

**Third IAI / UM Summer Institute on  
Interdisciplinary Global Change Science in the Americas**

*Lectures*

**INSTITUTIONAL ISSUES IN WATER MANAGEMENT**

*and*

**INSTITUTIONS AND CAPACITY BUILDING IN INTEGRATED WATER RESOURCES  
PLANNING AND MANAGEMENT**

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# THE PROBLEM SOLVING APPROACH (1)

***WATER RESOURCES DEVELOPMENT IS SUPPLY-ORIENTED.***

*IT IS CONCERNED WITH LARGELY STRUCTURAL MEASURES FOR INCREASING WATER AVAILABILITY.*

***WATER RESOURCES MANAGEMENT IS BOTH SUPPLY AND DEMAND-ORIENTED.***

*IT IS CONCERNED WITH MANAGING BOTH SUPPLIES OF WATER AND THE DEMANDS FOR THOSE SUPPLIES, TO ACHIEVE THE BEST USE OF LIMITED RESOURCES.*

*MANAGING DEMAND INVOLVES INFLUENCING THE BEHAVIOR OF PEOPLE, THE USERS OF WATER.*

# THE PROBLEM SOLVING APPROACH (2)

## *GENERAL PRINCIPLES*

*WATER RESOURCES MANAGEMENT IS A PROBLEM-SOLVING PROCESS.*

*AS SUCH, IT MUST PROCEED IN AN APPROPRIATE SEQUENCE OF TASKS IF IT IS TO SUCCEED. IN DETAIL, THEY ARE:*

*TO IDENTIFY THE SYMPTOMS WHICH ARE CAUSING, OR WILL CAUSE, DISSATISFACTION,*

*TO DIAGNOSE THE POSSIBLE CAUSES OF THESE SYMPTOMS (DEFINING THE PROBLEMS),*

*TO IDENTIFY POTENTIAL REMEDIES (LISTING ALTERNATIVES),*

*TO ANALYZE AND COMPARE THOSE OPTIONS IN ORDER TO DETERMINE THOSE WHICH SHOULD BE ADOPTED (EVALUATING ALTERNATIVES),*

*TO ADOPT SOLUTIONS (DECISION MAKING), AND*

*TO IMPLEMENT SOLUTIONS (ACTION).*

# THE PROBLEM SOLVING APPROACH (3)

## *GENERAL PRINCIPLES*

*IT WOULD BE IMPOSSIBLE, AND UNDESIRABLE IF IT WERE POSSIBLE, TO PROVIDE A SET OF RECIPES FOR INSTITUTIONAL CHANGE IN WATER RESOURCES MANAGEMENT.*

*THE SUBJECT IS TOO COMPLEX TO BE REDUCED TO SUCH A “COOKBOOK” APPROACH.*

*FURTHERMORE, INSTITUTIONAL CHANGE IS A PROCESS OF SOCIAL LEARNING WHICH CANNOT BE IMPOSED FROM OUTSIDE OR FROM ABOVE.*

*EACH SITUATION IS IN SOME RESPECTS UNIQUE, AND EACH DEMANDS A SITUATION-SPECIFIC APPROACH.*

*CERTAIN BROAD PRINCIPLES DO APPLY, HOWEVER:*

*1. WATER RESOURCE MANAGEMENT IS FUNDAMENTALLY A MATTER OF FINDING AND IMPLEMENTING CHANGES IN THE “RULES OF THE GAME”; THE RULES WHICH GOVERN HOW PEOPLE USE WATER AND HOW THEY INTERACT WITH EACH OTHER AND THE NATURAL ENVIRONMENT .*

*SOME, BUT NOT ALL, OF THOSE RULES HAVE TO DO WITH THE CREATION AND OPERATION OF INFRASTRUCTURE, SUCH AS DAMS AND WATER TREATMENT FACILITIES.*

*OTHERS OF THEM HAVE TO DO WITH PRICING, PROPERTY RIGHTS, AND*

# THE PROBLEM SOLVING APPROACH (4)

## ***GENERAL PRINCIPLES***

*2. RULES OF THESE KINDS EXIST TO HELP PEOPLE MAKE THE BEST POSSIBLE USE OF AVAILABLE WATER RESOURCES.*

*THEREFORE, THE KINDS OF RULE CHANGES WILL DEPEND UPON THE NATURE OF THE WATER RESOURCE, THE CHARACTERISTICS OF POSSIBLE USES OF IT, AND THE POTENTIAL IMPACTS OF SUCH USES UPON HUMANS AND THEIR ENVIRONMENT.*

*INSTITUTIONS SHOULD BE DESIGNED AS CAREFULLY AND AS OBJECTIVELY AS ARE ENGINEERING WORKS, FOR THEY HAVE LITTLE CHANCE OF SUCCEEDING IF THEY ARE NOT RESPONSIVE TO, AND DERIVED IN PART FROM, THE WATER USE SITUATION WHICH THEY ARE TO INFLUENCE.*

*3. THE WATER RESOURCE MANAGEMENT PROCESS, THEN, MUST BEGIN WITH AN ADEQUATE UNDERSTANDING OF THE ENTIRE SITUATION AT THE WATER USE LEVEL.*

*THIS SHOULD INVOLVE BUILDING INTEGRATED MODELS OF THE HYDROLOGY, ECONOMICS, AND OTHER ASPECTS OF THE WATER USE SITUATION.*

# THE PROBLEM SOLVING APPROACH (5)

## *GENERAL PRINCIPLES*

*4. A KEY PART OF SUCH AN INTEGRATED MODEL IS THE INCLUSION OF, AND EMPHASIS UPON, THE RULES BY WHICH THE BEHAVIORS OF RESOURCES, FACILITIES, AND WATER USERS ARE SHAPED.*

*THE USE OF ECONOMIC MODELS HAS BECOME COMMON, AS THE RELIANCE ON FORECASTS OF PROJECTED WATER NEEDS OR REQUIREMENTS (POINT ESTIMATES) HAS GIVEN WAY TO MORE USEFUL PROJECTIONS OF WATER DEMANDS AS A FUNCTION OF PRICES, FOR EXAMPLE.*

*RARELY, HOWEVER, IS AN EXPLICIT INSTITUTIONAL MODEL INCLUDED IN AN INTEGRATED WATER RESOURCES MANAGEMENT MODEL.*

*SUCH INTEGRATION IS ESSENTIAL FOR ADEQUATE EVALUATION OF INSTITUTIONAL ISSUES.*

# THE PROBLEM SOLVING APPROACH (6)

## *GENERAL PRINCIPLES*

*5. EXISTING WATER RESOURCE MANAGEMENT RULES SHOULD FIRST BE EVALUATED BY USING THE INTEGRATED MODEL TO PROJECT POSSIBLE OUTCOMES UNDER A RANGE OF SCENARIOS WHICH SPECIFY PLAUSIBLE VALUES OF KEY UNCONTROLLABLE EXPLANATORY VARIABLES, SUCH AS WEATHER, INTERNATIONAL MARKETS, AND POPULATION.*

