“KNOWLEDGE MANAGEMENT”
OR
“IT REALLY DOESN’T MATTER”

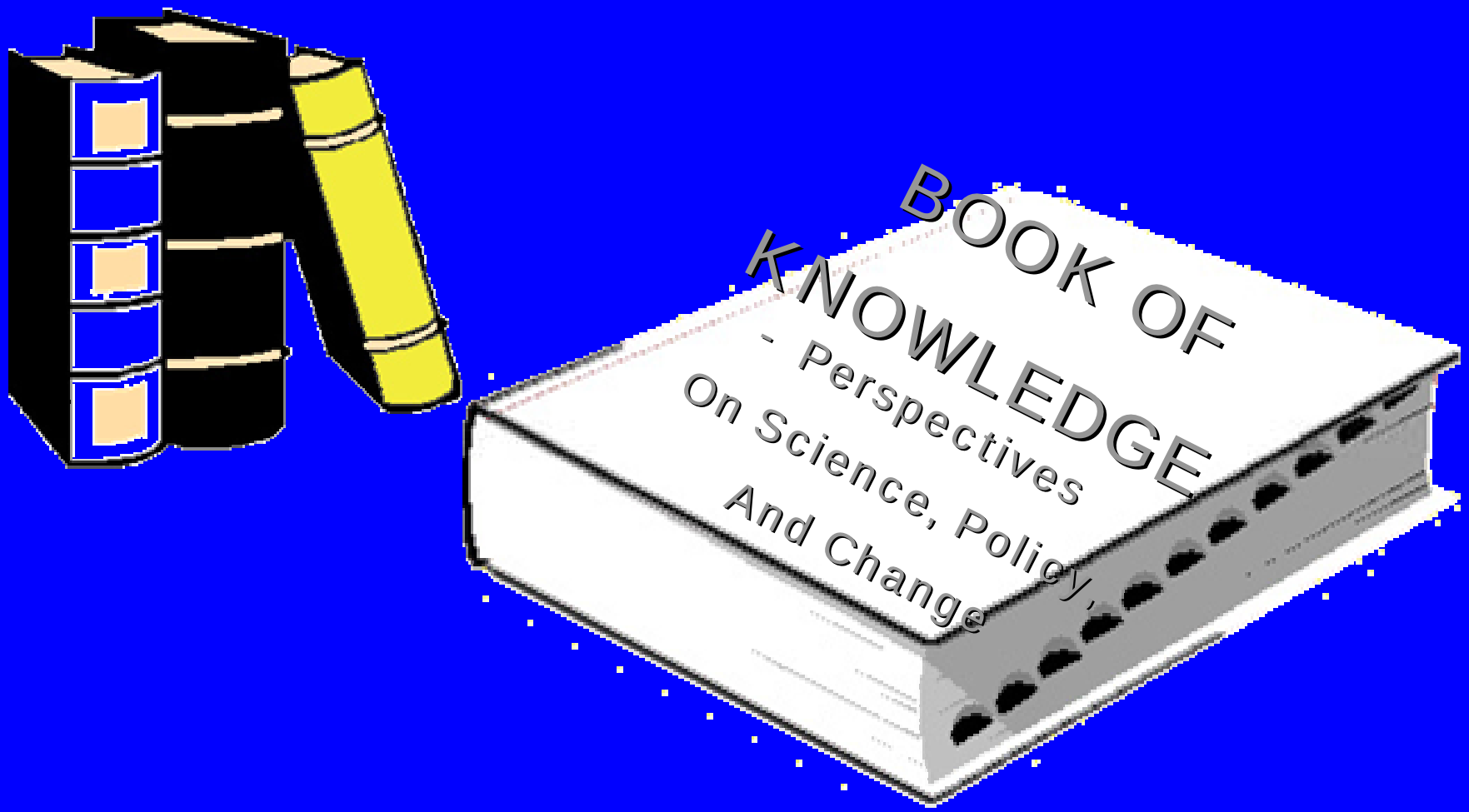
THE CHALLENGE FACING CHINA AFTER THE MAY 12, 2008 SICHUAN/WENCHUAN EARTHQUAKE

WALTER HAYS

GEORGE MASON UNIVERSITY

PREMIER WEN JIABAO URGES KNOWLEDGE MANAGEMENT DURING RECONSTRUCTION

- WEN JIABAO ISSUED A POLITICAL MANDATE TO CONSTRUCT EARTHQUAKE-RESILIENT BUILDINGS AND TO PROTECT THE ENVIRONMENT.


BOOK OF
KNOWLEDGE
- Perspectives
On Science, Policy,
And Change

SEISMIC ZONATION IS KNOWLEDGE MANAGEMENT

CHINA IS NOT THE ONLY NATION THAT HAS RECEIVED A POLITICAL MANDATE FOR KNOWLEDGE MANAGEMENT DURING RECONSTRUCTION

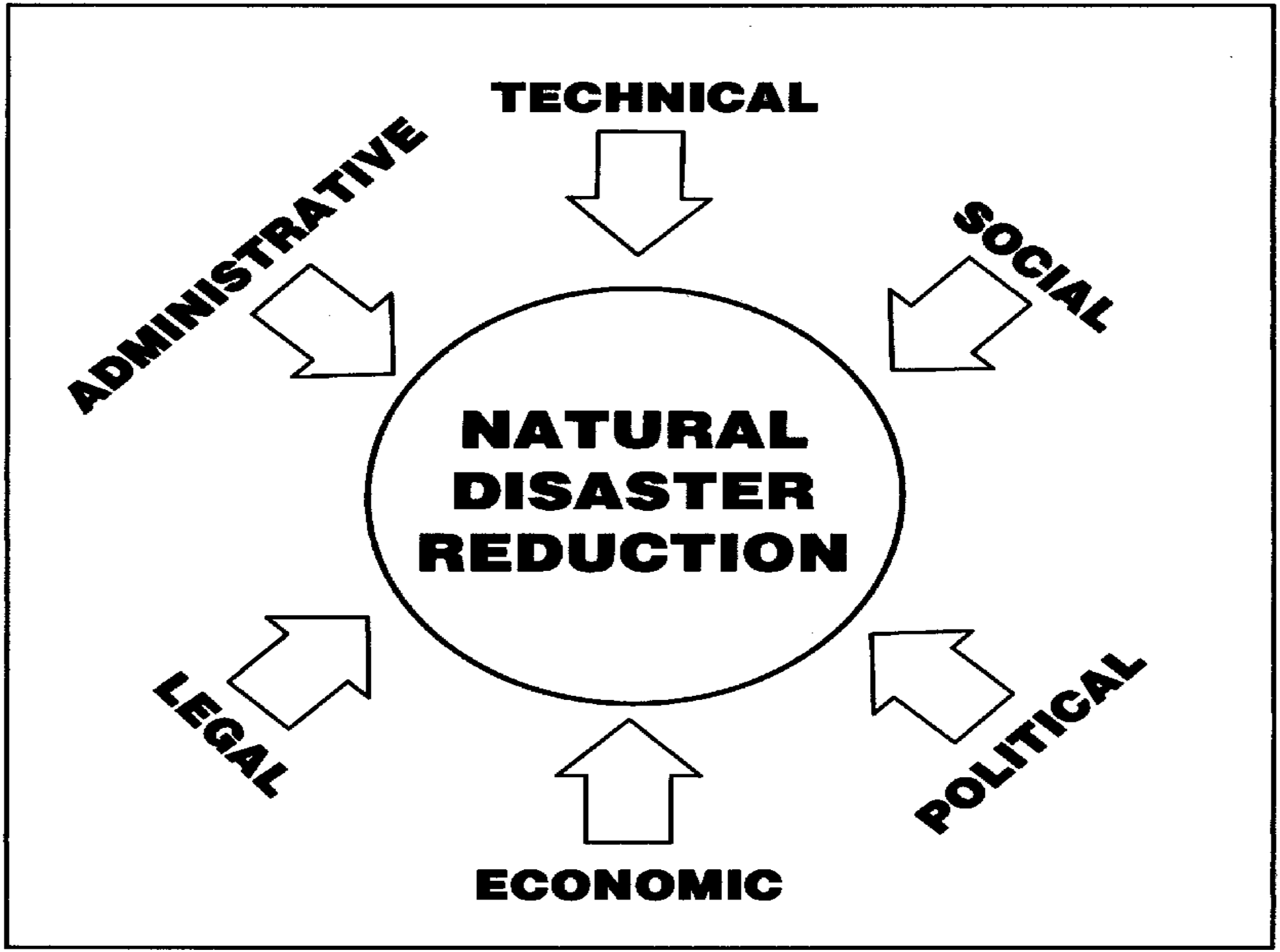
SEISMIC ZONATION ON A GLOBAL SCALE

CAN ALL NATIONS USE TECHNOLOGY TO IMPROVE THEIR GLOBAL KNOWLEDGE MANAGEMENT

SIMULTANEOSUSLY WITH RECONSTRUCTION IN THE SICHUAN PROVINCE, CHINA?

