TRANSPORTATION RESEARCH PROGRAM ADMINISTRATION

THE INTERNATIONAL TECHNOLOGY SCANNING PROGRAM SUMMARY REPORT

By

Barbara T. Harder
Principal
B. T. Harder, Inc.

June 9, 2008

Submitted to American Trade Initiatives

for distribution to

U.S. Department of Transportation, Federal Highway Administration
American Association of State Highway and Transportation Officials
National Cooperative Highway Research Program

DISCLAIMER

This document is disseminated with the cooperation of American Trade Initiatives under the sponsorship of the U.S. Department of Transportation, the American Association of State Highway and Transportation Officials, and the National Cooperative Highway Research program for the interest of information exchange. The United States Government assumes no liability for its contents or the use thereof. This report does not constitute a standard, specification, or regulation. The United States Government does not endorse products or manufacturers. Trade and manufacturers' names may appear in this report only because they are considered essential to the objective of this document.

ACKNOWLEDGMENTS

This summary report was completed in cooperation with the members of the scan team and all of the transportation professionals and organizational representatives who hosted the scan team and gave of their time and energy to organize presentations and site visits in the various host countries on the scan itinerary. Without their gracious hospitality and willingness to share their knowledge and experiences with the U.S. delegation, this report would not have been possible.

TABLE OF CONTENTS

LIST OF EXHIBITS ..... *ix*

SUMMARY REPORT *1*

Background **1**
- **Purpose** 2
- **Scan Team Members** 2
- **Areas of Interest** 3
- **Travel Itinerary** 4

Summary of Findings **6**
- **THEME: Setting the Research Agenda** 7
- **THEME: Partnership Models and Joint Research Activities** 10
- **THEME: Conduct of Research: Performance, Quality, and Value** 13
- **THEME: Delivery: Getting the Research Results into Widespread Practice** 16

Implementation Strategies **18**

References **21**

LIST OF EXHIBITS

Figure 1 TRPA Scan Team 3
Figure 2 Working Lunch – Synthesizing Information 6
Figure 3 European Union – Research integral to economic growth 7
Figure 4 The Netherlands DVS Integrated Strategy, Knowledge, and Innovation Agenda 8
Figure 5 KICTEP Strategic Research Agenda 8
Figure 6 KICTEP Developing the Ten Promising Technologies 9
Figure 7 Broader agenda context, PWRI Japan 9
Figure 8 EU Creating a Common Vision for R&D 9
Figure 9 VINNOVA Excellence Centers 12
Figure 10 Transport R&D Model in Hungary 13
Figure 11 VINNOVA Assessment, Monitoring, Evaluation, and Impact Analysis 13
Figure 12 KICTEP Project Evaluation Process 14
Figure 13 EU 7th Framework Program Budget 15
Figure 14 VTI's Ideas to Create Common Platform for Information Sharing 17
Figure 15 Forums for International Sharing of Research Results 17

SUMMARY REPORT

In April 2008, a team of eleven transportation research, asset, and policy management experts from the United States (U.S.) visited Sweden, Netherlands, Belgium (European Commission), France, Japan, and Korea to review and assess transportation research program administration practices. The scan tour members sought policy options and initiatives as well as process improvements to enhance the effectiveness of transportation research administrative activities in the U.S. Additionally the team identified successful practices having potential to be applied to U.S. surface transportation research programs particularly in the public sector. The scan team met with senior research program administrators from national governments and the European Commission, non-government national research consortia, and institutes, centers of excellence, research foundations, and universities. While the focus of the scan dealt with research administration, the team found potential opportunities for expanding the scope of U.S. research activities to include international collaborative efforts. The team also learned of the inseparability of transportation research, quality of life, and national economic competitiveness that exists in all of the countries visited, and thus gained a greater appreciation of the necessity for robust links between knowledge creation and knowledge application.

Background

The Transportation Research Program Administration (TRPA) Scan was conducted through the International Highway Technology Scanning Program (Scanning Program). The Scanning Program is jointly sponsored by the Federal Highway Administration's Office of International Programs and the American Association of State Highway and Transportation Officials' (AASHTO) Special Committee on International Activity Coordination, and in cooperation with the Transportation Research Board's National Cooperative Highway Research Program (NCHRP) Project 20-36, "Highway Research and Technology - International Information Sharing," the private sector, and academia.