*AS ONE EXAMPLE, SEPARATE AND UNCOORDINATED INSTITUTIONS GOVERNING WATER QUANTITY AND QUALITY MAY CAUSE PROBLEMS IF MODEL RUNS SHOW WATER QUANTITY AND QUALITY TO BE INTERRELATED, AS IS USUALLY THE CASE.*

*AND, SENSITIVITY ANALYSES CAN INDICATE THE IMPORTANCE OF VARIOUS KINDS OF MISSING INFORMATION, THEREBY DIRECTING FUTURE MONITORING AND OTHER DATA COLLECTION EFFORTS, AND AVOIDING LARGE EXPENDITURES DEVOTED TO COLLECTING NON-ESSENTIAL DATA.*

# THE PROBLEM SOLVING APPROACH (7)

## *GENERAL PRINCIPLES*

*6. ALTERNATIVE INSTITUTIONS, OR RULE SETS, SHOULD THEN BE EVALUATED IN THE SAME WAY AS ARE PHYSICAL ALTERNATIVES, BY PROJECTING THE OUTCOMES OF THEIR IMPLEMENTATION UNDER A RANGE OF PLAUSIBLE SCENARIOS.*

*IT MAY NOT MAKE SUCH CHOICES EASY, HOWEVER, AS WHEN AN EVALUATION OF FREE WATER MARKETING DISCLOSES IMPRESSIVE GAINS IN WATER USE EFFICIENCY, INCREASED ENVIRONMENTAL DEGRADATION, AND INCREASED CONCENTRATION OF INCOME AND WEALTH*

*THE IMPORTANT POINT HERE IS THAT PRESCRIPTIONS FOR CHANGES IN INSTITUTIONS SHOULD BE JUST AS SITUATION-SPECIFIC AS ARE PRESCRIPTIONS FOR CONTROLLING WATER FLOWS.*

*ONE-SIZE-FITS-ALL PRESCRIPTIONS ARE UNLIKELY TO SUCCEED.*

# THE PROBLEM SOLVING APPROACH (8)

## *GENERAL PRINCIPLES*

*7. NOT ALL WATER USE PROBLEMS CAN BE SOLVED AT THE NEXT HIGHER (WATER MANAGEMENT) LEVEL.*

*WATER MANAGEMENT RULES THEMSELVES MAY BE INADEQUATE FOR SOLVING ALL WATER USE PROBLEMS.*

*IN SUCH CASES IT IS USUAL FOR DISSATISFIED STAKEHOLDERS TO CARRY THE UNRESOLVED ISSUE TO A HIGHER LEVEL, SUCH AS TO A COURT OR LEGISLATURE.*

# THE PROBLEM SOLVING APPROACH (9)

## *GENERAL PRINCIPLES*

*8. MANY WATER RESOURCE CONFLICTS ARE ESPECIALLY DIFFICULT TO RESOLVE BECAUSE THE FUGITIVE NATURE OF THE RESOURCE ITSELF MAKES THEM ASYMMETRIC.*

*UPSTREAM WATER USERS CAN AND DO IMPOSE COSTS UPON THOSE DOWNSTREAM.*

*THEY HAVE LITTLE INCENTIVE TO REDUCE THOSE EXTERNAL COSTS BECAUSE ALL OF THE BENEFITS OF DOING SO ACCRUE TO THOSE DOWNSTREAM.*

*UPSTREAM PARTIES ARE UNLIKELY TO BARGAIN OVER RULE CHANGES WHICH WOULD BENEFIT THOSE DOWNSTREAM, AND THUS THE STAGE IS SET FOR MOVING SUCH ISSUES TO HIGHER LEVELS, AND OUT OF THE WATER MANAGEMENT BARGAINING ARENA.*

# WATER USE PROBLEMS (1)

*THE PROBLEMS WHICH INTERRELATIONSHIPS AMONG WATER USES AND USERS SPAWN, AND WHICH ARE EXACERBATED BY INCREASING DEMANDS OF ALL TYPES, MAY BE CATEGORIZED AS*

EXTERNALITY,

OPEN ACCESS,

SCARCITY, AND

PUBLIC GOODS PROBLEMS.

*OTHER TYPES MAY ALSO EXIST, BUT THESE FOUR ARE COMMON AND WILL SERVE TO ILLUSTRATE THE ANALYTICAL APPROACH.*

## WATER USE PROBLEMS (2)

### **EXTERNALITY PROBLEMS**

*AN **EXTERNALITY**, WHETHER COST OR BENEFIT, IS SAID TO EXIST WHEN THE ACTIONS OF ONE PARTY AFFECT THE WELL-BEING OF A SECOND PARTY, AND THE FIRST PARTY CANNOT ITSELF GAIN BY CONSIDERING THIS EFFECT AND MODIFYING ITS BEHAVIOR ACCORDINGLY.*

*A CLASSIC EXAMPLE OF AN **EXTERNAL COST**, USUALLY REFERRED TO SIMPLY AS AN **EXTERNALITY**, IS THAT OF THE UPSTREAM PAPER MILL WHICH DISCHARGES WASTES INTO A RIVER, THEREBY REDUCING DOWNSTREAM FISH POPULATIONS UPON WHICH OTHERS DEPEND.*

*AN EXTERNALITY IS THUS A PURELY ASYMMETRIC SITUATION.*

*THERE IS NOTHING WHICH THE BEARER OF THE EXTERNALITY CAN DO DIRECTLY TO LESSEN THE IMPACT.*

## WATER USE PROBLEMS (3)

### *OPEN ACCESS PROBLEMS*

*AN **OPEN ACCESS PROBLEM** IS SAID TO EXIST WHEN ACCESS TO THE USE OF A RESOURCE IS OPEN TO ALL, AND WHEN THE RATE OF USE OF THAT RESOURCE AFFECTS THE AMOUNT THAT CAN BE USED.*

*A CLASSIC EXAMPLE OF AN OPEN ACCESS PROBLEM IS THAT OF THE OCEAN FISHERY, IN WHICH EXCESS FISHING EFFORT DRIVES DOWN THE STOCK OF THE RESOURCE, EVENTUALLY REDUCING YIELDS OR, IN THE EXTREME, CAUSING THE EXTINCTION OF THE SPECIES.*

*AN OPEN ACCESS PROBLEM IS A SYMMETRIC ONE, BECAUSE EACH USER CREATES A COST WHICH IS SPREAD OVER ALL USERS, INCLUDING HIMSELF.*

*HOWEVER, THE COST WHICH A SINGLE USER BEARS IS MINOR IN RELATION TO THE TOTAL COST IMPOSED UPON ALL, AND THUS NO USER TAKES INTO ACCOUNT THE FULL IMPLICATIONS OF HIS ACTIONS.*