KNOWLEDGE MANAGEMENT IS SEISMIC ZONATION

SEISMIC ZONATION ADVANCES BEST PRACTICES BECAUSE IT USES THE SIX PRINCIPLES OF SUSTAINABILITY


TECHNICAL
ADMINISTRATIVE
SOCIAL
NATURAL
DISASTER
REDUCTION
LEGAL
POLITICAL
ECONOMIC

MAY 12, 2008
EARTHQUAKE

- HAZARD MAPS
- INVENTORY
- VULNERABILITY
- LOCATION

RISK

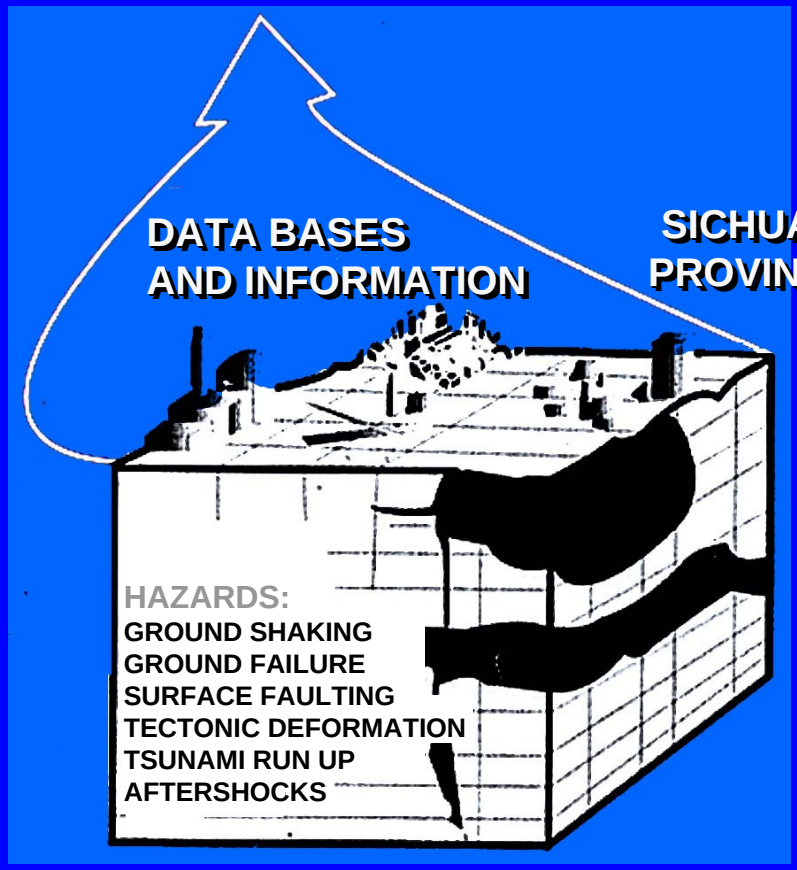
ACCEPTABLE RISK

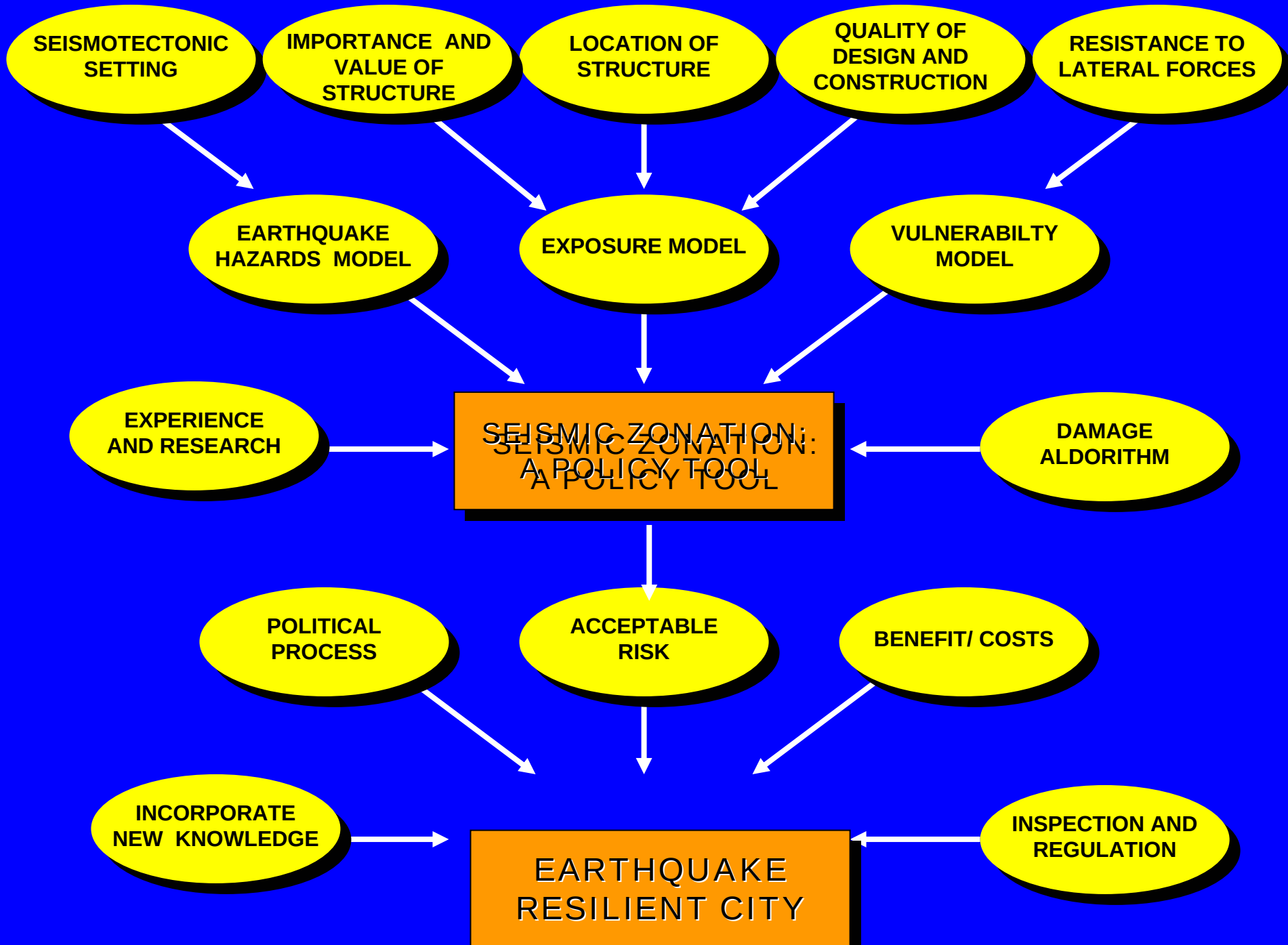
UNACCEPTABLE RISK

“STAPLE” DECISIONS

RECONSTRUCTION AND REASSURANCE

- MITIGATION
- ADAPTATION
- MONITORING




SEISMOTECTONIC SETTING
IMPORTANCE AND VALUE OF STRUCTURE
LOCATION OF STRUCTURE
QUALITY OF DESIGN AND CONSTRUCTION
RESISTANCE TO LATERAL FORCES
EARTHQUAKE HAZARDS MODEL
EXPOSURE MODEL
VULNERABILTY MODEL
EXPERIENCE AND RESEARCH
SEISMIC ZONATION: A POLICY TOOL
DAMAGE ALDORITHM
POLITICAL PROCESS
ACCEPTABLE RISK
BENEFIT/ COSTS
INCORPORATE NEW KNOWLEDGE
EARTHQUAKE RESILIENT CITY
INSPECTION AND REGULATION