The Scanning Program serves as a means to access innovative technologies and practices in other countries that could significantly improve highways and highway transportation services in the U.S. The program enables innovations to be adapted and put into practice more efficiently without spending scarce research funds to re-create advances already developed by other countries. Personal domestic and international networking, team dynamics, and the creation of domestic champions for promising foreign ideas are keystones of the scan process. Successful implementation in the U.S. of the world's best practices is the goal of the program. [1]

This scan is the first solely dedicated to research management topics. The scan topic originated through discussions among research managers committed to improving

Purpose

Organizations that perform successful research have a key element of success – research administration that reflects vision, leadership, competence, and effectiveness. Understanding how to better administer research programs or activities is a means to increase the likelihood of solving difficult problems, produce more rapid adoption of innovation, and create a higher value for research results. These benefits are attractive features for transportation research in the U.S. Moreover, there are exemplary international transportation research programs and activities that have mature and successful research administration processes. These international programs could provide insight and knowledge to enhance domestic transportation research administration practices and the ultimate implementation of the research results.

Recognizing that there is a rich body of international knowledge available to U.S. research managers, the TRPA scan team examined the management and administrative practices, policies, and experiences of other countries, and sought successful international practices that can be applied to benefit programs in the U.S. Additionally, the team realized its presence in the countries visited would provide avenues for developing research partnerships and collaboration opportunities as well as this unique circumstance would promote information sharing and technology transfer with international counterparts.

Scan Team Members

The members of the TRPA scan included representatives from the Federal Highway Administration field, program, and research offices, four State Departments of Transportation (one from each of the AASHTO regions), the private sector: Ford Motor Company and SME (Small/Medium sized private Entity), B. T. Harder, Inc., the Transportation Research Board, and the University of Minnesota.

Debra Elston (*FHWA Co-Chair*) Director, Office of Corporate Research and Technology
Federal Highway Administration, Turner-Fairbank Highway Research Center

David Huft *(AASHTO Co-Chair)* Research Program Manager and ITS Coordinator
South Dakota Department of Transportation

Barbara Thomas Harder *(Report Facilitator)* Principal
B. T. Harder, Inc.

Joyce Curtis Director of Field Services - North
Federal Highway Administration

Monique R. Evans Administrator Office of Research & Development
Ohio Department of Transportation

Christopher W. Jenks Director, Cooperative Research Programs
Transportation Research Board

Laurie McGinnis Associate Director, Center for Transportation Studies
University of Minnesota

Harold R. "Skip" Paul Director, Louisiana Transportation Research Center
Louisiana Department of Transportation and Development

Glenn Roberts Chief of Research, Bureau of Materials and Research
New Hampshire Department of Transportation

Eric Wingfield Knowledge Specialist, Information Technology, Strategy, and Organizational Development
Ford Motor Company

Butch Wlaschin Director, Office of Asset Management
Federal Highway Administration

Figure 1 TRPA Scan Team (L-R, Wingfield, Harder, Roberts, McGinnis, Wlaschin, Curtis, Huft, Evans, Jenks, Elston, and Paul)

Areas of Interest

The scan team identified four primary themes which describe its areas of interest. Each of the themes incorporates an aspect of the research administrative process from early stage -- determining the research agenda, to late stage -- getting the research results into widespread practice. The scan team also developed a series of amplifying questions detailing the information sought within each of the themes. The full set of amplifying questions will be included in the TRPA scan final report.

In the context of these four themes, the team focused on how the host countries administer their research programs and projects, that is, the methods, techniques, and tools used in accomplishing the broad spectrum of administrative functions. The scan team also investigated the roles, responsibilities, and working relationships among research entities within the various countries and within their international domains.