## **WATER USE PROBLEMS (4)**

### ***PUBLIC GOODS PROBLEMS***

*A PUBLIC GOODS PROBLEM IS SAID TO EXIST WHEN A PARTICULAR GOOD MUST BE PROVIDED TO ALL IN EQUAL AMOUNTS.*

*NO ONE CAN BE EXCLUDED FROM CONSUMING IT, AND THE COST OF PROVIDING IT TO ONE IS AS GREAT AS THE COST OF PROVIDING IT TO ALL.*

*NATIONAL DEFENSE IS THE CLASSIC EXAMPLE OF A PUBLIC GOOD, BUT ENDANGERED SPECIES PROVIDE ANOTHER.*

*THE PROBLEM, IN THIS CASE, IS THAT PUBLIC GOODS ARE LIKELY TO BE UNDERSUPPLIED BECAUSE NO ONE WILL UNDERTAKE TO PRODUCE THEM, SINCE THEY CANNOT BE WITHHELD FROM OTHERS, THUS CANNOT BE SOLD TO MAKE PROFIT.*

*PUBLIC GOODS THUS MUST ALWAYS PROVIDED BY GOVERNMENT, BUT IN THIS CASE IT IS IMPOSSIBLE TO DETERMINE HOW MUCH SHOULD BE PRODUCED BECAUSE NO ONE MUST PAY, AND THUS DISCLOSE WHAT THE GOOD IS WORTH TO HIM.*

# WATER USE PROBLEMS (5)

## *SCARCITY PROBLEMS*

*A SCARCITY PROBLEM MAY BE SAID TO EXIST WHEN THE USERS DESIRE MORE OF A GOOD THAN THE QUANTITY AVAILABLE.*

*VIRTUALLY ALL RESOURCES ARE SCARCE IN SOME SENSE, AND THOSE THINGS WHICH ARE NOT SCARCE ARE OFTEN NOT CONSIDERED TO BE RESOURCES.*

*ECONOMIC MARKETS HANDLE SCARCITY BY ALLOWING COMPETITION, IN WHICH THOSE WITH THE MOST PURCHASING POWER, AND TO WHOM THE RESOURCE IS MOST VALUABLE, WILL BID IT AWAY FROM OTHERS.*

*BUT SCARCITY IS ALSO COMMONLY DEALT WITH BY NON-MARKET INSTITUTIONS, A FREQUENT SITUATION IN THE WATER RESOURCES FIELD.*

# **MEANS FOR ACHIEVING WATER RESOURCE MANAGEMENT GOALS AND OBJECTIVES (1)**

*THE WATER RESOURCE MANAGEMENT LITERATURE CONTAINS FREQUENT REFERENCES TO SUCH MEASURES AS*

***PRIVATIZATION,  
DECENTRALIZATION,  
WATER MARKETING,  
PUBLIC PARTICIPATION,  
IMPROVING HUMAN CAPITAL,  
INSTITUTIONAL INNOVATION,  
RIVER BASIN MANAGEMENT,  
FULL COST RECOVERY,  
DEMAND MANAGEMENT, AND  
INTEGRATED WATER AND ENVIRONMENTAL (OR LAND AND WATER)  
MANAGEMENT***

*AS MEANS FOR IMPROVING WATER RESOURCE MANAGEMENT.*

*ALL OF THESE MEANS ARE APPROPRIATE, IN SOME FORMS AND IN SOME SITUATIONS.*

*ALL CAN BE INAPPROPRIATE AS WELL.*

*WHAT IS NEEDED IS THE ABILITY TO DESCRIBE AND PRESCRIBE MORE CLEARLY THAN THESE VERY GENERAL TERMS PERMIT.*

# MEANS FOR ACHIEVING WATER RESOURCE MANAGEMENT GOALS AND OBJECTIVES (2)

*THE USE OF AN ANALYTICAL FRAMEWORK AS THAT PRESENTED IS ONE WAY OF ACHIEVING THE REQUISITE CLARITY.*

## ***EXAMPLE: PRIVATIZATION***

*IT CAN BE CHARACTERIZED AS THE ADOPTION OF POSITION AND AUTHORITY RULES WHICH STIPULATE THAT NON-GOVERNMENTAL ACTORS MAY ASSUME THE ROLES OF OWNERS AND MANAGERS OF CERTAIN RESOURCES.*

*BUT TO BEGIN DOWN THIS PATH RAISES IMMEDIATELY SUCH QUESTIONS AS SCOPE (WHAT IS THE RANGE OF OWNERSHIP RIGHTS CREATED?),*

*ENTRY AND EXIT (HOW ARE PRIVATE RIGHTS ASSIGNED, AND HOW MAY THEY BE TRANSFERRED?),*

*INFORMATION (HOW ARE PRIVATE ACTIONS MONITORED, AND BY WHOM?),*

*DECISION MAKING (HOW DO THE MULTIPLE DECISIONS OF MULTIPLE PRIVATE OWNERS INTERACT TO BECOME COLLECTIVE ACTIONS?),*

*BENEFITS AND COSTS (HOW ARE THE BENEFITS, ESPECIALLY MONOPOLISTIC RENTS, DISTRIBUTED?), AND...*

# MEANS FOR ACHIEVING WATER RESOURCE MANAGEMENT GOALS AND OBJECTIVES (3)

*AT WHAT LEVEL IS PRIVATIZATION OCCURRING?*

*(WATER USE, WHICH IS ALREADY LARGELY PRIVATE IN MANY SITUATIONS, WATER RESOURCE MANAGEMENT, THROUGH CREATION OF MARKET INSTITUTIONS, OR WATER POLICY AND LAW, SUCH AS THE NATIONALIZATION OF WATER RESOURCES AND FACILITIES?).*

*THE USE OF A SYSTEMATIC ANALYTICAL FRAMEWORK IMPROVES THE CLARITY OF DISCUSSION AND HELPS TO ASSURE CONSIDERATION OF ALL RELEVANT ASPECTS OF THE SITUATION.*

*A DEFINITIVE ANALYSIS REQUIRES NOT ONLY THIS ANALYTICAL FRAMEWORK BUT ALSO THE APPLICATION WITHIN IT OF MODELS OF ALL OF THE IMPORTANT SUB-SYSTEMS INVOLVED.*

# IMPROVING WATER RESOURCE MANAGEMENT IN LATIN AMERICA AND THE CARIBBEAN COUNTRIES (LAC)

*AMONG THE PROBLEMS IDENTIFIED FOR WATER RESOURCES MANAGEMENT IN LAC THERE ARE FOUR AT THE WATER USE LEVEL:*

- 1) CONTAMINATED SURFACE AND GROUND WATER SUPPLIES DUE TO POORLY CONTROLLED POLLUTION,*
- 2) SHORTAGE OF POTABLE WATER SUPPLIES,*
- 3) SALTWATER INTRUSION AND/OR EXCESSIVE PUMPING COSTS DUE TO AQUIFER MINING, AND*
- 4) EXCESSIVE URBAN FLOOD DAMAGES*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (1)**