RISK ASSESSMENT

- HAZARD MAPS
- INVENTORY
- VULNERABILITY
- LOCATION

RISK

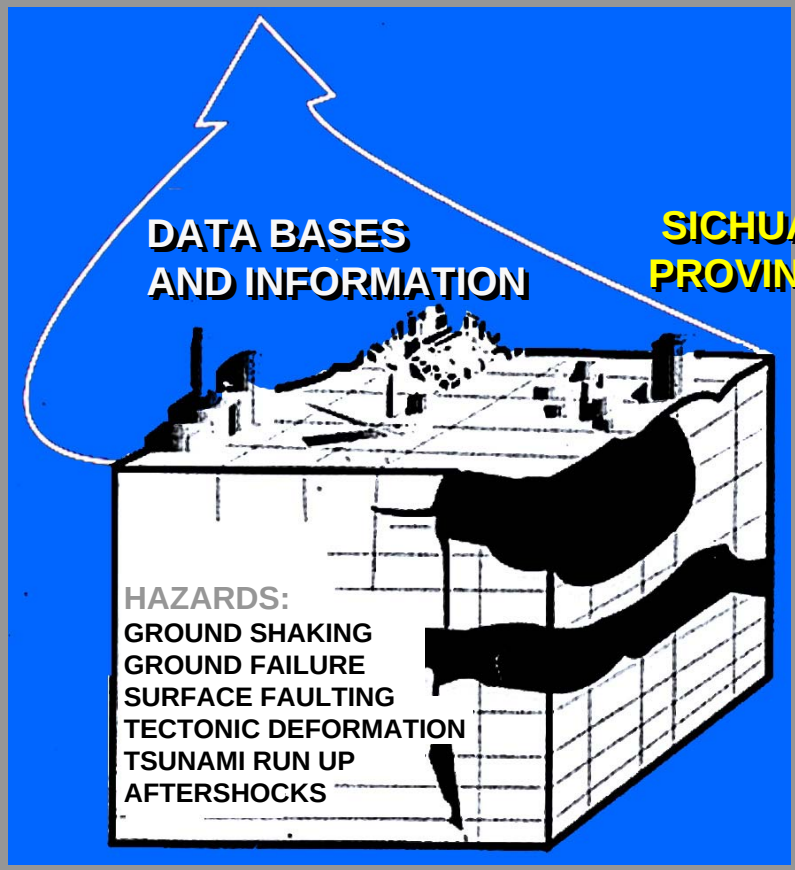
ACCEPTABLE RISK

UNACCEPTABLE RISK

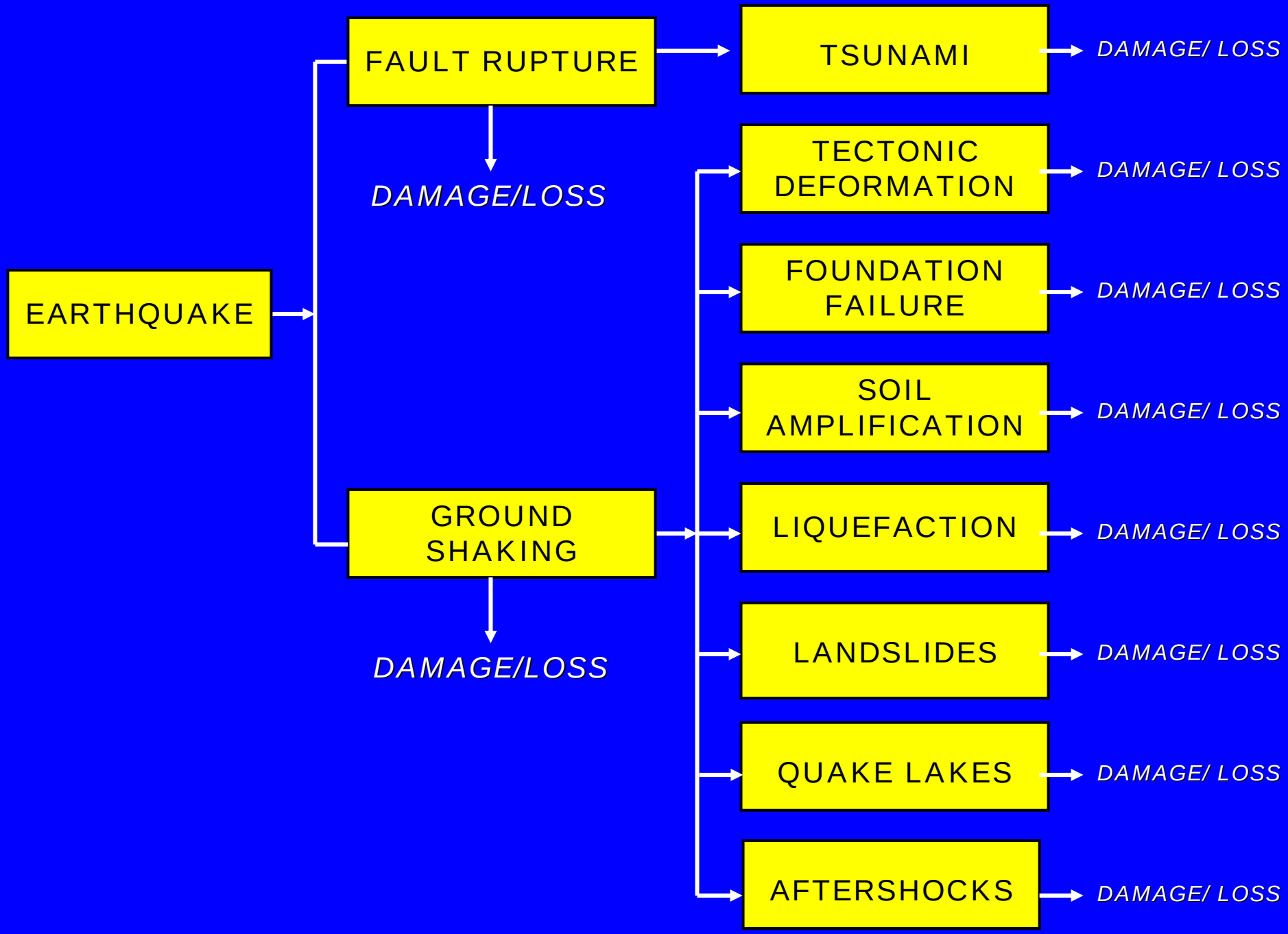
SESMIC ZONATION

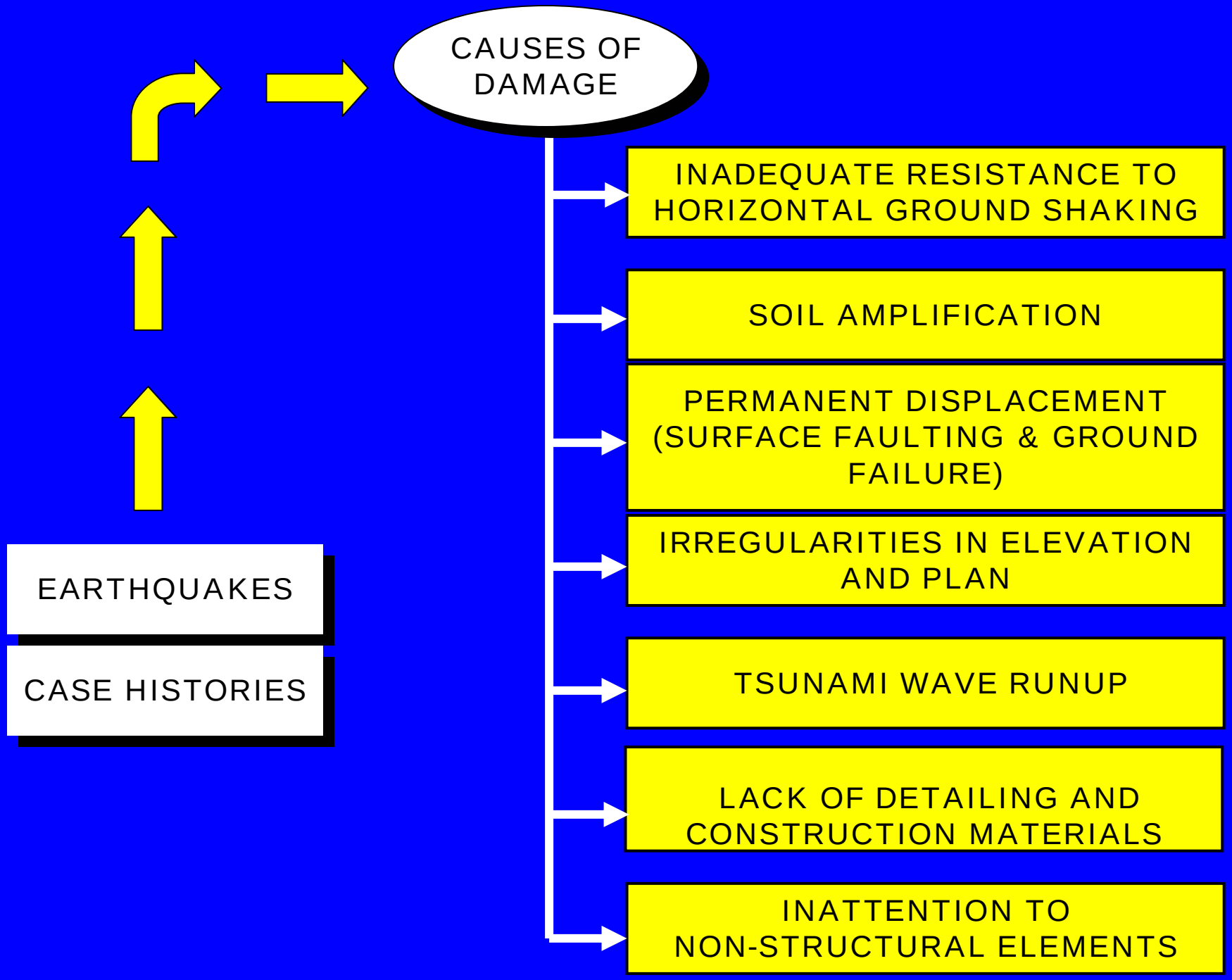
POLICY TOOL FOR RISK MANAGEMENT

- MITIGATION
- PREPAREDNESS
- EMERGENCY RESPONSE
- RECOVERY and RECONSTRUCTION



SEISMIC ZONATION PROVIDES A POLICY TOOL FOR RECONSTRUCTION IN THE SICHUAN PROVINCE

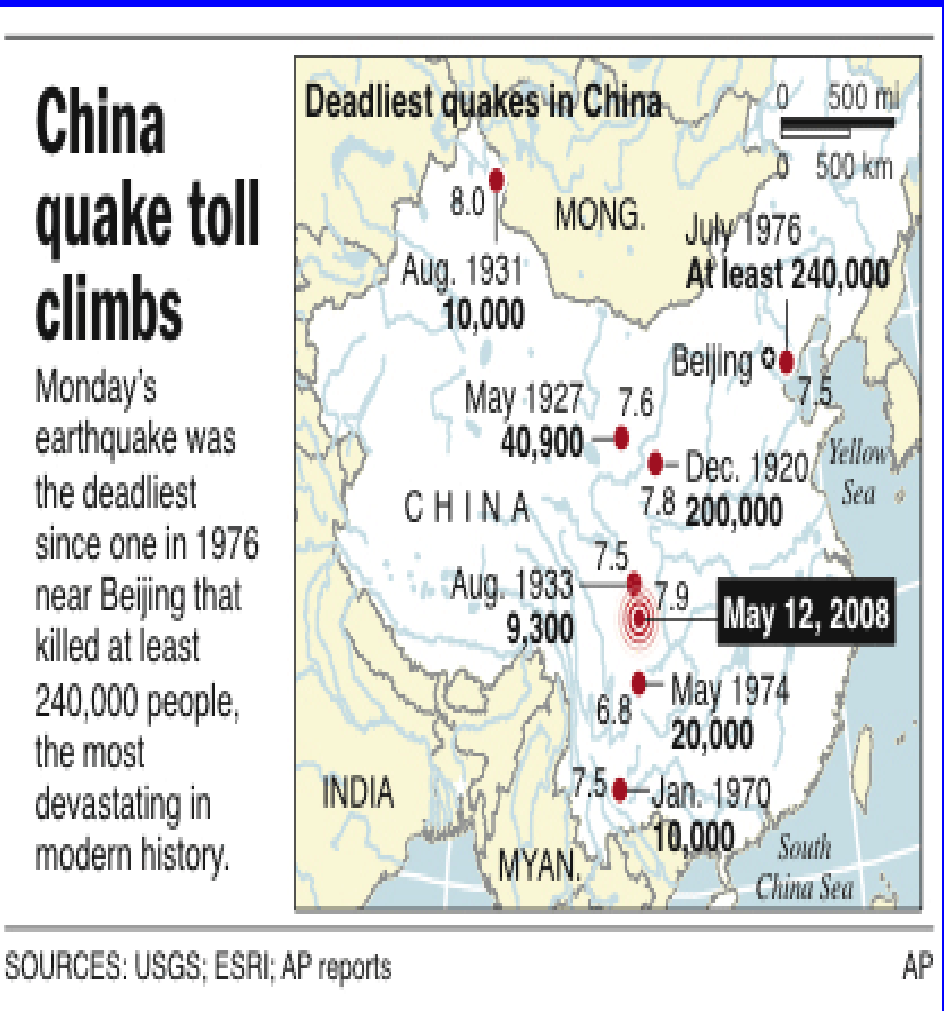

EARTHQUAKE
FAULT RUPTURE
DAMAGE/LOSS
GROUND SHAKING
DAMAGE/LOSS
TSUNAMI
DAMAGE/ LOSS
TECTONIC DEFORMATION
DAMAGE/ LOSS
FOUNDATION FAILURE
DAMAGE/ LOSS
SOIL AMPLIFICATION
DAMAGE/ LOSS
LIQUEFACTION
DAMAGE/ LOSS
LANDSLIDES
DAMAGE/ LOSS
QUAKE LAKES
DAMAGE/ LOSS
AFTERSHOCKS
DAMAGE/ LOSS


CAUSES OF DAMAGE
INADEQUATE RESISTANCE TO HORIZONTAL GROUND SHAKING
SOIL AMPLIFICATION
PERMANENT DISPLACEMENT (SURFACE FAULTING & GROUND FAILURE)
IRREGULARITIES IN ELEVATION AND PLAN
TSUNAMI WAVE RUNUP
LACK OF DETAILING AND CONSTRUCTION MATERIALS
INATTENTION TO NON-STRUCTURAL ELEMENTS
EARTHQUAKES
CASE HISTORIES

SEISMIC ZONATION WILL START WITH KNOWN ACTIVE FAULT ZONES

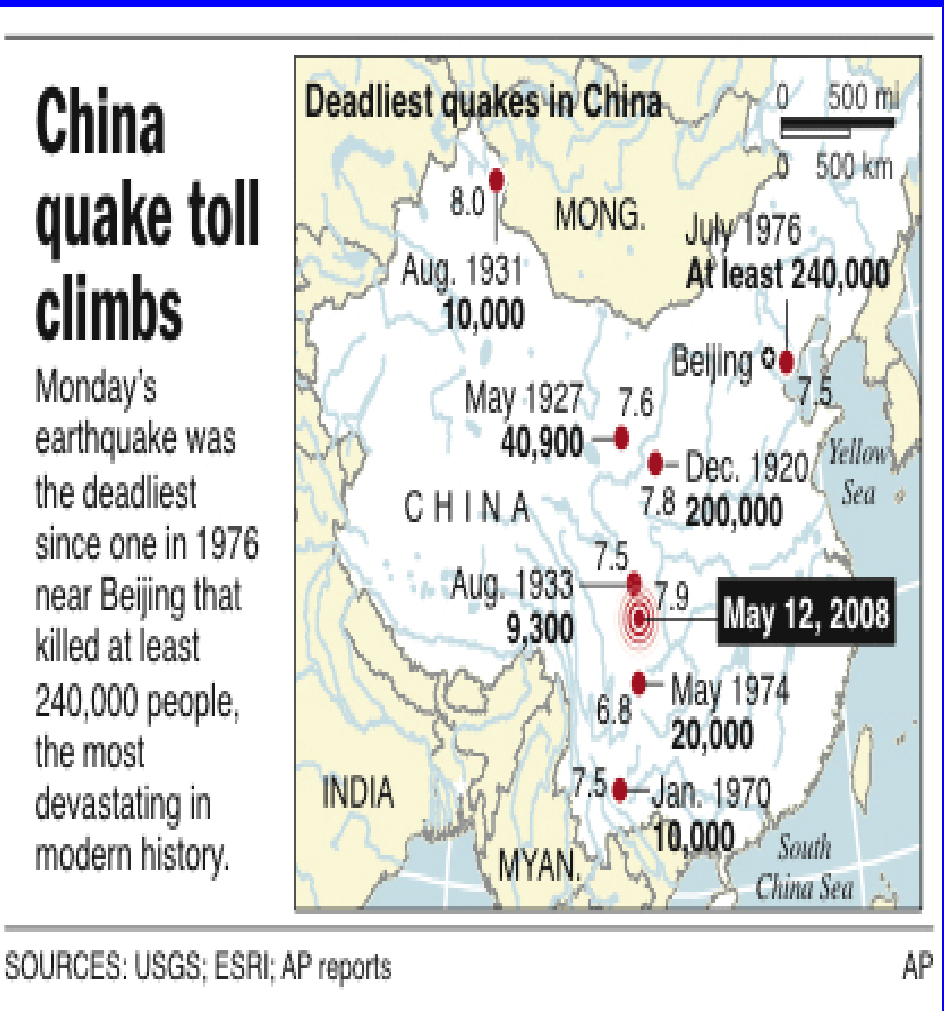
- LONGMENSHAN FAULT ZONE
- A ZONE OF BLIND THRUST FAULTS
- SEISMICITY ASSOCIATED WITH THESE FAULT ZONES

SEISMIC ZONATION WILL USE KNOWLEDGE FROM PAST EARTHQUAKES



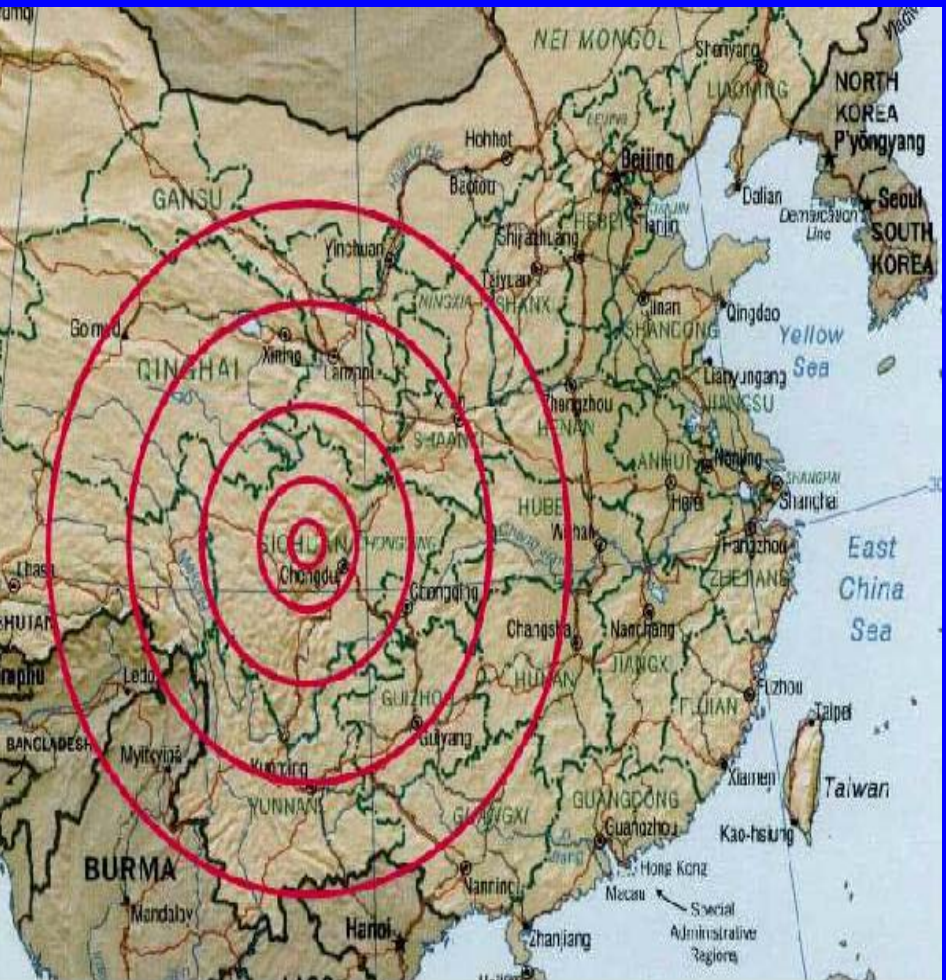
- DECEMBER 1920
- MAY 1927
- AUGUST 1931
- AUGUST 1933
- JANUARY 1970
- MAY 1974
- JULY 1976