The four primary themes are:

1. Setting the Research Agenda – practices used to determine where to put the emphasis and effort to solve current problems and emerging issues, on local, national/federal, and international levels
2. Partnership Models and Joint Research Activities – methods of cooperation that are an effective means to enhance technical capacity and increase fiscal and other resources required for research
3. Conduct of Research: Performance, Quality, and Value – tools and processes used to measure the performance, quality, and value of research programs and projects
4. Delivery: Getting Research Results into Widespread Practice – keys to enhancing the effectiveness of deployment and increasing the use of research results

Travel Itinerary

The TRPA scan team divided its time during the two week tour spending one week in Europe and one week in Asia. The team convened several times to plan for upcoming activities in host countries and for opportunities to synthesize information gathered from its meetings and discussions with the variety of organizations' representatives. The summary travel itinerary is as follows:

13 April — Stockholm, Sweden
Team Meeting

14 April — Stockholm, Sweden
Swedish Governmental Agency for Innovation Systems (VINNOVA), Swedish Road Administration: Meetings and Discussions

15 April — Rotterdam, the Netherlands
Rijkswaterstaat Transport and Navigation Department, SWOV Institute for Road Safety Research, and TNO, an independent contract research organization for Dutch public and private organizations: Meetings and Discussions

16 April — Brussels, Belgium
European Commission and European Union (EU) Transport Research Stakeholders:

ERA-Net Transport, ERA-Net Road, FEHRL (Forum of European National Highway Research Laboratories) and ERTRAC (European Road Transport Research Advisory Council): Meetings and Discussions

17 April — Brussels, Belgium
The European Conference of Transport Research Institutes (ECTRI) and including representatives from Hellenistic Institute of Transport; French National Institute for Transport and Safety; Transport Research Center, Czech Republic; Polytechnic University of Madrid; German Aerospace Center; VTT Technical Research Center of Finland; KTI Institute for Transport Sciences, Hungary:

Meetings and Discussions

18 April — Paris, France
French National Road Agency, General Highways Department (GHD); Department for Research and Scientific and Technical Coordination (DRAST); National Institute for Transport and Safety Research (INRETS); French Research Laboratory for Public Works (LCPC); and Program of Research, Experimentation, and Innovation in Land Transport (PREDIT): Meetings and Discussion

19 April — Travel Day

20 April — Tokyo, Japan
Mid-tour Team Meeting

21-23 April — Tokyo, Japan
Institute for Transport Policy Studies, Institute of Behavioral Sciences, Japan Institute of Construction Engineering, Ministry of Land, Infrastructure, Transport, and Tourism, National Institute for Land and Infrastructure Management, Public Works Research Institute, Mitsubishi Research Institute, University of Tokyo: Meetings and Discussions

22 April — Tokyo, Japan
Evening Team Meeting

24-25 April — Seoul, Korea

Korean Institute of Construction and Transportation Technology Evaluation and Planning, Korea Transport Institute, Department of Land Transport and Advanced Technologies, Korean Institute of Construction Technology: Meetings and Discussions

26 April — Seoul, Korea
Team Meeting

27 April — Return to U.S.

A complete list of individuals and their organizations will be provided in the TRPA scan final report.

Figure 2 Working Lunch -- Synthesizing Information

Summary of Findings

The Neighboring Lawn is Beautiful
(Shigeru Morichi, president, Institute for Transport Policy Studies, Japan)

During the early days of the tour, the scan team approached gathering its findings in a segmented manner – looking at the important information discussed and exchanged organized by country and then by primary themes. As the tour progressed the significant aspects of the thematic areas emerged, forming a body of information for consideration of its applicability to U.S. research program administrative policies and practices. This Summary of Findings discusses the initial findings of the team organized by the four primary themes of interest. Implementation strategies addressing the findings follow this section. The strategies relate closely to the four themes by bringing attention to a national transportation agenda, recommending strengthening the innovation process, promoting international cooperation and collaboration, and more.

One of the most important aspects of this summary report and the experience of the scan team is that we learned what we in the U.S. could do better and learned what we should do together globally.

THEME: Setting the Research Agenda

Transport research agenda is closely related to visions of society development, global competitiveness, citizen and company needs, {and} political government programs.
(Matti Roine, Chief Research Scientist, VTT Finland) [2]

Areas of interest within the agenda setting theme span sub-themes such as identification and scope of the research agenda, addressing consensus, and elements of program portfolios. Additionally, issues dealing with national policy and direction as well economic position were important topics of consideration.