## ***WATER POLLUTION (EXTERNALITY PROBLEMS)***

*THE MOST COMMON WATER RESOURCE-RELATED EXTERNALITY IN LATIN AMERICA AND THE CARIBBEAN IS THE ADVERSE EFFECT ON THE QUALITY OF WATER SUPPLIES OF DOWNSTREAM USERS RESULTING FROM THE UNTREATED DISCHARGES OF UPSTREAM PARTIES.*

*THIS IS AN EXAMPLE OF AN EXTERNALITY PROBLEM, IN WHICH THE EFFECTS OF ACTIONS BY SOME PARTIES ARE FELT, USUALLY AS COSTS, BY OTHER PARTIES, BUT AT NO COST TO THE INSTIGATING PARTY.*

*SUCH EXTERNALITIES ARE ASYMMETRIC, IN THE SENSE THAT THE UPSTREAM PARTIES AFFECT THE WELL-BEING OF DOWNSTREAM PARTIES, BUT NOT VICE VERSA.*

*ABSENT INSTITUTIONAL CHANGE, THERE IS USUALLY LITTLE OR NO INCENTIVE FOR POLLUTERS TO ABATE THEIR POLLUTION AND IMPROVE THE WELL-BEING OF EXTERNALITY BEARERS, EVEN WHEN THE BENEFITS OF SUCH POLLUTION ABATEMENT MAY FAR EXCEED THEIR COSTS.*

*ASYMMETRIC EXTERNALITY PROBLEMS MAY BE RESOLVED THROUGH THREE GENERAL KINDS OF INSTITUTIONAL CHANGES:*

*TO ADOPT AND IMPLEMENT REGULATIONS (DISCHARGE STANDARDS WHICH LIMIT THE RIGHTS OF POLLUTERS WHILE REDUCING THE LIABILITIES OF OTHERS)*

*TO CREATE INCENTIVES, SUCH AS EFFLUENT FEES OR TAXES, WHICH DISCOURAGE UNDESIRABLE ACTIVITIES BY MAKING THEM COSTLY, AND WHICH ENCOURAGE POLLUTERS IN THIS CASE TO FIND INEXPENSIVE WAYS OF ABATING POLLUTION.*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (2)**

## ***WATER POLLUTION (EXTERNALITY PROBLEMS)***

*TO CHANGE THE STRUCTURE OF PROPERTY RIGHTS, MAKING THE USE OF WATER FOR WASTE DISPOSAL A MARKETABLE RIGHT, WHICH MAY BE ASSIGNED INITIALLY TO EITHER UPSTREAM OR DOWNSTREAM PARTIES, BUT WHICH THEN PERMITS THE PARTIES WHICH VALUE THOSE RIGHTS MOST HIGHLY, WHETHER POLLUTERS OR SUFFERERS, TO PURCHASE THEM.*

*POLLUTERS CAN PURCHASE RIGHTS TO POLLUTE, IF THE ECONOMIC GAINS OF DOING SO OUTWEIGH THE BENEFITS OF CLEAN WATER.*

*ALTERNATIVELY, THOSE WHO VALUE CLEAN WATER CAN PURCHASE THE RIGHT TO IT, IF ITS VALUE OUTWEIGHS THE VALUE OF THE WATER BODY FOR WASTE DISPOSAL PURPOSES.*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (3)**

## ***WATER POLLUTION (EXTERNALITY PROBLEMS)***

*IMPLEMENTING ANY OF THREE MENTIONED APPROACHES REQUIRES ADJUSTMENTS IN MOST OF THE SEVEN KINDS OF RULES IDENTIFIED BEFORE:*

*IT IS NOT ENOUGH TO ADOPT A REGULATION AND THEN ASSUME THAT IT WILL BE FOLLOWED. MONITORING (INFORMATION RULES) AND ENFORCEMENT (AUTHORITY RULES) WILL BE REQUIRED AS WELL.*

*IN MOST COUNTRIES, REGULATION IS THE MOST COMMON OF THE THREE APPROACHES FOR DEALING WITH WATER POLLUTION, BUT INADEQUACIES IN MONITORING AND ENFORCEMENT AND A LACK OF INFORMATION ON POLLUTERS AND STREAM WATER QUALITY IMPEDE EFFORTS TO SOLVE THE PROBLEM.*

*SIMILARLY, IT IS NOT ENOUGH TO LEVY POLLUTION TAXES (PAYOFF RULES). MONITORING, COLLECTION, AND ENFORCEMENT WILL BE REQUIRED.*

*IT IS NOT ENOUGH TO CREATE A STRUCTURE OF PROPERTY RIGHTS (AUTHORITY RULES). AGAIN, MONITORING AND ENFORCEMENT WILL BE NECESSARY TO MAKE THEM MEANINGFUL .*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (4)**

## ***WATER POLLUTION (EXTERNALITY PROBLEMS)***

*WATER RESOURCE MANAGEMENT ORGANIZATIONS AT THE RIVER BASIN OR OTHER SUB-NATIONAL LEVEL IN MOST LAC COUNTRIES POSSESS LIMITED POWERS TO EFFECT RULE CHANGES WHICH ARE APPROPRIATE TO ADDRESSING EXTERNALITY PROBLEMS.*

*THEY MAY ADOPT AND ENFORCE DISCHARGE STANDARDS, BUT ONLY IF NATIONAL LEGISLATION PERMITS THEM TO DO SO.*

*IN SOME COUNTRIES THERE IS NO LEGISLATION WHICH PROVIDES FOR WATER POLLUTION CONTROL REGULATIONS AT ANY LEVEL, WHILE IN SOME OTHER COUNTRIES SUCH LEGISLATION EXISTS BUT IT DOES NOT ALLOW THE DELEGATION OF STANDARD SETTING, MONITORING, AND ENFORCEMENT TO SUB-NATIONAL LEVELS.*

*THE LACK OF ANY WATER QUALITY CONTROL LEGISLATION MUST BE ADDRESSED AT THE NATIONAL LEVEL, THROUGH CHANGES IN NATIONAL WATER POLICIES AND LAWS BEFORE ANYTHING CAN BE ACCOMPLISHED AT THE REGIONAL OR RIVER BASIN LEVEL.*

*WATER QUALITY CONTROL LEGISLATION WHICH PROVIDES UNIFORM NATIONAL WATER QUALITY STANDARDS IS FREQUENTLY TOO INFLEXIBLE TO ALLOW THE ADOPTION OF STANDARDS WHICH ARE APPROPRIATE TO SITE-SPECIFIC CONDITIONS.*

*SOMETIMES SUCH INFLEXIBILITY IS DESIRABLE, SUCH AS FOR ENSURING SAFE DRINKING WATER SUPPLIES OR KEEPING HIGHLY TOXIC COMPOUNDS OUT OF ALL WATER BODIES.*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (5)**