SEISMIC ZONATION WILL USE KNOWLEDGE FROM PAST EARTHQUAKES



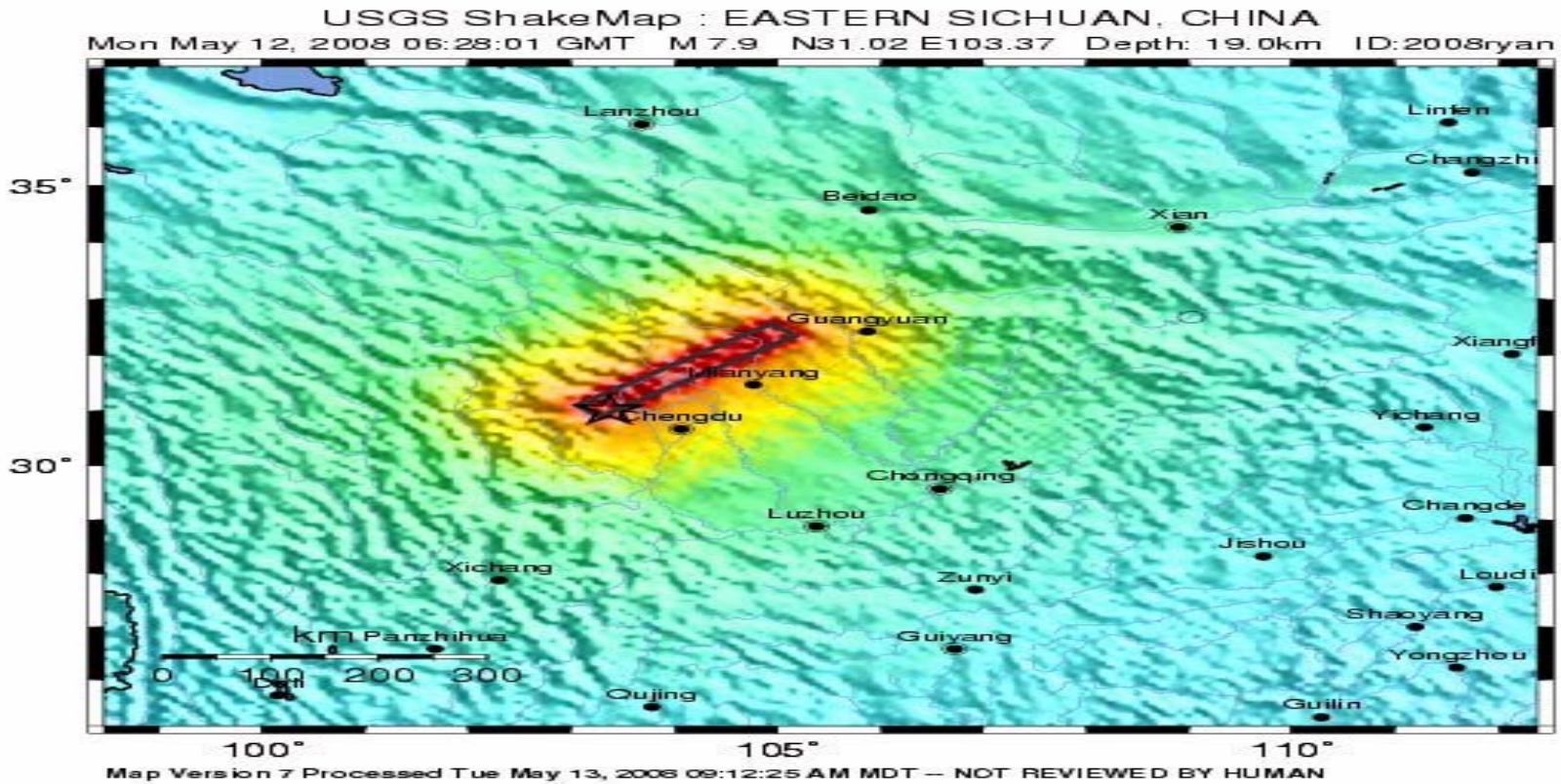
- **MAY 12, 2008**

SEISMIC ZONATION WILL USE SPECIFIC KNOWLEDGE FROM WENCHUAN EARTHQUAKE



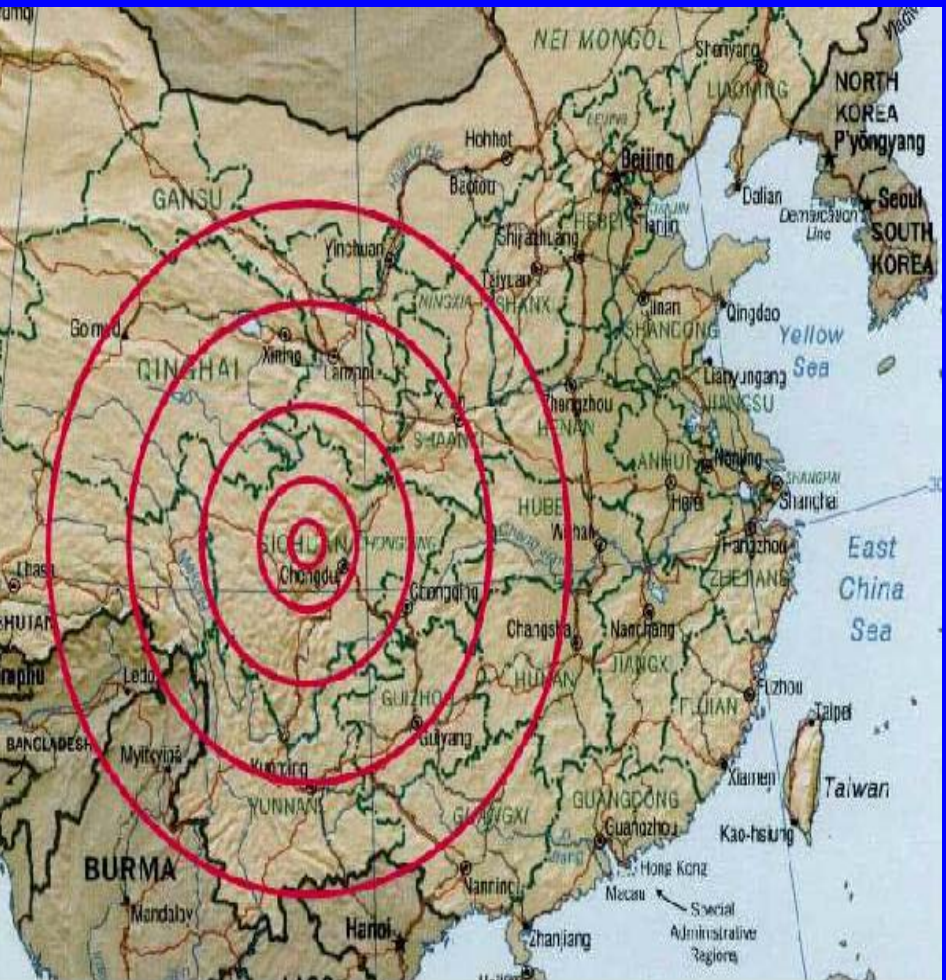
- A **200-KM-FAULT RUPTURE** WITH **5-M SLIP**
- **120 SECONDS** OF GROUND SHAKING
- POSSIBLE **“KILLER PULSE”**

LONGMENSHAN FAULT: SHAKE MAP



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

SEISMIC ZONATION WILL USE SPECIFIC KNOWLEDGE FROM WENCHUAN EARTHQUAKE



- **OVER 25 MILLION BUILDINGS (INCLUDING SCHOOLS) NEEDING RE-CONSTRUCTION OR REPAIR**

THE LONGMENSHAN FAULT SYSTEM MARKS A MAJOR COLLISION ZONE

- **ALTHOUGH THE REGION WILL LIKELY BE SEISMICALLY QUIET FOR A FEW DECADES, THE MOUNTAINS ARE EVIDENCE OF ON-GOING TECTONIC ACTIVITY**

THE LONGMENSHAN FAULT SYSTEM MARKS A MAJOR COLLISION ZONE

- **ON MAY 12, STRESS WAS TRANSFERRED TO SEISMICALLY ACTIVE THRUST FAULTS NEAR CHENGDU, THE CAPITOL.**

SEISMIC ZONATION WILL IDENTIFY ZONES OF LIKELY STRONG GROUND SHAKING

- PROXIMITY TO THE FAULT
- SHALLOW FOCUS
- LONG DURATION OF SHAKING
- SOIL AMPLIFICATION

SEISMIC ZONATION WILL IDENTIFY ZONES OF LIKELY GROUND FAILURE

- LANDSLIDES IN BEICHUAN AREA
- EXTENSIVE LANDSLIDES IN EPICENTRAL REGION

SEISMIC ZONATION WILL IDENTIFY LOCATIONS OF LIKELY "QUAKE LAKES"

- **ONE OF 69 "QUAKE LAKES"**

SEISMIC ZONATION WILL IDENTIFY ZONES OF LIKELY FLOODING FROM QUAKE LAKES

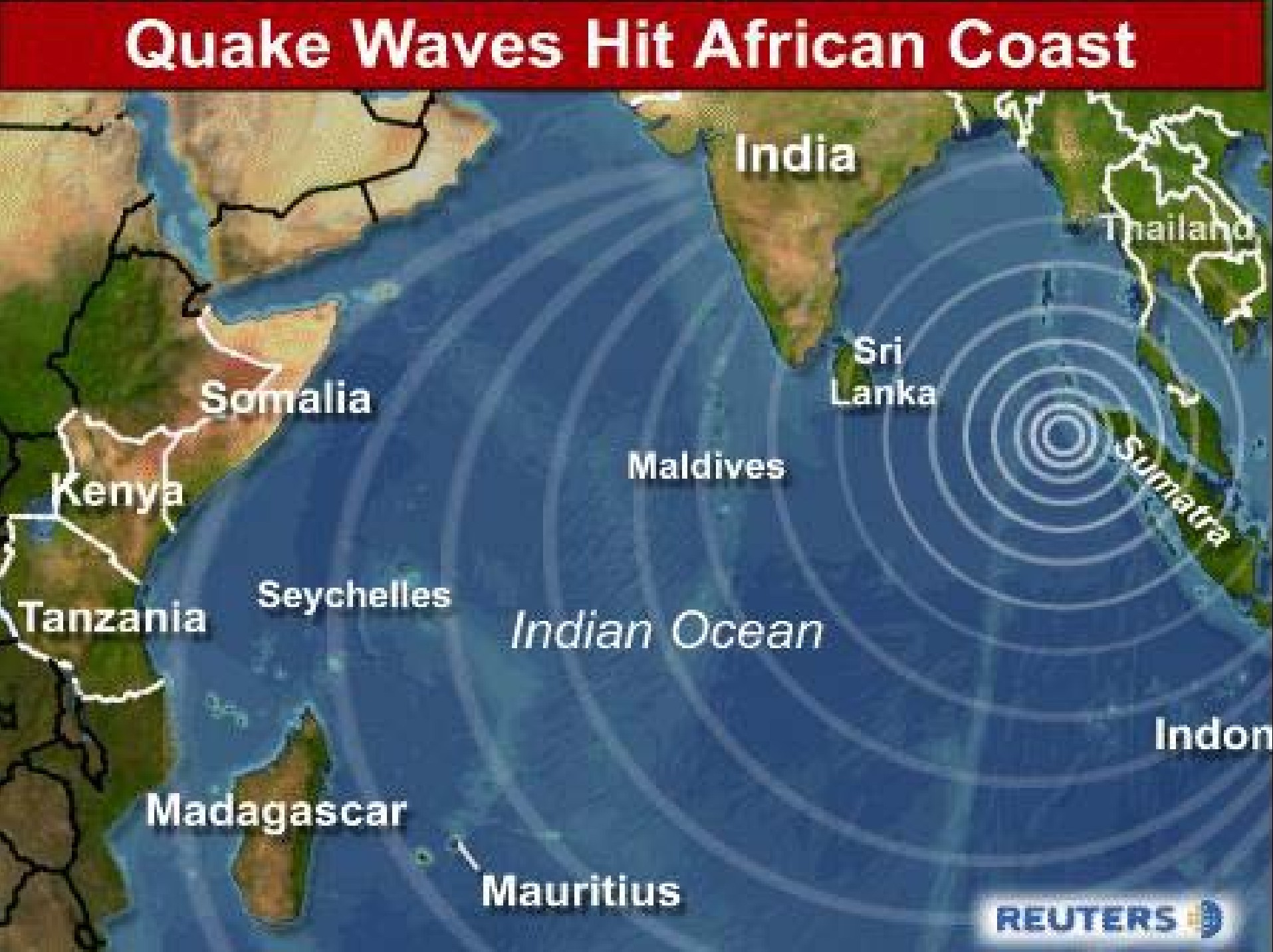
- BEI HE RIVER
- OTHER RIVERS

CHINA IS NOT THE ONLY NATION THAT HAS RECEIVED A POLITICAL MANDATE FOR KNOWLEDGE MANAGEMENT DURING RECONSTRUCTION

SOLOMON ISLANDS: 2007

ICA, PERU; 2007

ISLAMABAD, PAKISTAN; 2005


Quake Waves Hit African Coast
India
Thailand
Sri Lanka
Somalia
Maldives
Kenya
Sumatra
Seychelles
Tanzania
Indian Ocean
Indon
Madagascar
Mauritius
REUTERS