Transportation research is directly related to national economic growth and competitiveness: In every country visited, the belief was prevalent, "If you aren't doing R&D, then you won't be globally competitive." The U.S. international counterparts appreciated their R&D activities in the context of the entire world. Their perspective on transportation research differed greatly from the U.S. public sector model; the host countries see research as an integral piece of their efforts at maintaining or creating a more robust national economy. European countries individually as well as collectively, through the European Union, clearly saw a role for transportation and infrastructure research activities as a major avenue to achieve a higher global competitive stance. They viewed the outcomes of research as economic stimulus to start new businesses, and hence increased economic development. Additionally knowledge is identified by the triangle of research, education, and innovation – these three aspects are necessary for sustainable growth, employment, and leadership. [3] (See Figure 3.)

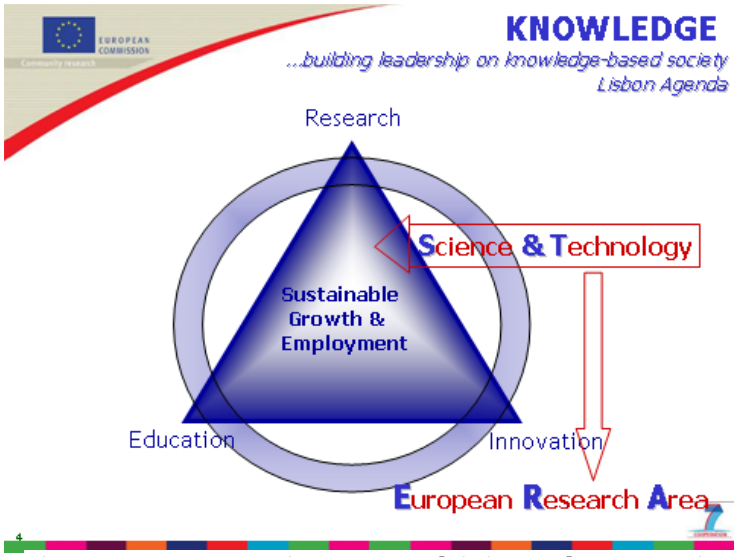


Figure 3 European Union – Research is integral to economic growth

Korea and Japan likewise, while expressing the economic competitive stance in different terms, such as "for societal good," were well aware of the strong relationship between research outcomes and creating economic value. In fact, most countries visited regularly expressed their transportation R&D efforts in terms of percentage of the country's gross national product. Moreover and remarkably, every country had recent legislation for research and technology efforts, which addressed more clearly the issue of transportation R&D value and its direct relationship to economic advantage. Certainly, the concept of transportation R&D as being a lever to create value for the economy was a dominant concern.

Strategic and policy driven agendas for transportation research are the standard: Transportation research agendas are set nationally, for the most part from the top down, through a strategic process that is closely tied to national policy goals and objectives. These research agendas are all encompassing in that they include broad societal issues, not just transportation. In nearly every country, the degree and effort committed to preparing and using a national research agenda was notable.

Efforts that are particularly exemplary are the activities performed by The Netherlands, Rijkswaterstaat Transport and Navigation Department (DVS). DVS uses an integrated Strategy, Knowledge, and

Figure 4 The Netherlands DVS Integrated Strategy, Knowledge, and Innovation Agenda

Innovation Agenda (SKIA). (See Figure 4.) "Given the close connection between knowledge and innovation, and the importance of both for policy, implementation, and supervision, both knowledge and innovation {are} incorporated into one agenda." Both knowledge and innovation are required to, "realize the future societal challenges against acceptable costs… action is required now in order to be prepared for the future. Therefore: start 'thinking for tomorrow' today." [4]

Other countries' agenda setting models included multi-tiered strategic planning activities. France develops a medium term plan which includes its strategic priorities for a 4-year term. The example provided to the scan team included 5 thematic priorities (each having a corresponding research program) within that medium-term plan, each priority having approximately 10 research areas, and each area having 3 to 4 topics yielding from 150-200 research problems. To accomplish this planning process the "top-down" orientation is used, however, "bottom-up" origination proposals are received for accomplishing the research.

The Korean Institute of Construction and Transportation Technology Evaluation and Planning (KICTEP) showed the results of its strategic approach including a long-term planning process which identifies promising "value creator" technologies for research emphasis.