*WATER POLLUTION (EXTERNALITY PROBLEMS)*

*AT OTHER TIMES THE INFLEXIBILITY IS UNDESIRABLE, AS WHEN FISHERY-BASED STANDARDS ARE IMPOSED UPON WATER BODIES WHICH DO NOT AND CANNOT SUPPORT FISH POPULATIONS (EPHEMERAL STREAMS, FOR EXAMPLE).*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (6)**

## ***OVEREXPLOITATION OF GROUND WATER SUPPLIES (OPEN ACCESS PROBLEM)***

*GROUND WATER IS AN EXAMPLE OF AN OPEN ACCESS RESOURCE, IN WHICH THE “RACE TO THE BOTTOM OF THE AQUIFER” OFTEN CAUSES PROBLEMS OF SALT WATER INTRUSION AND/OR WATER LEVEL DECLINE WHICH RENDERS REMAINING SUPPLIES USELESS IN THE FIRST INSTANCE OR MORE EXPENSIVE IN THE SECOND.*

*OVEREXPLOITATION OF GROUND WATER SUPPLIES, OFTEN RESULTING IN MINING OF THE AQUIFER, IS A COMMON PROBLEM IN MANY LAC COUNTRIES.*

*OPEN ACCESS PROBLEMS ARE SAID TO EXIST WHEN MULTIPLE USERS RELY ON A RESOURCE, AND NONE CAN BE EXCLUDED FROM ITS USE.*

*FURTHERMORE, THE CHARACTER OF THE RESOURCE IS SUCH THAT THE FLOW OF GOODS OR SERVICES WHICH IT YIELDS CAN BE DIMINISHED BY OVERUSE, SOMETIMES TO THE POINT OF EXHAUSTION, BUT MORE OFTEN ONLY TO AN UNECONOMICALLY LOW LEVEL.*

*YET EACH USER CONTINUES TO PURSUE HIS OWN PATTERN OF EXPLOITATION SO LONG AS HIS OUT-OF-POCKET COSTS DO NOT EXCEED HIS SHORT RUN BENEFITS.*

*NOT TO DO SO IS NOT TO SAVE THE RESOURCE, BUT ONLY TO GIVE UP BENEFITS TO OTHERS, FOR OTHERS WILL DEplete IT ANYWAY.*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (7)**

## ***OVEREXPLOITATION OF GROUND WATER SUPPLIES (OPEN ACCESS PROBLEM)***

*OPEN ACCESS PROBLEMS CANNOT BE RESOLVED THROUGH THE SAME THREE GENERAL KINDS OF INSTITUTIONAL CHANGES WHICH CAN BE APPLIED TO EXTERNALITY PROBLEMS.*

*THE REGULATORY APPROACH IS SOMETIMES USED TO LIMIT THE RATE OF USE, THE LEVEL OF EFFORT, OR THE TECHNOLOGY EMPLOYED BY RESOURCE USERS.*

*NONE OF THESE WORK, HOWEVER, BECAUSE THE NUMBER OF USERS IS NOT CONSTRAINED.*

*THE RESULT IS ONLY MORE NUMEROUS, SMALLER (AND LESS EFFICIENT) USERS.*

*THE INCENTIVES APPROACH HAS ALSO BEEN TRIED, BUT IF THE RESOURCE IS TRULY OPEN ACCESS, THEN USER FEES CANNOT BE IMPOSED EFFECTIVELY BECAUSE THEY CANNOT BE MADE A CONDITION OF ACCESS.*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (8)**

## ***OVEREXPLOITATION OF GROUND WATER SUPPLIES (OPEN ACCESS PROBLEM)***

***RESTRUCTURING PROPERTY RIGHTS OFFERS THE ONLY SOLUTION TO THE OPEN ACCESS PROBLEM.***

***PROPERTY RIGHTS TO AN OPEN ACCESS RESOURCE MAY BE RESTRUCTURED IN SEVERAL WAYS:***

- 1. TO INSTITUTE GOVERNMENT OWNERSHIP OF THE RESOURCE, WITH ACCESS THEN RESTRICTED TO THOSE WHO ARE SO PERMITTED BY THE GOVERNMENT (OCEAN FISHERIES ARE AN UNOWNED AND THUS OPEN ACCESS RESOURCE, BUT THE FISHERIES WITHIN THE CONTINENTAL LIMITS OF NATIONS ARE “OWNED” BY THOSE NATIONS).***
- 2. PRIVATIZATION. THE ASSIGNMENT OF OWNERSHIP RIGHTS, HENCE CONTROL, TO A SINGLE PRIVATE OWNER.***
- 3. TO ASSIGN OWNERSHIP RIGHTS TO A DEFINED USER GROUP, SUCH AS A COOPERATIVE OR ASSOCIATION.***

***ALL THREE PROPERTY RIGHTS APPROACHES ACHIEVE THE ESSENTIAL CONDITION OF RESTRICTED ACCESS, SO THAT OVEREXPLOITATION AND ATTENDANT RENT DISSIPATION CAN BE AVOIDED, AT LEAST IN PRINCIPLE.***

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (9)**

## ***OVEREXPLOITATION OF GROUND WATER SUPPLIES (OPEN ACCESS PROBLEM)***

*EACH APPROACH HAS OTHER DRAWBACKS, HOWEVER:*

*GOVERNMENT OWNERSHIP BRINGS THE USUAL DIFFICULTIES OF BUREAUCRATIC INEFFICIENCY AND POSSIBLE UNRESPONSIVENESS TO PUBLIC DESIRES.*

*PRIVATIZATION BRINGS THE USUAL DIFFICULTIES OF MONOPOLY CONTROL, INEFFICIENCY, AND INEQUITY.*

*COMMON PROPERTY OR COLLECTIVE OWNERSHIP BRINGS PROBLEMS OF MONITORING AND ENFORCEMENT IN ORDER TO MINIMIZE FREE RIDER PROBLEMS (EACH USER MUST BE ASSURED THAT ALL OTHER USERS WILL OBSERVE LIMITATIONS OR HE WILL NOT DO SO EITHER).*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (10)**

## ***URBAN FLOOD DAMAGES (PUBLIC GOODS PROBLEM)***

*URBAN FLOODING IS A COMMON PROBLEM IN MANY LAC COUNTRIES, AND MANY BELIEVE THAT THE DAMAGES CAUSED BY SUCH FLOODING CONSIDERABLY EXCEED THE COSTS OF AVOIDING AT LEAST PART OF THEM THROUGH MORE EFFECTIVE FLOOD CONTROL MEASURES.*

*SUCH MEASURES CAN BE:*

*STRUCTURAL (STORM DRAINAGE, DAMS, LEVEES, AND CHANNELIZATION)*

*NON-STRUCTURAL (FLOOD PLAIN ZONING AND FLOOD INSURANCE)*

*URBAN FLOOD CONTROL HAS MANY **PUBLIC GOOD** CHARACTERISTICS, AND SO IT IS OFTEN UNDERPROVIDED.*

*THE PROBLEM IS THAT OF DETERMINING HOW MUCH OF A PUBLIC GOOD TO PRODUCE SINCE THERE IS NO DIRECT EVIDENCE OF THE VALUE OF SUCH GOODS, I.E., HOW MUCH FLOOD PROTECTION TO PROVIDE OR HOW MUCH MAINTENANCE TO PERFORM ON EXISTING FLOOD CONTROL STRUCTURES IF THE VALUE OF THE FLOOD PROTECTION IS UNCERTAIN.*

