TOWARD IMPROVED TECHNOLOGY TRANSFER

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ABSTRACT

This paper presents a model and describes two new initiatives for improving technology transfer. The model and the initiatives call for the following paradigm shifts:

1. Be proactive instead of reactive.
2. Improve leadership skills first, then management skills.
3. Organize and execute around a few critical activities that matter the most instead of the many that matter the least.
4. Think win-win, instead of "my way" or "your way."
5. Listen first, speak second.
6. Make 1+1=1,000 instead of 2.
7. Renew resources daily instead of intermittently.

INTRODUCTION

Countries throughout the world are seeking solutions to urgent local and national problems that differ only in their nature, social priority, and end points in time and space. These problems include:

1. Sustainability of economic development,
2. prevention of adverse environmental impact,
3. preservation of fragile ecological systems,
4. conservation of renewable and non-renewable energy resources, and
5. ensuring the safety of the populace at risk from natural and technological hazards.

It is well known that the solutions to these problems require innovative technology transfer. Innovation is needed because a paradigm shift must take place in either the researcher or the end-user, or both before ownership of information, knowledge, experience, and know-how and responsibility for its use can be transferred from researchers to end-users.

A model for improving technology transfer must include seven types of paradigm shifts (i.e., sets of specific changes or actions) that provide a new way of viewing or thinking about the problem. They are:

1. Be proactive instead of reactive.

   Technology (e.g., information, knowledge, experience, and know-how) does not transfer itself; therefore, a deliberate, action-oriented and people-dependent process must be created by either the researchers or the end users or both to enlarge every one's circles of influence. This calls for a shift from the paradigm of reactive thinking, which always becomes a self-fulfilling prophesy, to proactive thinking.

2. Improve leadership skills first, management skills second.

   Leadership comes first. Successful technology transfer requires leadership so that the people involved know not only where they are going but also why and when because they have the same vision, purpose, and direction. Leaders facilitate a paradigm shift from analytical, logical, and verbal skills to intuitive, creative, and visual skills.

3. Organize and execute around a few critical activities that matter the most instead of the many that matter the least.

Leadership, commitment, and resources are the critical elements for transferring technology. After vision, purpose, and direction are set, managers focus on how it will be done by forming strategic coalitions, merging agendas, devising and implementing strategic plans, and forging strong interpersonal relationships. This calls for the difficult, but essential paradigm shift from fragmented individual efforts to integrated collaborative efforts.

4. Think win-win instead of "my way" or "your way."

Technology transfer requires effective people-to-people interactions not only to implement the process but also to ensure that the proposed solutions are beneficial to everyone. This calls for a paradigm shift from an emphasis on "my way" or "your way" to "a better way."

5. Improve credibility by listening first, speaking second.

Technology transfer from researchers to practitioners or policymakers initially requires as much or more listening as speaking. This will ensure credibility because experiences and new ideas will be placed in the context of the other person's needs, concerns, and paradigms. Listening is a major paradigm shift because people typically talk first and listen second.

6. Make 1+1=1,000 instead of 2.

Technology transfer will succeed in a big way (e.g., 1+1=1,000) when strategic coalitions and merged agendas result in a higher level of trust, communication, and cooperation. These attributes will significantly leverage the available resources and the potential benefit of both the researcher's and end-user's circles of influence. This calls for a paradigm shift from independence to interdependence.

7. Renew resources daily, instead of intermittently.

Although technology transfer is a long-term process, the rate of progress depends on how frequently and how effectively researchers and end-users renew physical, emotional, mental, and spiritual assets. Daily renewal provides more unexpected opportunities to learn and contribute to the dynamic process than intermittent renewal. This calls for a paradigm shift from the typical mind set of impossibility (e.g., "it cannot be done") and scarcity (e.g., "we cannot afford it") to one of possibility and sufficiency.

NEW INITIATIVES TO IMPROVE TECHNOLOGY TRANSFER

Two new initiatives, described below, are underway and will test the above model for technology transfer. The first initiative relates to the goal in the United States of community sustainability and resiliency to natural hazards; the second to the goal in the Eastern Mediterranean Region (EMR) of earthquake safety.

THE UNITED STATES AT RISK FROM NATURAL HAZARDS

Every State and Territory of the United States is at risk from one or more natural hazards which often strike communities with little or no warning. To cope with the great sudden loss potential represented individually and collectively by earthquakes, floods, severe storms, landslides, volcanic eruptions, wildfires, droughts, and tsunamis, the United States adopted a national goal in 1994 to take steps to reduce the risk. The goal has four components:

-- Safety Of The Populace,
-- Hazard Resilience of every community,
-- Sustainability Of Economic Development, and
-- Protection Of Fragile Ecosystems And The Environment.