In general, Korea's transport agenda setting is a very formal process for establishing its innovation roadmap. (See Figure 5.) The process is performed annually, and meshes the top-down direction for long-term strategic direction with bottom-up response for mid-term project identification. [5]

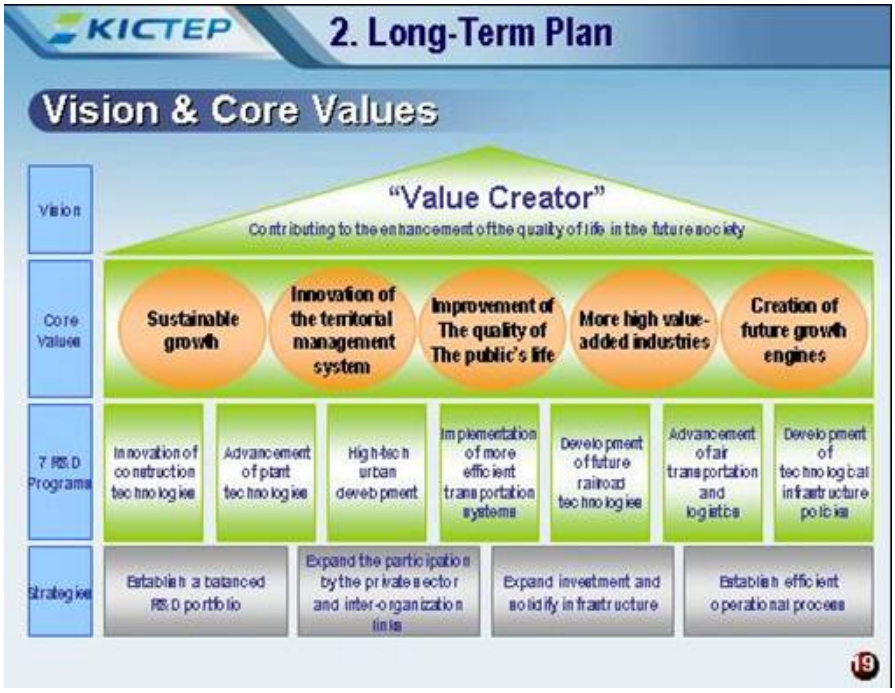


Figure 5 KICTEP Strategic Agenda Setting

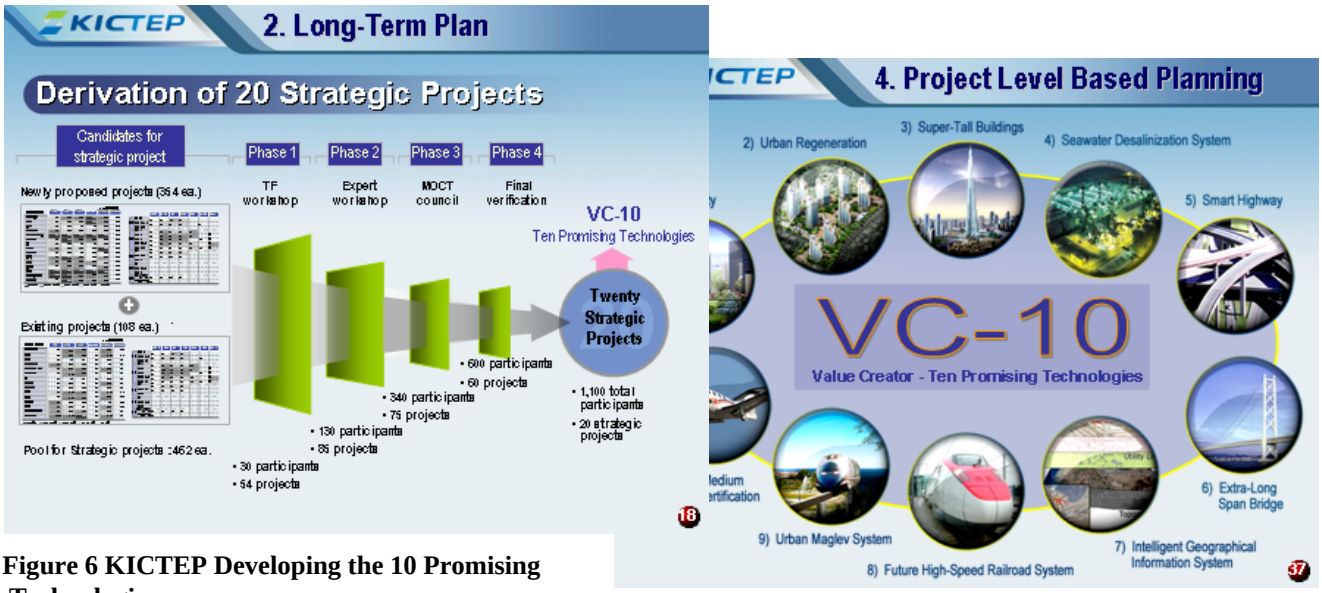


Figure 6 KICTEP Developing the 10 Promising Technologies

Figure 8 EU Creating a Common Vision for R&D

Figure 7 Broader Agenda Context, PWRI Japan

Ability to align the transport research agenda with a common vision: In addition to the clear and purposeful approach for strategic agenda setting that the countries demonstrated, there is a notable focus on communication of the agendas within the countries visited. Furthermore for European countries, the strategic agenda developed for transportation research at the European Union (EU) level was fully understood and incorporated as part of the vision and mission for the individual EU countries visited. [6] (See Figures 6 and 8.) For Korea and Japan, there is a unique cultural emphasis on the coordinated society, which assists in communicating the agenda to support a common vision for the research activities. [7] (See Figure 7.)

However in all host countries there is a great deal of attention given to assuring the vision is communicated well and owned by all stakeholders: through effective and efficient planning, through extensive incorporation of industry and academia in building the common vision and accomplishing the

research activities, and with main drivers being societal goals, rather than industrial goals – using transportation as a means to improve the quality of life.

The issue of common vision also is evident in the manner in which the various modes and elements of the transportation industry are brought together to perform R&D efforts. In the European host countries as well as those in Asia, the vision for transportation research was to solve larger issues – such as reinventing the city, climate change, or creating knowledge for economic advancement – thus bringing autos, trucks, roads, safety, environment, technology, private, quasi-public, public sectors, academia, and other areas together to work on the problems at hand.

National research agendas had common topics in many of the host countries and they are being addressed by cross-ministerial R&D activities. The host countries articulated series of agenda items that had common elements. Some of these items are:

- Climate change
- Environmental considerations in transportation
- Aging population and mobility
- Workforce
- Aging infrastructure
- Congestion management
- Safety and security

Many of the concerns of the host countries are also concerns within the U.S. Yet, host countries' research programs look to solve these national priorities in a manner that uses a substantially broader perspective – incorporating extensive cross-ministerial bodies that include land, infrastructure, energy, environment, culture, and sports, for example.

THEME: Partnership Models and Joint Research Activities