*CONSEQUENTLY, PUBLIC GOODS OFTEN TEND TO BE UNDERPROVIDED, ALTHOUGH THEY MAY ALSO BE OVERPROVIDED.*

*IN EITHER CASE, DETERMINING HOW MUCH TO PROVIDE IS LIKELY TO BE A HIGHLY CONTESTABLE POLITICAL DECISION.*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (11)**

## ***URBAN FLOOD DAMAGES (PUBLIC GOODS PROBLEM)***

*BECAUSE THEY ARE INCAPABLE OF GENERATING REVENUE, PUBLIC GOODS WILL BE PRODUCED PRIMARILY BY THE GOVERNMENT*

*PRIVATE PROFIT-MAKING ORGANIZATIONS FIND NO REASON TO PRODUCE THEM.*

*EVEN PRIVATE NOT-FOR-PROFIT ENTITIES MAY BE RELUCTANT TO PRODUCE PUBLIC GOODS BECAUSE THEY CAN BE ENJOYED BY ALL, AND NOT JUST BY THOSE WHO PAY FOR THEM.*

*THE REGULATORY AND INCENTIVES APPROACHES ARE INAPPLICABLE IN THE CASE OF A PUBLIC GOOD.*

*ONLY THE PROPERTY RIGHTS APPROACH IS USEFUL FOR CONTROLLING THE OUTPUT OF A PUBLIC GOOD, AND THE PROPERTY RIGHT MUST BE A COLLECTIVE OR GOVERNMENTAL ONE.*

*THE PROBLEM THEN BECOMES ONE OF INFORMATION RULES; HOW TO ASCERTAIN THE VALUE OF THE PUBLIC GOOD IN ORDER TO DETERMINE HOW MUCH OF IT TO PRODUCE.*

*FLOOD DAMAGE ESTIMATES, WHICH RELY UPON MARKET PRICES OF THAT WHICH IS DAMAGED, SHOULD BE USED WHEREVER APPLICABLE.*

*BUT MANY PUBLIC GOODS, SUCH AS THE EXISTENCE VALUE OF ENDANGERED SPECIES WHOSE HABITAT MAY BE THREATENED BY FLOOD WATERS, ARE NOT BOUGHT AND SOLD, AND THUS HAVE NO MARKET VALUES.*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (13)**

*INADEQUATE SUPPLIES OF POTABLE WATER (SCARCITY PROBLEM)*

*THERE ARE TWO CONTRASTING WAYS OF DEALING WITH SCARCITY PROBLEMS:*

*SUPPLY AUGMENTATION (OR WATER RESOURCES DEVELOPMENT)*

*DEMAND MANAGEMENT, WHICH HAS BEEN APPLIED MUCH LESS FREQUENTLY,  
EXCEPT IN PERIODS OF DROUGHT OR OTHER INSTANCES OF TEMPORARILY  
INCREASED SCARCITY.*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (14)**

## ***INADEQUATE SUPPLIES OF POTABLE WATER (SCARCITY PROBLEM)***

*SUPPLY AUGMENTATION IS STRUCTURALLY ORIENTED AND OFTEN TAKES THE FORM OF SURFACE WATER STORAGE AND SUBSEQUENT DELIVERY, ALTHOUGH DIVERSION AND TRANSPORT IS COMMON AS WELL.*

*EVEN MORE COMMON IN LESS DEVELOPED COUNTRIES IS DRILLING ADDITIONAL WELLS TO TAP GROUND WATER SUPPLIES, WHICH IN MANY REGIONS ARE LIKELY TO BE OF HIGHER QUALITY THAN SURFACE WATER.*

***DEMAND MANAGEMENT CAN BE ACCOMPLISHED THROUGH A VARIETY OF METHODS:***

*MANY THINK FIRST OF THE REGULATORY APPROACH, WHICH EMBODIES WATER RATIONING OR SIMILAR ENFORCED QUOTAS.*

*HOWEVER, THE INCENTIVES METHOD, EMBODYING WATER PRICING, IS OFTEN PREFERABLE BECAUSE IT IS LESS HEAVY-HANDED AND BECAUSE IT HAS FAVORABLE REVENUE IMPLICATIONS.*

*THE REGULATORY APPROACH IS BETTER SUITED TO SHORT EMERGENCY SITUATIONS, AND IT IS MORE EASILY ACCEPTED BY THE PUBLIC IN SUCH SITUATIONS.*

*PRICING IS THE SUPERIOR LONG TERM METHOD, PROVIDED THAT IT DOES NOT RAISE EQUITY AND HARDSHIP DIFFICULTIES FOR LOW INCOME PEOPLE.*

# **SOLVING WATER USE PROBLEMS THROUGH INSTITUTIONAL INNOVATION (15)**

## ***INADEQUATE SUPPLIES OF POTABLE WATER (SCARCITY PROBLEM)***

*THE HEAVY CAPITAL REQUIREMENTS OF MANY WATER SUPPLY TECHNOLOGIES, TOGETHER WITH THE ECONOMIC INEFFICIENCY OF DUPLICATIVE SYSTEMS, CREATES A NATURALLY MONOPOLISTIC SITUATION.*

*UNCONTROLLED PRIVATE MONOPOLIES HAVE BOTH THE MOTIVATION AND THE OPPORTUNITY TO RESTRICT PRODUCTION, RAISE PRICES ABOVE AVERAGE COSTS, AND THUS REAP EXCESSIVE PROFITS.*

*PUBLIC UTILITY REGULATION HAS BEEN THE MEANS MOST OFTEN EMPLOYED TO CONTROL MONOPOLY PRICING.*

*HOWEVER, REGULATORS IN SUCH SITUATIONS TOO OFTEN BECOME VIRTUAL CAPTIVES OF THE REGULATED MONOPOLIES.*

*IF PRIVATE OWNERSHIP TENDS TO UNDULY RESTRICT PROVISION OF GOODS AND SERVICES, PUBLIC OWNERSHIP, BY CONTRAST, IS APT TO BE CHARACTERIZED BY UNDERPRICING AND OVERPRODUCTION.*

*PUBLIC MANAGERS ARE OFTEN GUILTY OF OVERSPENDING UPON EXCESS CAPACITY, BECAUSE THEY HOPE TO AVOID THE POLITICAL CONSEQUENCES OF RAISING TARIFFS AND/OR RATIONING USES WHEN OCCASIONAL SHORTAGES OCCUR.*

