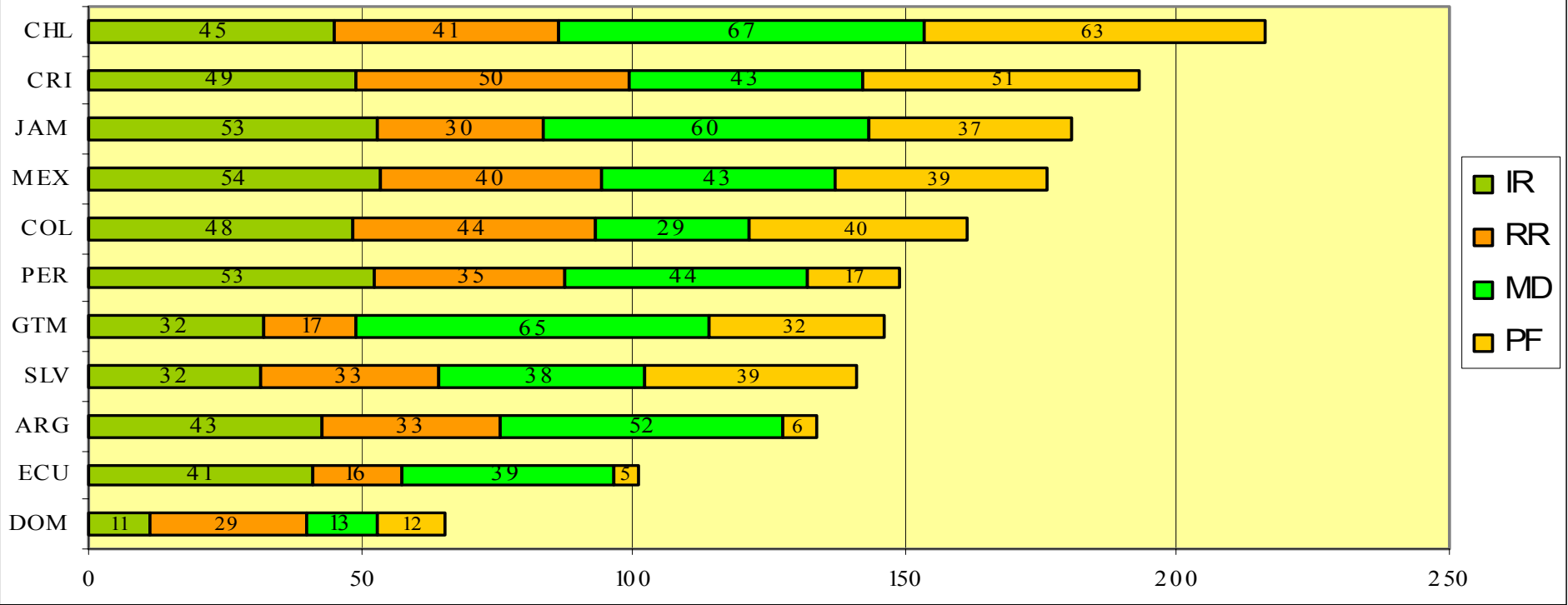


RMIFP





RMI_{TOTAL}, 2000



Current Urgent Concerns...

- ✓ Although many best and exemplary mitigation practices exist these are still by far the exception and not the rule.
- ✓ A lack of knowledge is not the problem but, rather, the lack of coverage and effectiveness in the implementation of risk reduction policies and measures.
- ✓ The problem is growing far faster than the solution.

Challenges for DRM Improvement...

- ✓ *Disaster risk assessment undertaken from a holistic perspective to promote political-will and -feasibility.*
- ✓ *DRM performance evaluation to get political commitment, visibility, effectiveness and to move forward.*
- ✓ *Global networked governance and dialogue for the follow up of the governments' DRM performance.*

*When ...the facts are uncertain,
...the values are in dispute,
...the stakes are high,
and ...the decisions are urgent.*