Understand, Trust, Commit (EU Success Factors)[8]

In host countries, transport research partnerships and joint research efforts are essential, ubiquitous, and actively promoted. The role and use of partnerships and the collaboration of multiple players are integral elements of the research activities in the various countries visited. For Europe, the effort of creating a single economic market is a catalyst for fostering joint research. The European 7th Framework Program (FP7) research activities spawned a number of independently formed venues for collaboration, including ERTRAC, the European Road Transport Research Advisory Council and ECRTI, the European Conference of Transport Research Institutes. Furthermore, there is a strong sense of "we know we can't do all this separately," and organizations such as FEHRL, the Forum of European National Highway Research Laboratories, are actively promoting the attractiveness and effectiveness of stewardship and leveraging of research resources for all aspects of the research cycle (agenda setting to implementation/deployment).

Some typical partnership concepts in use in Europe are as follows:

- EU research activities require multi-country participation – at least three
- EU encourages 3rd country or the E12 (newest members in the EU) participation in research and with countries outside the EU
- There is a strong emphasis on incorporating SMEs (small/medium sized enterprises) with a goal to foster the creation of new business opportunity
- High respect for and use of academic expertise

- In most European host countries and the EU research programs, research grant moneys are distributed according to the size (e.g., large business, SME) and type (e.g., private sector, institute, academia) of partner
- The EU international collaboration platform recognizes each individual country's competitive stance. While each country is a member of the EU and can benefit by being part of a unified economic entity, it is also an individual economic entity with unique country priorities.
- The EU views itself as a world partner

Host countries' transport R&D collaboration activities begin substantially further upstream than in the U.S. Research programs in host countries incorporated academic and industry participation for research activities very early in the research process compared to the timing of initiating partnerships for comparable activities in the U.S. In the host countries there is a continuous flow, incorporating collaboration from problem definition (which may include agenda setting participation) through the conduct of the research and the delivery of research products. For all programs reviewed, there is less separation or definition of the various stages of the research continuum than defined in the U.S. The early incorporation of academia demonstrates the necessity for developing knowledge and the workforce capacity which is needed for sustainable economies and global competition; the integration of industry early in the process shows an understanding of research being a factor to grow national income generation opportunities. Academia provides knowledge creation and industry provides knowledge application.