# **ADOPTION AND IMPLEMENTATION ISSUES (1)**

*INSTITUTIONAL CHANGE, BY WHICH WE MEAN THE ADOPTION OF NEW WATER USE RULES TO SOLVE PROBLEMS OF THE KINDS JUST DISCUSSED, IS THE RESULT OF ACTIONS TAKEN AT THE WATER RESOURCE MANAGEMENT LEVEL.*

*ORGANIZATIONALLY, SUCH RULE MAKING HAS OCCURRED IN LAC COUNTRIES MOSTLY IN CENTRALIZED GOVERNMENT AGENCIES, AND WITH LIMITED PARTICIPATION BY STAKEHOLDERS.*

*REGULATORY APPROACHES HAVE BEEN FAVORED OVER MARKETING AND OTHER INCENTIVE-BASED APPROACHES.*

*INTERNATIONAL AID ORGANIZATIONS AND CONFERENCES HAVE CALLED FOR A SHIFT FROM A DEVELOPMENT PROJECT ORIENTATION FOR ASSISTANCE PROGRAMS TO ONE OF BASIN-WIDE, AND EVEN COUNTRY-WIDE, ANALYSIS AND PLANNING.*

*THE NEED FOR THIS SHIFT CANNOT BE OVERSTATED, BECAUSE IT IS ABSOLUTELY ESSENTIAL TO THE ACHIEVEMENT OF GOOD WATER MANAGEMENT.*

*HOWEVER, IMPLEMENTING THIS SHIFT MUST BE TRANSLATED TO SPECIFIC ACTS AT THE TWO HIGHER ACTION LEVELS OF WATER RESOURCE MANAGEMENT AND WATER POLICY AND LAW.*

## **ADOPTION AND IMPLEMENTATION ISSUES (2)**

*LAC WATER MANAGERS CITED THE PROBLEMS OF:*

*FRAGMENTED AND DIFFUSED WATER RESOURCES MANAGEMENT,*

*INADEQUATE AND POORLY MAINTAINED INFRASTRUCTURE,*

*INSUFFICIENT AND POOR QUALITY DATA,*

*INADEQUATE ENFORCEMENT,*

*INADEQUATE CONSIDERATION OF ENVIRONMENTAL IMPACTS, AND*

*MINIMAL STAKEHOLDER PARTICIPATION*

# **ADOPTION AND IMPLEMENTATION ISSUES (3)**

*THREE IMPORTANT ISSUES SHOULD BE CONSIDERED IN THE EVALUATION OF RULE CHANGES, REGARDLESS OF THE LEVEL AT WHICH THEY OCCUR:*

*EMPHASIS ON INSTITUTIONAL INNOVATION*

*ATTENTION TO SOCIO-CULTURAL CONSIDERATIONS*

*EDUCATION IN MANY DIMENSIONS*

# EMPHASIS ON INSTITUTIONAL INNOVATION (1)

*PRIORITY MUST BE GIVEN TO INSTITUTIONAL ANALYSIS AND CHANGE, OVER BUILDING PHYSICAL INFRASTRUCTURE.*

*MANY OF THE ACTIVITIES INVOLVED IN WATER RESOURCES MANAGEMENT (DEMAND MANAGEMENT, FOR EXAMPLE) HAVE LITTLE TO DO WITH BUILDING PROJECTS.*

*A CONTINUED FOCUS UPON PROJECTS WILL FAIL TO IDENTIFY THE NEEDED INSTITUTIONAL CHANGES WHICH COMPRISE MUCH OF WHAT IS MEANT BY GOOD WATER MANAGEMENT.*

*NEVERTHELESS, THIS SHIFT WILL NOT BE EASY FOR MANY COUNTRIES TO MAKE.*

*CUSTOM, HABIT, ORGANIZATIONAL STRUCTURE, BUREAUCRATIC INERTIA, PROFESSIONAL SPECIALIZATION, AND POLITICAL ADVANTAGE ALL WEIGH IN ON THE SIDE OF BUSINESS AS USUAL.*

*DIFFICULT OR NOT, THIS SHIFT IN FOCUS IS THE FIRST ESSENTIAL STEP FOR IMPROVING WATER RESOURCE MANAGEMENT.*

## **EMPHASIS ON INSTITUTIONAL INNOVATION (2)**

*NOT ONLY DOES MANAGEMENT CONSIST MOSTLY OF INSTITUTIONAL DESIGN AND IMPLEMENTATION, BUT EVEN THE SUCCESSFUL OPERATION OF PROJECTS DEPENDS UPON PUTTING APPROPRIATE INSTITUTIONS IN PLACE.*

*HOWEVER, PROFESSIONAL WATER RESOURCES STAFFS ARE FREQUENTLY CONSTITUTED BY ENGINEERING PERSONNEL WITH LITTLE TRAINING OR FAMILIARITY WITH INSTITUTIONAL ANALYSIS AND ACTION.*

*THE MESSAGE THAT WATER RESOURCE MANAGEMENT IS NOW THE ORDER OF THE DAY MUST BE ARTICULATED AT THE HIGHEST ORGANIZATIONAL LEVELS, AND REINFORCED BY ORGANIZATIONAL POLICIES AND OPERATING PROCEDURES.*

*HIRING PRACTICES MUST BE REVAMPED TO ENSURE THAT A PROPER MIX OF DISCIPLINES IS ATTAINED.*

*ALL OF THIS MEANS THAT WATER USE INSTITUTIONS MUST BE INVENTORIED, CHARACTERIZED, AND ANALYZED JUST AS EXPLICITLY, COMPREHENSIVELY, AND CAREFULLY AS ARE HYDROLOGIC AND ECONOMIC CONDITIONS.*

# ATTENTION TO SOCIO - CULTURAL CONSIDERATIONS

*SOME COUNTRIES' LANDSCAPE IS LITTERED WITH WATER RESOURCE DEVELOPMENT PROJECTS WHICH LIE IN STATES VARYING FROM MISUSE TO NON-USE.*

*A MAJOR REASON IS THAT SUCH PROJECTS WERE DESIGNED AND BUILT WITH TECHNICAL EXPERTISE, BUT WITHOUT ALLOWANCE FOR LOCAL CULTURAL CONDITIONS AND TRADITIONS.*

*THE SAME THING CAN OCCUR IF WATER RESOURCE MANAGEMENT INSTITUTIONS ARE NOT CRAFTED WITH THESE CONDITIONS IN MIND.*

*MIGRATORY HERDSMEN CANNOT BE TURNED INTO IRRIGATION FARMERS SIMPLY BY GIVING THEM IRRIGABLE LAND AND IRRIGATION WATER.*

*NEITHER CAN WATER MARKETS BE ESTABLISHED AND FUNCTION IF NOT INTEGRATED WITH LOCAL LAWS, CUSTOMS, AND ECONOMIES.*

*SUCH INTEGRATION MUST BE A CORNERSTONE OF WATER RESOURCE MANAGEMENT ACTIVITIES.*

*A PART OF THE INTEGRATION WHICH IS NEEDED CAN BE ACHIEVED BY EXPANDING THE DISCIPLINARY MIX OF PROFESSIONALS WHO ARE INVOLVED IN WATER RESOURCE MANAGEMENT ACTIVITIES.*