BAM, IRAN; 2003

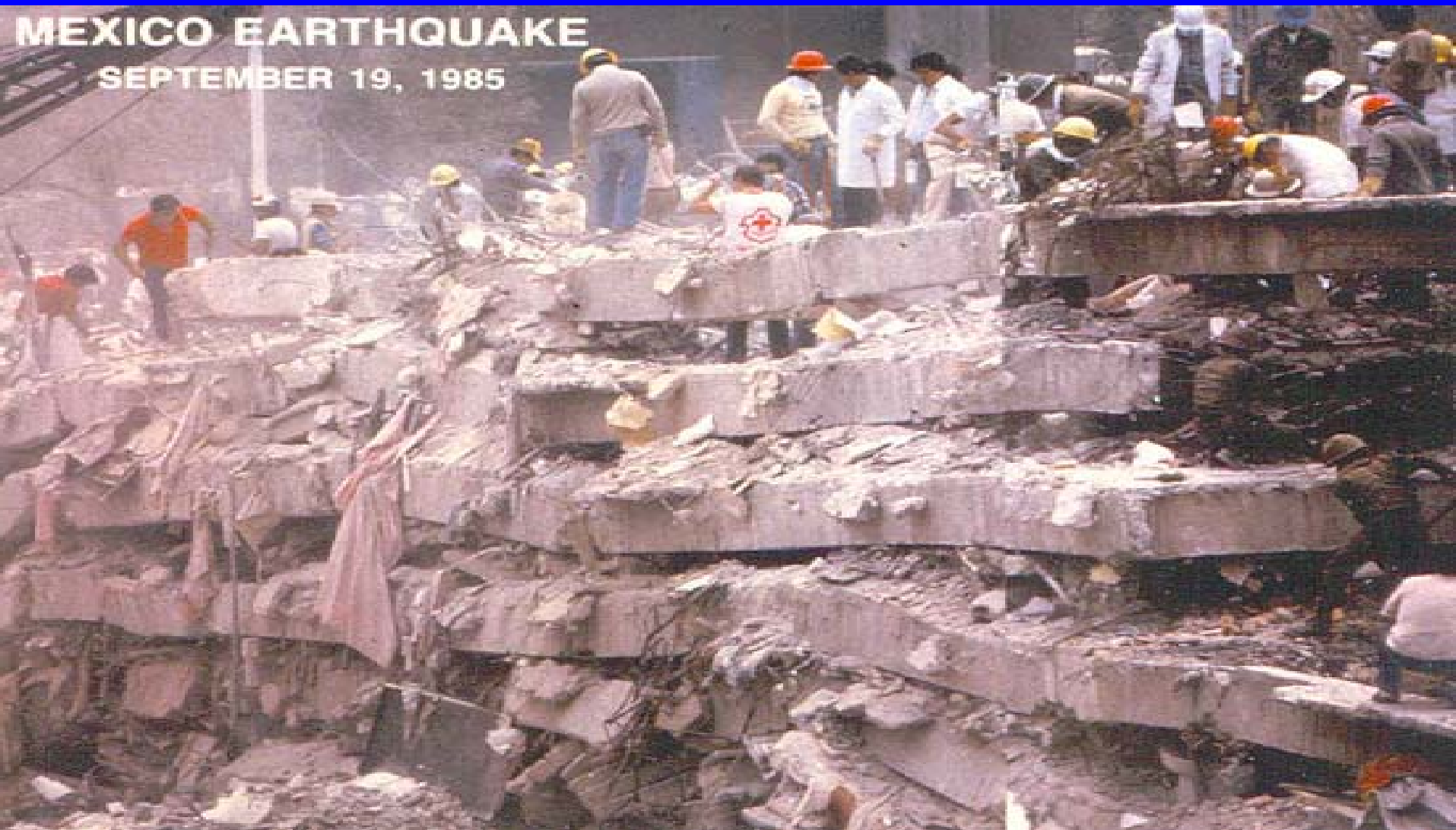
ERZICAN, TURKEY; 1992

KOACELI, TURKEY; 1999

KOBE, JAPAN; 1995

SPITAK, ARMENIA; 1988

MEXICO, 1985



MEXICO, 1985

TANGSHAN, CHINA; 1976

NIIGATA, JAPAN; 1964

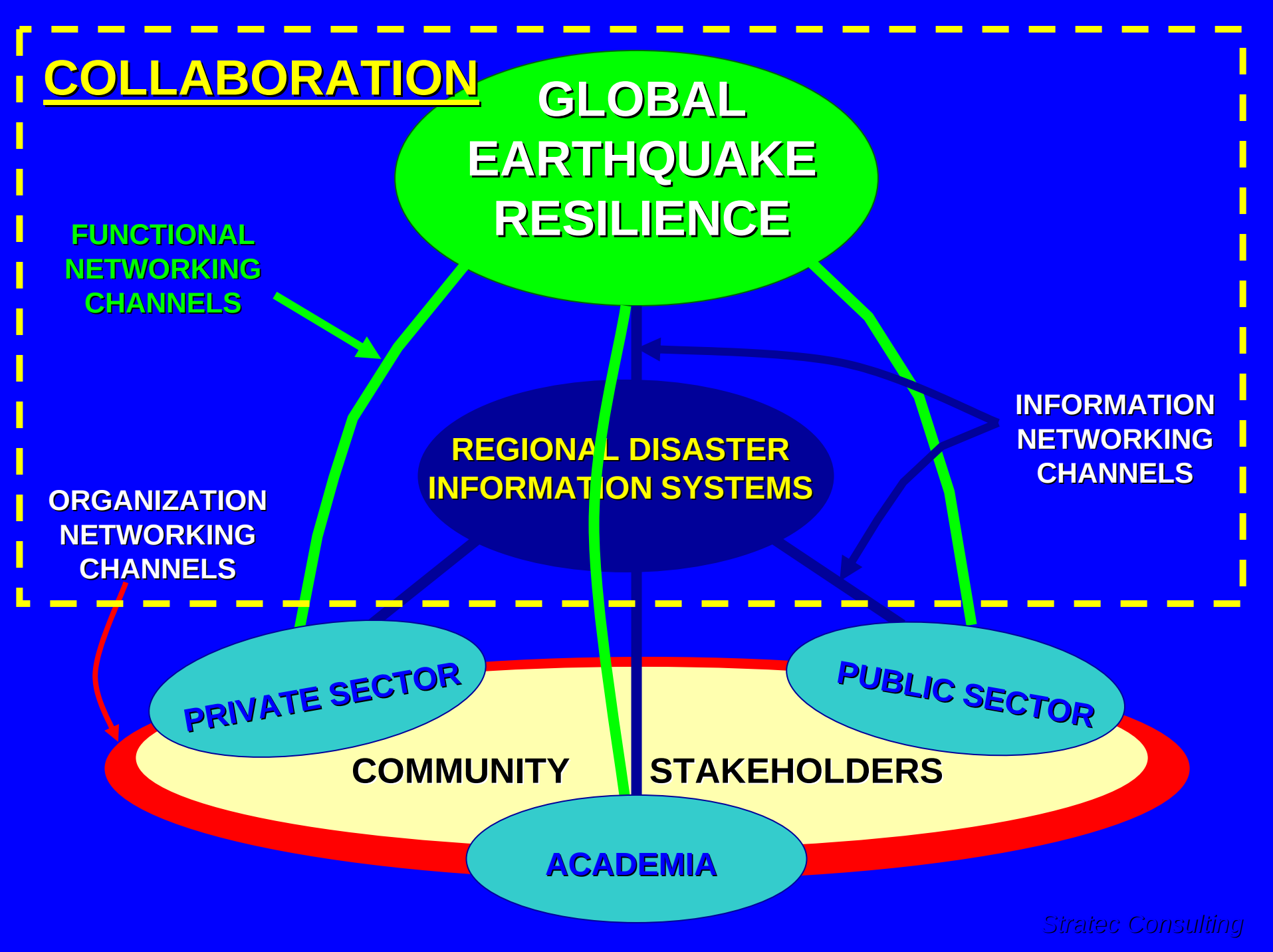
KANTO-TOKYO, 1923

SAN FRANCISCO, 1906

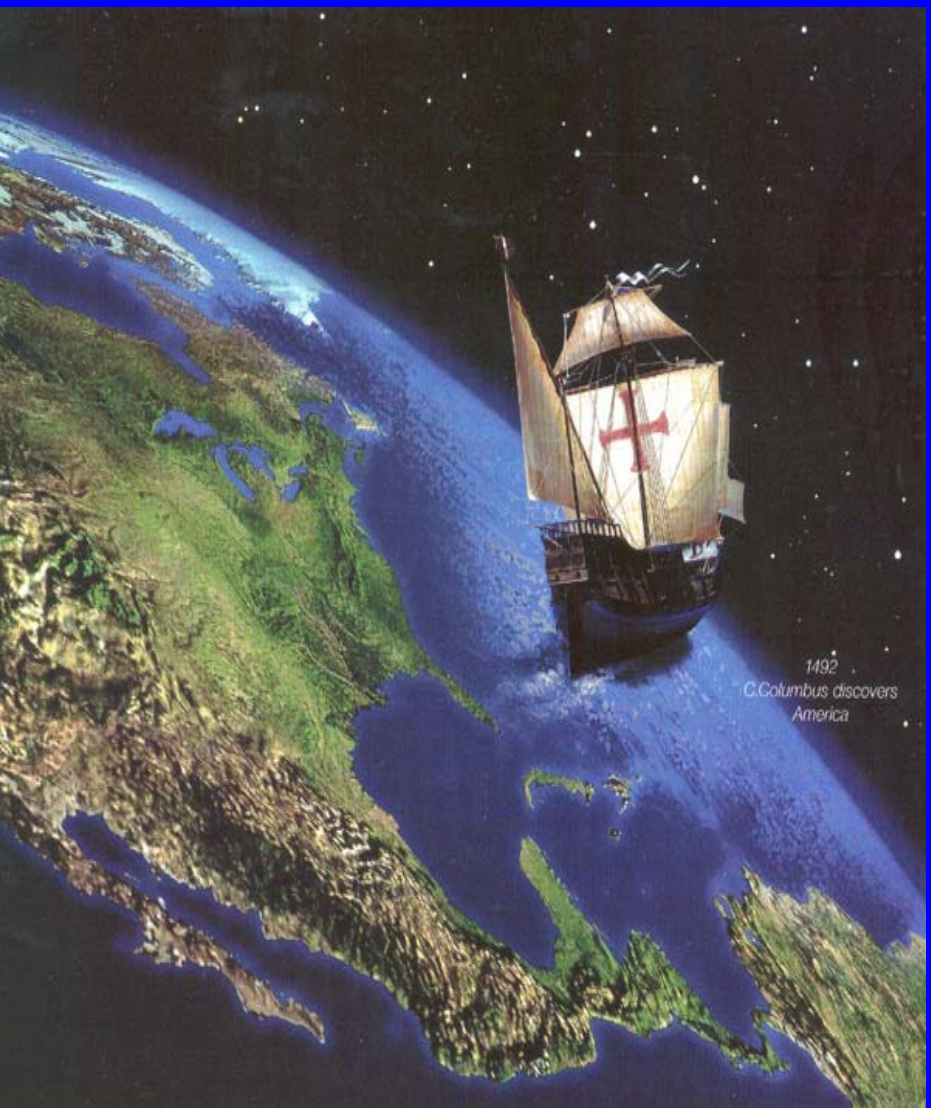
SEISMIC ZONATION ON A GLOBAL SCALE

CREATE AND IMPLEMENT GLOBAL KNOWLEDGE MANAGEMENT SIMULTANEOSUSLY WITH RECONSTRUCTION IN THE SICHUAN PROVINCE, CHINA

COLLABORATION AND TECHNOLOGY TRANSFER WILL INCREASE GLOBAL CAPACITY FOR LIVING WITH RISK


COLLABORATION
GLOBAL EARTHQUAKE RESILIENCE
FUNCTIONAL NETWORKING CHANNELS
INFORMATION NETWORKING CHANNELS
ORGANIZATION NETWORKING CHANNELS
REGIONAL DISASTER INFORMATION SYSTEMS
PRIVATE SECTOR
PUBLIC SECTOR
COMMUNITY
STAKEHOLDERS
ACADEMIA
Stratec Consulting

IT CAN BE DONE!