To reach the goal, Federal, State, and local government; universities, professional and volunteer organizations; and the private sector are forming new or expanded coalitions to achieve specific risk management objectives (Figure 1). They include activities performed before, during, and after natural hazards strike, such as:

- -- Monitoring networks consisting of more than 25,000 land, water, and satellite based sensors to locate and characterize geologic and hydrologic hazards in time and space and to warn the public.
- -- maps, data bases, and geographic information systems;
- -- Basic research to determine "where," "how big," "how often," and "how bad;"
- -- Risk assessment (i.e., hazard, exposure, and vulnerability assessments) on national, international, regional, and local scales;
- -- Transfer of technology to end users responsible for reducing risk (i.e., mitigation, preparedness, emergency response, and recovery); and
- -- Post disaster investigations.

ELEMENTS OF RISK

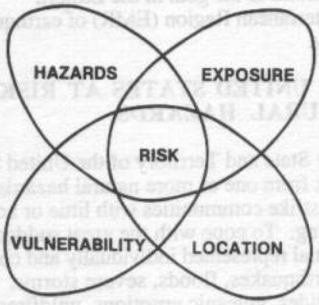

Figure 1.--Elements involved in risk assessment and risk management.

The Nation's existing inventory which needs to be made resilient to natural hazards includes:

- -- Tens of millions of single and multiple family dwellings, including manufactured housing.
- -- More than 5 million miles of roads and highways, railroads, and transit systems.
- -- More than 5 million miles of underground pipelines associated with oil, gas, water, and electrical utilities.
- -- Hundreds of thousands of Federal, State, and private sector buildings.
- -- Hundreds of thousands of schools, colleges, and universities.
- -- Hundreds of thousands of factories and manufacturing facilities.
- -- Hundreds of thousands of small businesses and shopping centers.
- -- Approximately 575,000 bridges.
- -- Tens of thousands of civic centers and places of public assembly.
- -- Tens of thousands of hospitals and health care facilities.
- -- Tens of thousands of monuments, historic buildings, and museums.
- -- Thousands of ports and harbors.
- -- Thousands of conventional power plants.
- -- Thousands of military bases.
- -- Thousands of airports.
- -- Hundreds of dams.
- -- Hundreds of national forests and parks.
- -- Capitols of the 50 States and Territories.
- -- White House and Capitol.

At present, the Nation is winning the battle concerning loss of life, but it is losing the economic battle with natural hazards. Direct losses to buildings and infrastructure have reached $1 billion each week--$52 billion each year.

THE EMR AT RISK FROM EARTHQUAKES

The term, EMR, refers to those countries that are affected by earthquakes caused by tectonic movements along the western margin of the Arabian Plate. They are: Turkey, Cyprus, Lebanon, Syria, Jordan, Israel, Egypt, West Bank, Saudi Arabia, and Yemen. The EMR's seismicity is related to the tectonic forces that opened the Gulf of Aden and the Red Sea, that continue to transport the Arabian Plate northward at the rate of about 0.5 cm/year, and that formed the mountains in Turkey and Iran north of the plate boundary.

Damaging earthquake, tsunamis, and landslides have occurred repeatedly in the EMR throughout history and the geologic record shows clear evidence of seismotectonic deformation over millions of years. The Dead Sea transform, a 1,000 km-long left-lateral strike slip fault system, marks the western boundary of the Arabian plate; whereas, the East and North Anatolian fault zones, the latter a 1,200 km-long, right-lateral strike slip fault zone in Turkey, mark the northern boundary.

In 1993, the EMR countries in cooperation with USGS and UNESCO, adopted a comprehensive seven-point program to reduce earthquake losses. The program encompasses unilateral, bilateral, and multilateral activities such as:

1. Seismotectonic framework studies to improve understanding of the cause and nature of the seismicity.
2. Monitoring.
3. Assessment of earthquake hazards.
4. Assessment of risk.
5. Risk management.
6. Technology transfer.
7. Public awareness.

These programmatic activities are expected to increase the capacity of researchers, practitioners, and policy and decisionmakers to address four basic questions:

1. Which urban areas in the EMR are likely to be adversely impacted in the in the next 10, 20, and 50 years?
2. What are the expected losses during these exposure times for a range of realistic scenarios?
3. What are the most effective mix of risk management policies and strategies (i.e., mitigation, preparedness, emergency response, and recovery) that will control these losses and ensure sustainable development?
4. What social, technical, administrative, political, legal, and economic actions are needed to adopt and implement them?

CONCLUSIONS

These two initiatives should improve technology transfer from researchers to policymakers and practitioners in the United States and the EMR. They will provide a "laboratory" to test and refine the dynamic model for technology transfer.

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