# EDUCATION IN MANY DIMENSIONS (1)

*INSTITUTIONAL CHANGE OF THE KIND WHICH IS NEEDED IS A PROCESS OF SOCIAL LEARNING, NOT JUST A MATTER OF PUTTING NEW RULES IN PLACE.*

*IN FACT, THE NEW RULES TO BE PUT IN PLACE CANNOT BE FOUND IN ANY MANUAL.*

*THEY MUST BE DEVELOPED OVER TIME THROUGH A PROCESS OF ANALYSIS AND EXPERIMENTATION WHICH TAKES FULL COGNIZANCE OF LOCAL CONDITIONS, BE THEY ENVIRONMENTAL, CULTURAL, POLITICAL, OR ECONOMIC.*

*SUCH A PROCESS DEPENDS UPON THE EFFECTIVE INVOLVEMENT OF STAKEHOLDER GROUPS AND OF KNOWLEDGEABLE SPECIALISTS INTERACTING WITH EACH OTHER IN A PROPERLY STRUCTURED SITUATION.*

*THAT SITUATION MUST BE CREATED, AND THE ESSENCE OF DOING SO IS EDUCATION.*

*THE NEED FOR ADDITIONAL SPECIALIST TRAINING IS WIDELY APPRECIATED, BUT ALL PARTICIPANTS MUST LEARN HOW TO INTERACT WITH EACH OTHER PRODUCTIVELY.*

## EDUCATION IN MANY DIMENSIONS (2)

*TOO OFTEN, WATER RESOURCE MANAGEMENT CONFLICTS ARE CHARACTERIZED BY PROTRACTED DISPUTES OVER THE "FACTS" OF THE SITUATION, WITHOUT SUFFICIENT ATTENTION GIVEN TO THE VALUE ASPECTS.*

*THE RESULT IS OFTEN ONE OF STAKEHOLDERS MAKING FACTUAL JUDGEMENTS ABOUT WHICH THEY ARE LESS WELL INFORMED THAN ARE THE SPECIALISTS.*

*AND SPECIALISTS MAKING IMPLICIT VALUE JUDGMENTS WHICH REFLECT ONLY THEIR PROFESSIONAL BIASES, AND NOT THE VALUES OF THE REAL STAKEHOLDERS.*

*BOTH GROUPS MUST BE EDUCATED AS TO THEIR LEGITIMATE AND NECESSARY ROLES, AND HOW TO PARTICIPATE EFFECTIVELY IN THE DECISION MAKING PROCESS.*

# CAPACITY BUILDING (1)

*CAPACITY BUILDING REFERS BOTH TO THE DEVELOPMENT OF HUMAN CAPITAL AND THE STRENGTHENING OF INSTITUTIONS.*

*THE RAMPANT DECENTRALIZATION EFFORTS UNDERWAY THROUGHOUT SEVERAL COUNTRIES HAVE DRAWN ATTENTION TO THE SCARCITY OF WELL-TRAINED, QUALIFIED PERSONNEL.*

*THIS LACK OF HUMAN RESOURCES HAS HAMPERED THE PROGRESS OF MANY DECENTRALIZATION PROGRAMS, WHETHER FOR WATER SUPPLY AND SANITATION OR IRRIGATION INFRASTRUCTURE.*

*THE TRAINING PROGRAMS THAT ACCOMPANY DECENTRALIZATION EFFORTS HAVE BEEN NON-EXISTENT OR HAVE BEEN INSUFFICIENT TO ADEQUATELY PREPARE THOSE WHO ARE TO ASSUME NEW RESPONSIBILITIES.*

*AS MOST COUNTRIES INTEND TO INCREASE STAKEHOLDER PARTICIPATION IN PLANNING AND MANAGEMENT OF WATER PROJECTS, THE IMPORTANCE OF THESE TRAINING PROGRAMS SHOULD NOT BE OVERLOOKED.*

*THESE PROGRAMS SHOULD INCLUDE A COMPONENT THAT ADDRESSES THE FLIGHT OF HUMAN RESOURCES FROM THE REGIONS TO THE CAPITAL AND/OR OVERSEAS.*

## **CAPACITY BUILDING (2)**

*CAPACITY BUILDING PROGRAMS (E.G., TRAINING PROGRAMS, REORGANIZATION, ADMINISTRATIVE IMPROVEMENTS, LEGISLATIVE REFORM) ARE NOW A REQUISITE OF MOST ALL INFRASTRUCTURE OR SECTORAL IMPROVEMENT PROJECTS.*

*INSTITUTIONAL STRENGTHENING OF WATER RESOURCES MANAGEMENT PROGRAMS, HOWEVER, HAVE DIFFERENT STAFFING NEEDS AND EXPERTISE REQUIREMENTS, AND CANNOT BE HELD TO A "CONSTRUCTION" SCHEDULE OF THE INFRASTRUCTURE PROJECT.*

*FURTHERMORE, INSTITUTIONAL STRENGTHENING THROUGH INFRASTRUCTURE PROJECTS MAY PROVIDE A LIMITED PERSPECTIVE AND A LIMITED TIME FRAME FOR IMPLEMENTATION.*

*THEY ALSO TEND TO MISS THE CROSS-SECTORAL COMPONENTS THAT ARE BECOMING INCREASINGLY IMPORTANT FOR MANAGEMENT OF WATER RESOURCES.*

*SHOULD INSTITUTIONAL STRENGTHENING AND CAPACITY BUILDING PROGRAMS BE CONSIDERED INDEPENDENTLY OF THE INFRASTRUCTURE DEVELOPMENT PROJECTS, OR AT LEAST CAN SOME COMPONENTS OF INSTITUTIONAL STRENGTHENING BE IMPLEMENTED INDEPENDENTLY?*

*THE INVESTMENT PROGRAMS AND PROJECTS OFTEN SERVE AS LEVERAGE FOR THE IMPLEMENTATION OF INSTITUTIONAL STRENGTHENING PROGRAMS.*

## **FINAL COMMENTS**

***THE CONCEPTUAL FRAMEWORK WE HAVE RAPIDLY ANALYZED CAN BE A POWERFUL AND INSIGHTFUL TOOL FOR PROBLEM SOLVING AND INSTITUTIONAL INNOVATION.***

***THOUGH, OF COURSE, MORE INFORMATION IS NECESSARY TO PROVIDE A MORE THOROUGH ANALYSIS OF WATER RESOURCES MANAGEMENT IN OUR COUNTRIES, I HOPE THAT THE IDEAS PRESENTED PROVIDES A GLIMPSE OF THE USEFULNESS OF THIS TYPE OF FRAMEWORKS FOR CLASSIFYING PROBLEMS AND IDENTIFYING POTENTIAL SOLUTIONS.***