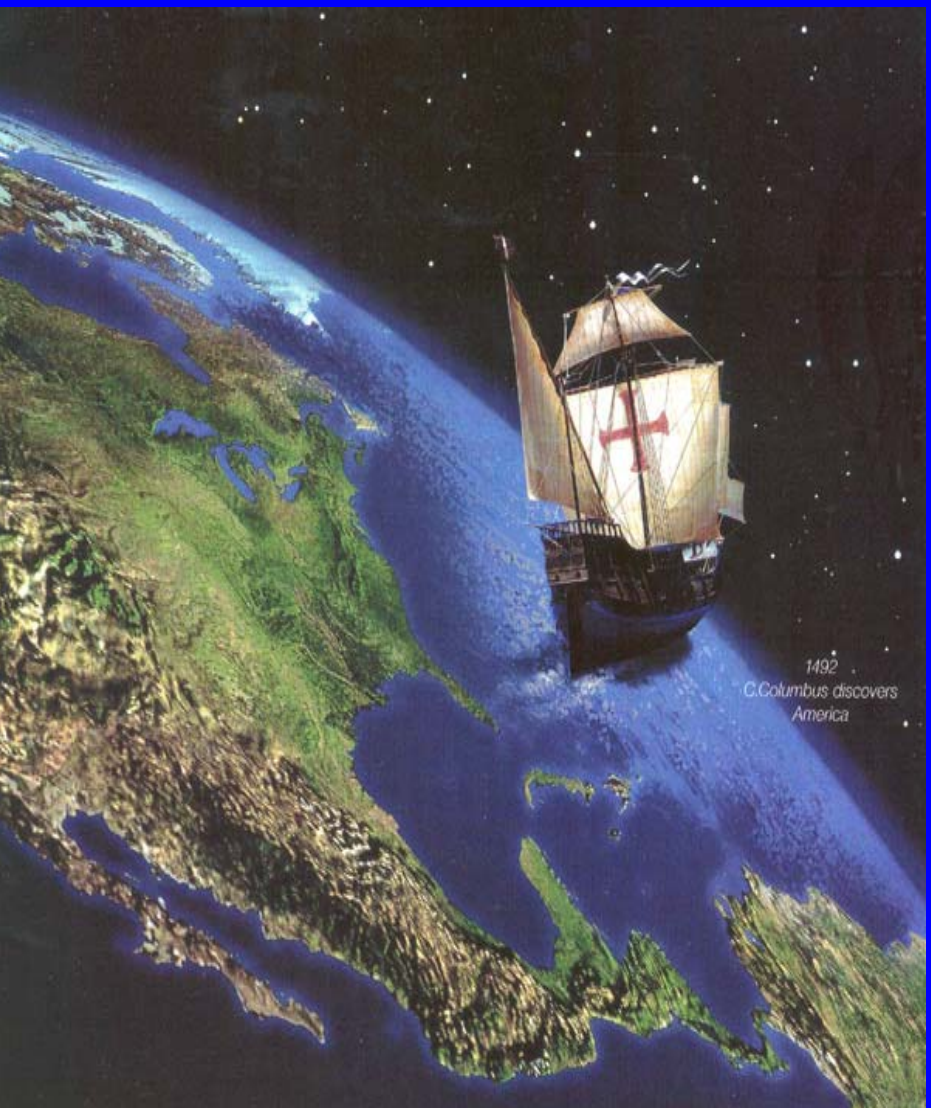


- GLOBAL TECHNOLOGY TRANSFER
- REGIONAL INFORMATION SYSTEMS

ELEMENTS OF SUCCESS

LEADERS WITH A VISION OF SUSTAINABLE DEVELOPMENT AND A COMMITMENT TO LONG-TERM REGIONAL AND GLOBAL COLLABORATION.

IT CAN BE DONE!

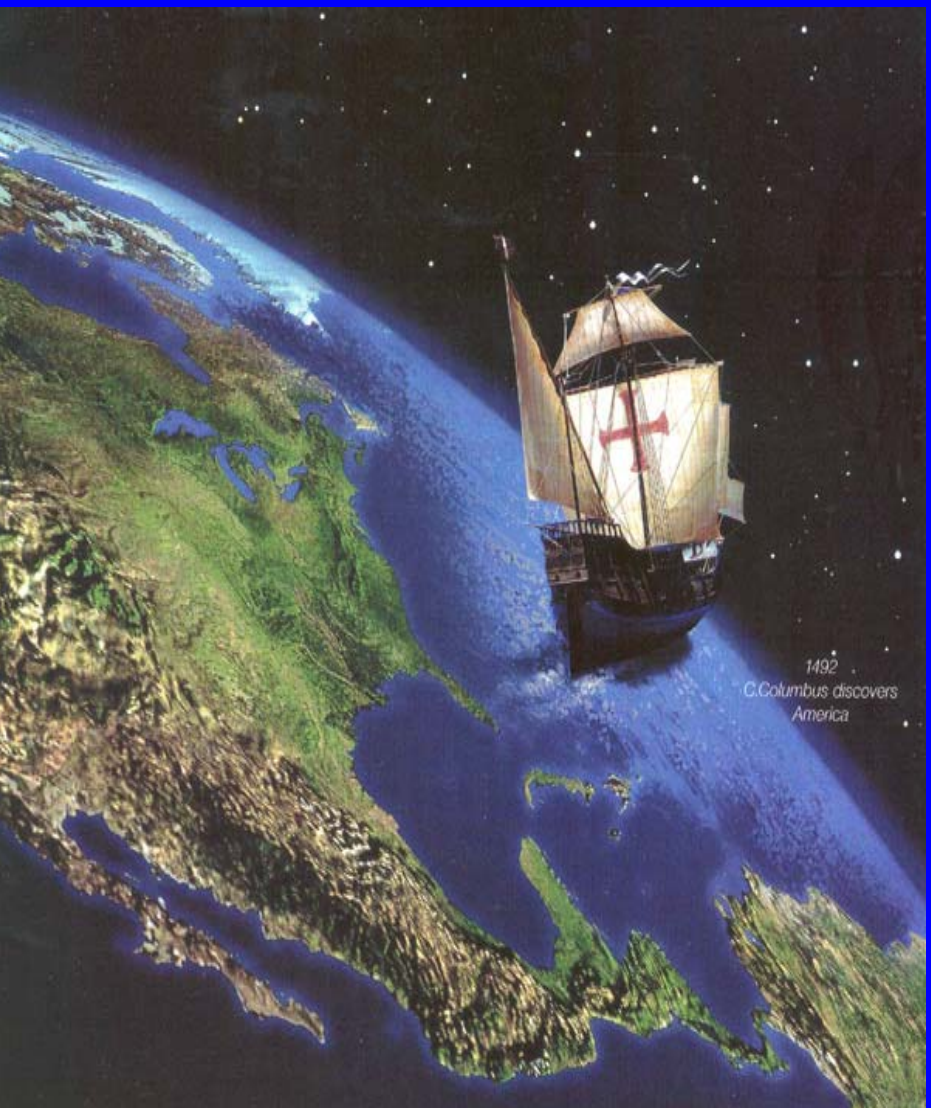


- IMPLEMENTATIO NOF EXISTING AND EMERGING TECHNOLOGIES

ELEMENTS OF SUCCESS

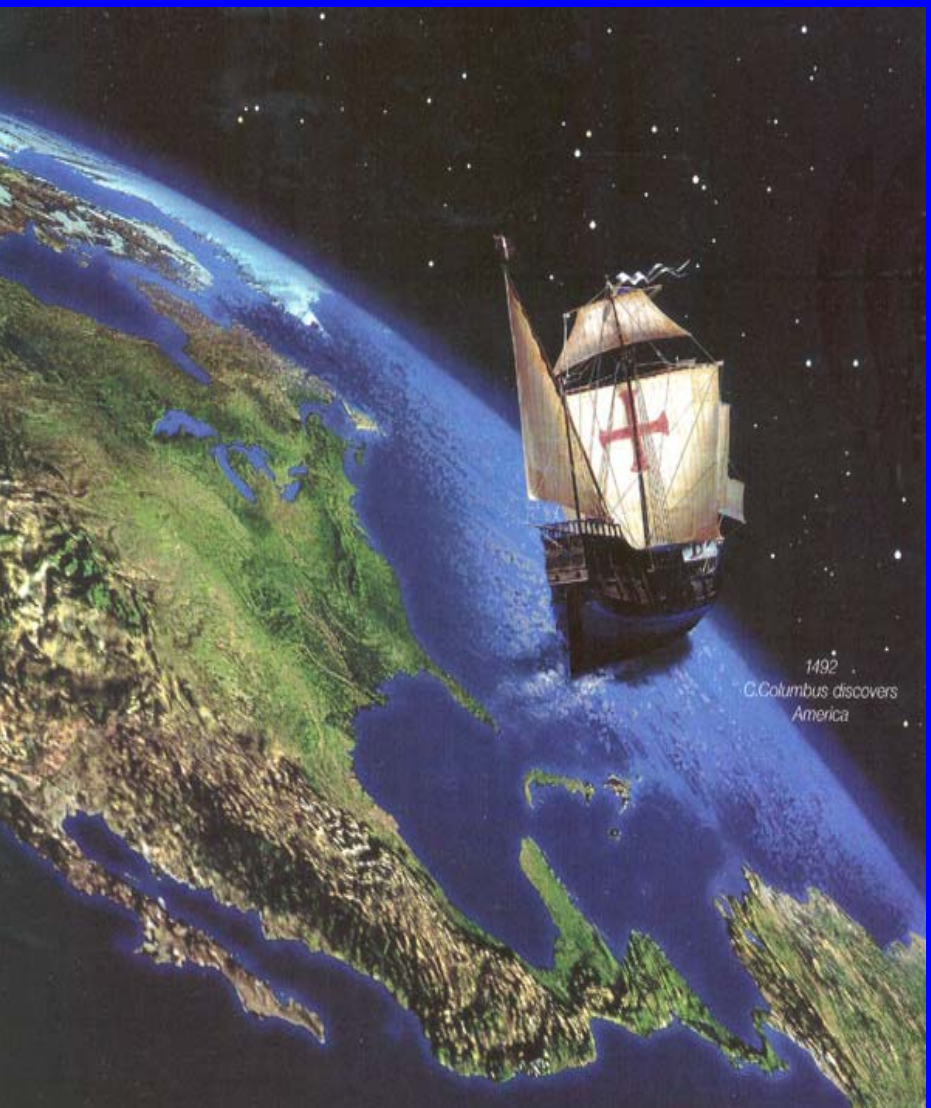
PROFESSIONALS WHO WILL TRANSFER OWNERSHIP OF EXISTING KNOWLEDGE, EXISTING TECHNOLOGY, AND BEST PRACTICES.

IT CAN BE DONE!



- **GLOBAL EARTHQUAKE RESILIENCE**
- **REGIONAL EARTHQUAKE RESILIENCE**

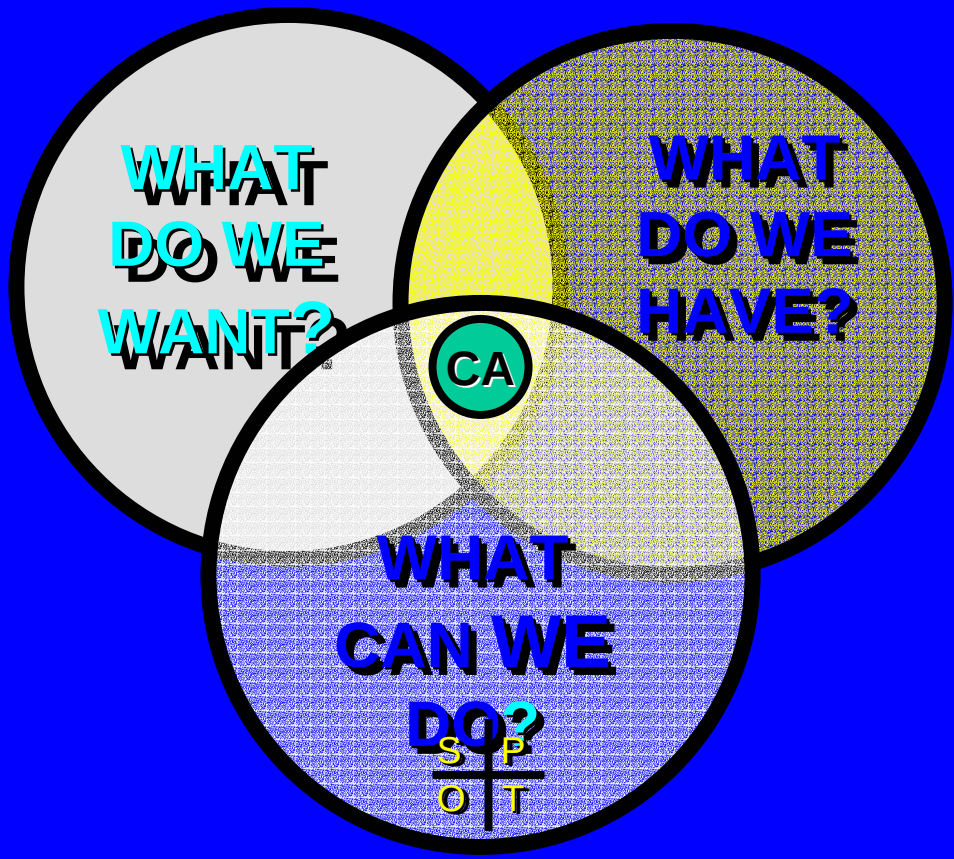
IT CAN BE DONE!



- **REGIONAL SUSTAINABLE DEVELOPMENT**
- **URBAN SUSTAINABLE DEVELOPMENT**

STRATEGIC PLANNING ENHANCES COLLABORATION

W^3 MODEL FOR STRATEGIC PLANNING



ELEMENTS OF SUCCESS

- 3) PROFESSIONALS ABLE TO THINK STRATEGICALLY AND BUILD TECHNICAL AND POLITICAL CAPACITY FOR REDUCING PHYSICAL, SOCIAL, AND ENTERPRISE VULNERABILITIES

TECHNOLOGIES FOR REDUCING URBAN VULNERABILITIES

- MONITORING TECHNOLOGIES (E.G., GLOBAL EARTH OBSERVING SYSTEM)
- SATELITES AND REMOTE SENSING TECHNOLOGY
- INFORMATION TECHNOLOGY (E.G., COMPUTERS, GIS)

TECHNOLOGIES FOR REDUCING URBAN VULNERABILITIES

- TECHNOLOGY FOR HAZARD ASSESSMENT
- TECHNOLOGY FOR ASSESSING PHYSICAL VULNERABILITIES
- TECHNOLOGY FOR RISK ASSESSMENT

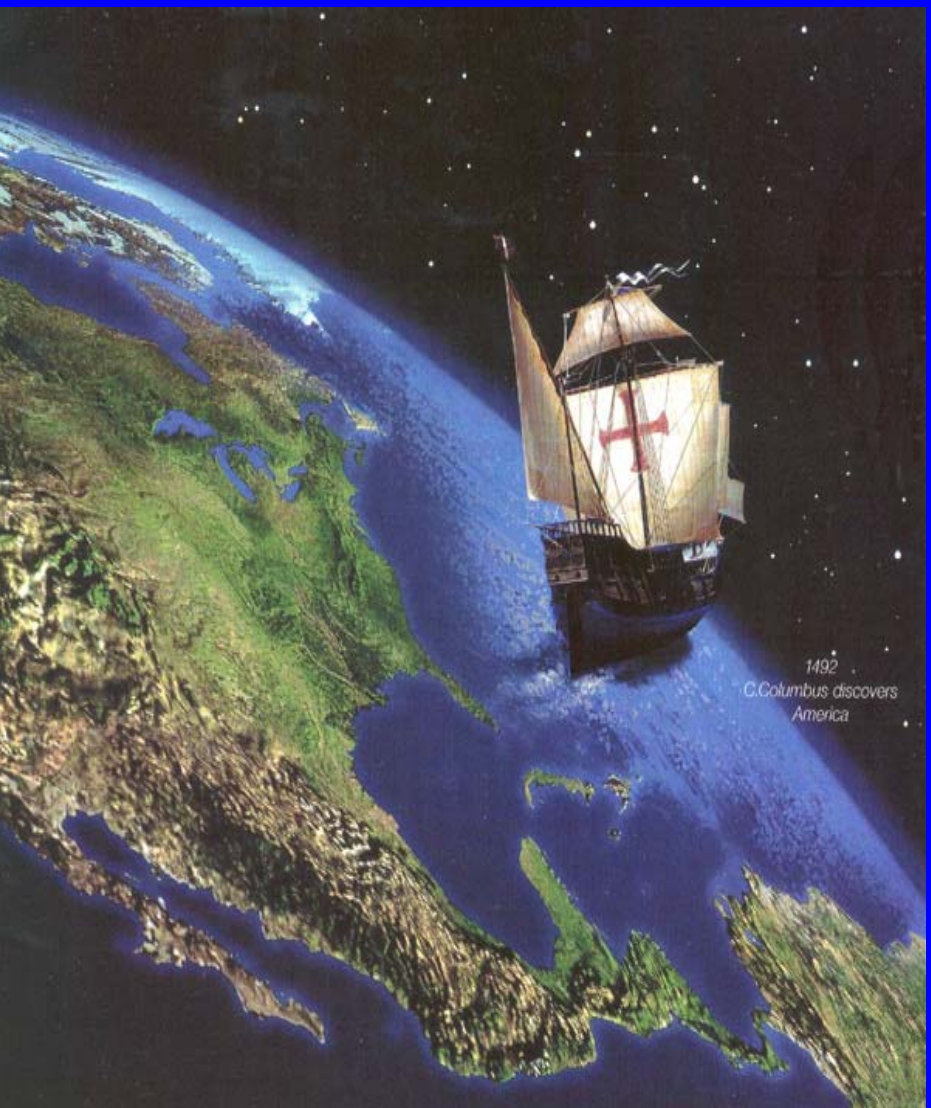
TECHNOLOGIES FOR REDUCING URBAN VULNERABILITIES

- DATABASES FOR EXPERT SYSTEMS
- CASE HISTORIES
- BEST PRACTICES

TECHNOLOGIES FOR REDUCING URBAN VULNERABILITIES

- ADVANCED MATERIALS
- AUTOMATED CONSTRUCTION TECHNIQUES
- COMPUTER-AIDED DESIGN
- ACTIVE AND PASSIVE ENERGY DISSIPATION DEVICES
- PERFORMANCE BASED DESIGN

IT CAN BE DONE!

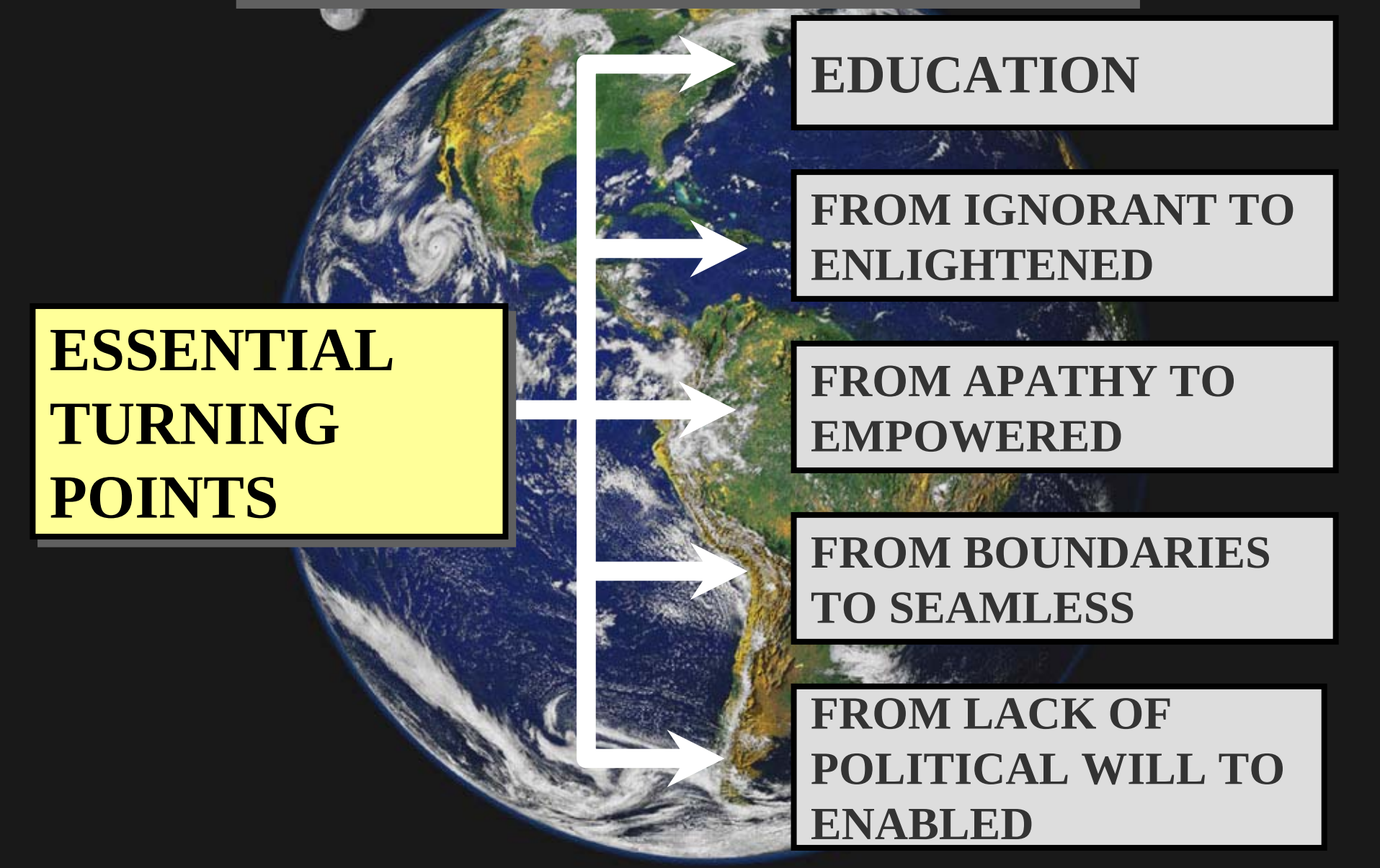


- TOWARDS INCREASED DISASTER RESILIENCE IN EVERY COMMUNITY AND REGION OF THE WORLD

CREATING GLOBAL TURNING POINTS FOR EARTHQUAKE SUSTAINABILITY

- INTEGRATION OF SCIENTIFIC AND TECHNICAL SOLUTIONS
- CREATING EQUITY AS ALL SECTORS CONTRIBUTE TO IMPLEMENTATION

GOALS FOR BUILDING A CULTURE OF EARTHQUAKE RESILIENCE



ESSENTIAL TURNING POINTS

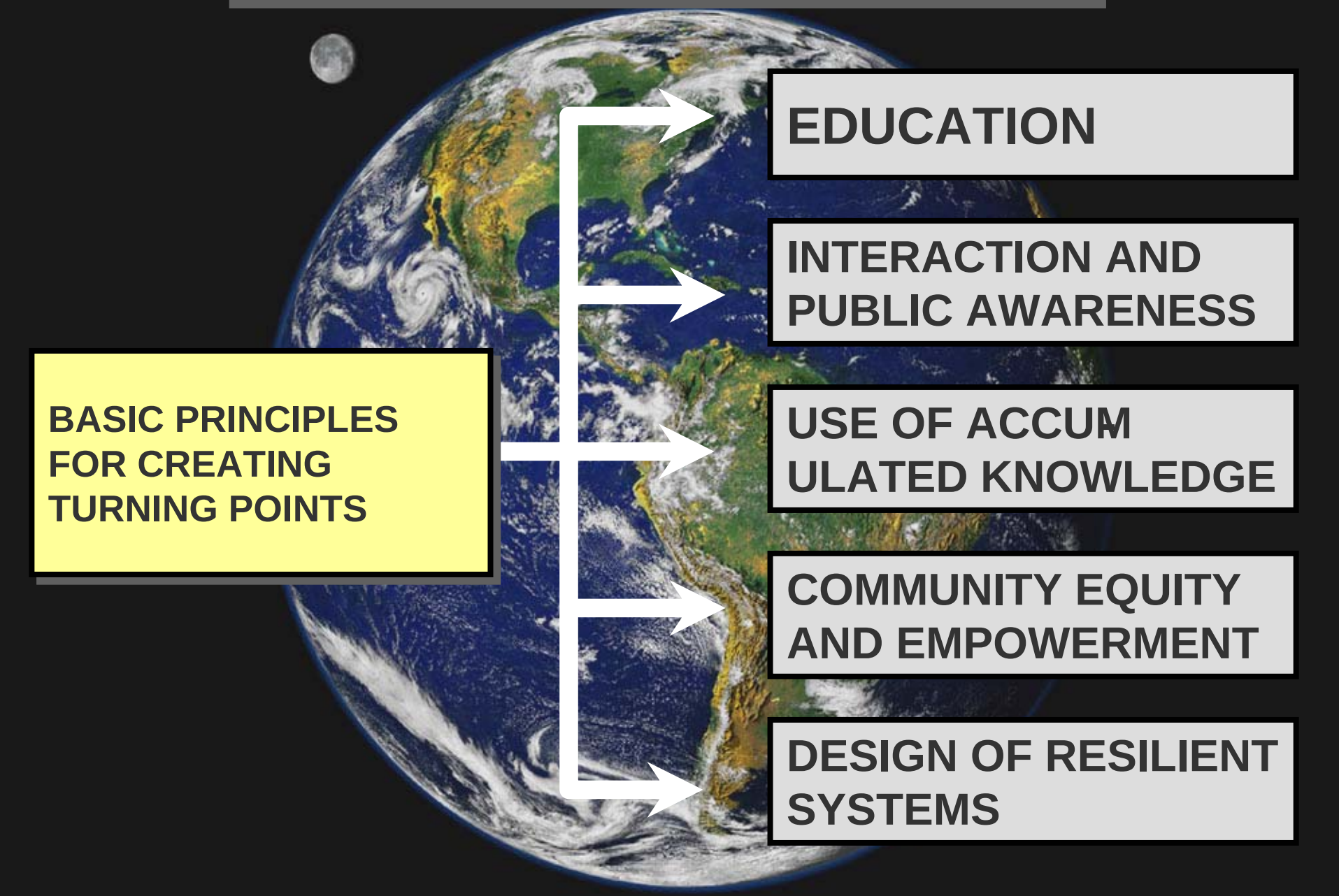
- **EDUCATION**
- **FROM IGNORANT TO ENLIGHTENED**
- **FROM APATHY TO EMPOWERED**
- **FROM BOUNDARIES TO SEAMLESS**
- **FROM LACK OF POLITICAL WILL TO ENABLED**

BARRIERS TO SUCCESS

INEVITABLE OBSTACLES

- **COMMUNITIES UNABLE TO OVERCOME IGNORANCE, APATHY, ORGANIZATIONAL BOUNDARIES, AND LACK OF POLITICAL WILL**

KNOWLEDGE MANAGEMENT



BASIC PRINCIPLES FOR CREATING TURNING POINTS

- **EDUCATION**
- **INTERACTION AND PUBLIC AWARENESS**
- **USE OF ACCUM ULATED KNOWLEDGE**
- **COMMUNITY EQUITY AND EMPOWERMENT**
- **DESIGN OF RESILIENT SYSTEMS**

KNOWLEDGE MANAGEMENT

- **PRINCIPLES**
  - **TURNING POINT**
  - **GOVERNMENTS PROVIDING THE BEST POSSIBLE KNOWLEDGE MANAGEMENT TO THE PEOPLE AT RISK**

KNOWLEDGE MANAGEMENT

- PRINCIPLES

- TURNING POINT
- KNOWLEDGE MANAGEMENT **IS AN INTER-ACTIVE PROCESS** AMONG THE INSTITUTIONS INVOLVED IN IT

KNOWLEDGE MANAGEMENT

- **PRINCIPLES**
  - **EACH COMMUNITY HAS ASSESSED ITS LEVEL OF IGNORANCE, APATHY, DISCIPLINARY BOUNDARIES, AND LACK OF POLITICAL WILL**

KNOWLEDGE MANAGEMENT

- PRINCIPLES
- EACH COMMUNITY HAS FORMU-LATED STRATEGIES TO INCREASE PUBLIC AWARENESS

KNOWLEDGE MANAGEMENT

- **PRINCIPLES**

- **TURNING POINTS**
- **DESIGNS THAT WILL PROTECT PEOPLE, INFRASTRUCTURE, AND LIVELIHOODS ARE MANDATED**

KNOWLEDGE MANAGEMENT

- **PRINCIPLES**

- **TURNING POINTS**
- **PROFESSIONALS AND POLICY MAKERS AT COMMUNITY AND NATIONAL LEVELS ARE EMPOWERED AND ENABLED**

KNOWLEDGE MANAGEMENT

- **PRINCIPLES**

- **TURNING POINTS**
- **IGNORANCE IS TRANSFORMED INTO ENLIGHTEN-MENT**

KNOWLEDGE MANAGEMENT

- **PRINCIPLES**

- **TURNING POINTS**
- **APATHY IS TRANSFORMED INTO EMPOWERMENT**

KNOWLEDGE MANAGEMENT

- **PRINCIPLES**
- **TURNING POINTS**
- **DISCIPLINARY AND POLITICAL BOUNDARIES ARE TRANSFORMED INTO SEAMLESS, ENFICHED UNIVERSES**

KNOWLEDGE MANAGEMENT

- **PRINCIPLES**

- **TURNING POINTS**
- **LACK OF POLITICAL WILL IS TRANSFORMED INTO POLITICAL ENABLEMENT AND SUCCESSES**

KNOWLEDGE MANAGEMENT

- **PRINCIPLES**

- **TURNING POINTS**
- **COOPERATION, COMMUNICATION, COORDINATION, AND COLLAB-ORATION IS THE NORM IN ALL COMMUNITIES**

KNOWLEDGE MANAGEMENT

- **PRINCIPLES**

- **TURNING POINTS**
- **COMMUNITIES OF DEVELOPED NATIONS ASSISTING COMMUNITIES IN LESS DEVELOPED NATIONS**

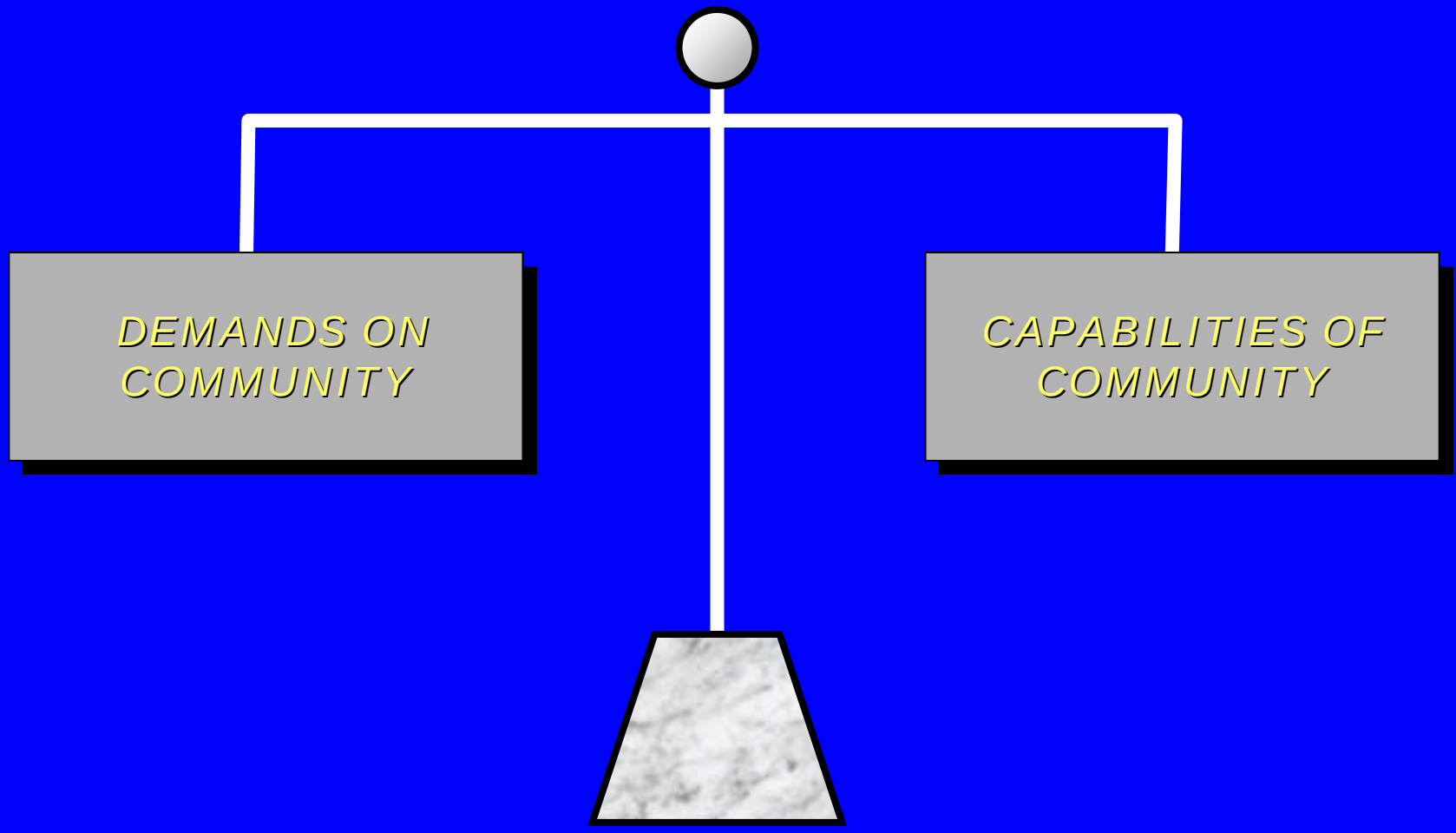
KNOWLEDGE MANAGEMENT

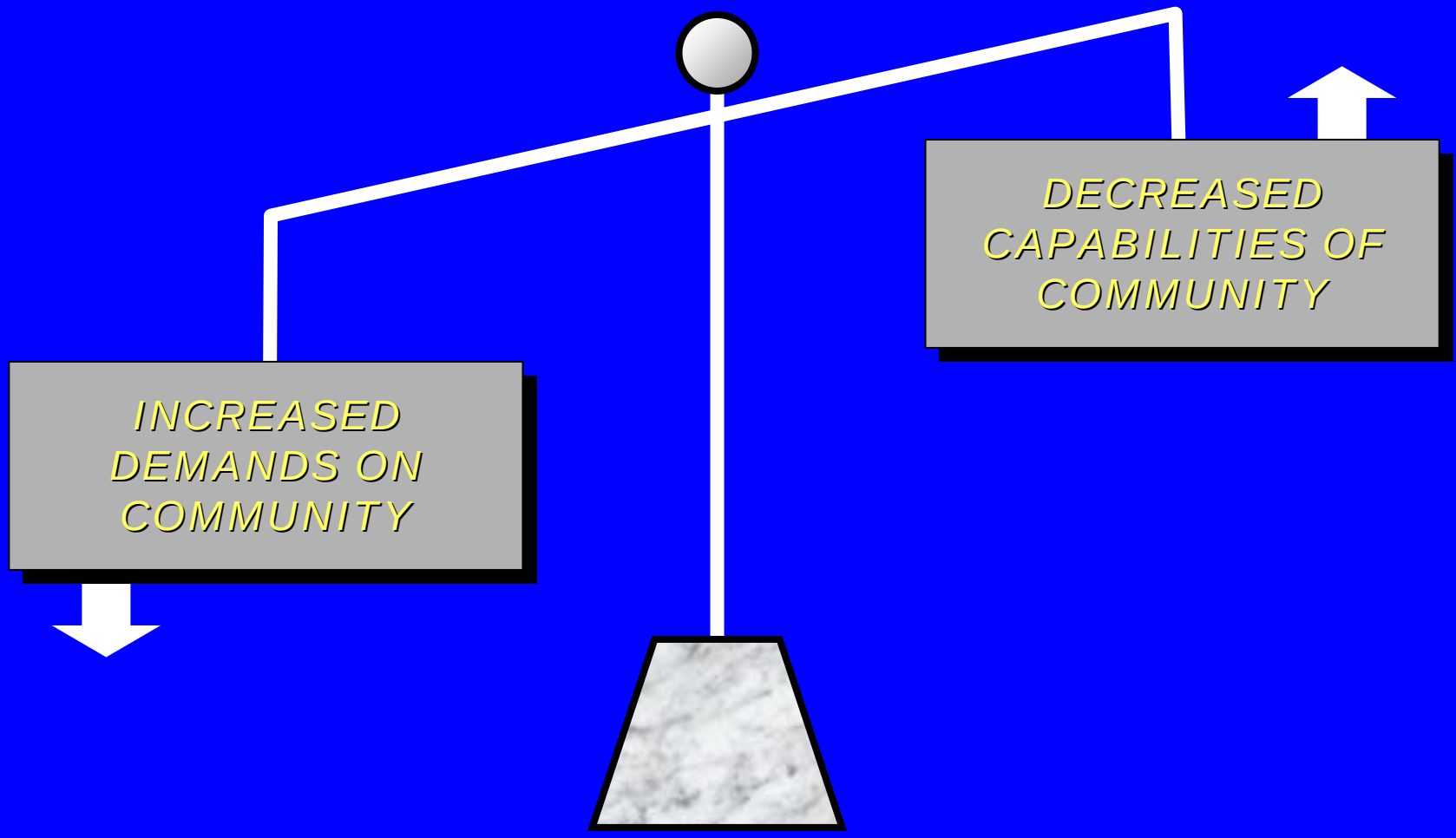
- **PRINCIPLES**

- **TURNING POINTS**
- **THE DIALOGUE ON THE PROBLEMS AND THE SOLUTIONS BECOMES A CONTINUING PROCESS**

LIVING WITH RISK

SUCCESS



LIVING WITH RISK

FAILURE