Research institutes are a very important vehicle for exercising transportation partnerships and collaboration. Without exception, each host country had some form of research institute that is a primary vehicle to either fund and financially manage and/or foster, house, and accomplish collaborative research efforts. The formation and structure of the research institutes varied from country to country, yet each example brought together government, quasi-government/foundation/government-funded-independent, academia, and industry in a unique manner that was able to more effectively respond to the national strategic agenda in collaboration than each organization was able to do on its own. Institutes often were the venues bringing together the knowledge creation, knowledge management, and knowledge application aspects of R&D. There were a number of instances where collaboration for R&D is written into law, facilitating industry, university, and government collaboration. Overall, the U.S. does not have comparable unique entities to facilitate collaborative research on this level – some U.S. structures can accomplish portions of the roles of these institutes, however such integration of responsibility in one institutional structure is clearly a non-U.S. model.

An example of the use of institutes is the French Research Laboratory for Public Works (LCPC), a French state-owned institute under the authority of the Ministry for Ecology, Energy, Sustainable Development, and Spatial Planning and the Ministry for Research. LCPC facilitates partnerships with the French National Research Agency, universities, and industry for pre-competitive research (research on topics that are not product specific nor have an identified industrial application or capability for commercial exploitation), for research calls by the EU framework program, with FEHRL, and other European technology platforms such as ERTRAC (private sector). LCPC promotes research pools of expertise to address research topics, executes memoranda of understanding for accomplishing research domestically and internationally, as well as promotes activities of the Centers for Competitive Capacity a multi-partner R&D effort. Other countries, such as Sweden, Japan, and Korea are also highly supportive of the research institute concept to accomplish transportation R&D.

Partnership models in transport have similarities to models used in the U.S. but present additional capacities. VINNOVA, the Swedish Governmental Agency for Innovation Systems, exhibits a Center of Excellence model for accomplishing collaborative research. The Centers of Excellence: [9]

- Provide multi-disciplinary, international research leadership

- Create new collaborations among the public sector, business, universities and other research organizations
- Accomplish research programs that are designed and carried out jointly by the participants
- Include a geographic focus; use a university or college as the organizational center (See Figure 9.)

Figure 9 VINNOVA Excellence Centers

Another example is the four Collaboration Models identified by the European Research Area Network for Roads (ERA-NET Roads)[10] are:

- The Common Program is the lowest level of cooperation:
  - Participants agree to align their national program into a common program.
  - The themes, the time-schedules and the dissemination are aligned.
  - Projects undertaken within the national program remain national (e.g., funding, procurement, publishing).
- The Common Project involves more cooperation:
  - The national research agencies (NRA) have national programs with common objectives and agree on a common project.
  - Research on a common project is divided into sub-projects; contributing to the final goal.
  - Each NRA is responsible for one sub-project (including funding and procurement).
  - One of the sub-projects includes the lead of the common project, to align the results, timing and final common report.
- The Common Obligation (program or project) is also called the "virtual common pot":
  - The NRAs agree on a theme for a common program or project. A project executive board is made up of the participating NRAs, making an agreement on all aspects of the study and cooperation.
  - One NRA takes the lead, in project governance and procuring.
  - All NRAs make a budget reservation. At the end of the (approved) project or project phase the NRAs pay their share to the lead NRA: they pay on demand.
  - The results of the study become available for all participating NRAs.
- The real Common Pot is the highest level of cooperation:
  - The NRAs also agree on a common program or project, a common budget and on a project- or program- leader.
  - However in contrast to the Common Obligation Model, the whole budget is transferred *in advance* to the leading NRA.
  - Involved NRAs have equal ownership of the results

Elements of these models are found in some U.S. R&D activities, yet elements of agenda setting, work sharing, and financing present additional capacities that are not frequently used in the U.S.

A typical model of research partnerships – this example, Figure 10, is from Hungary. Like others, the roles of government, industry, and academia are essential.

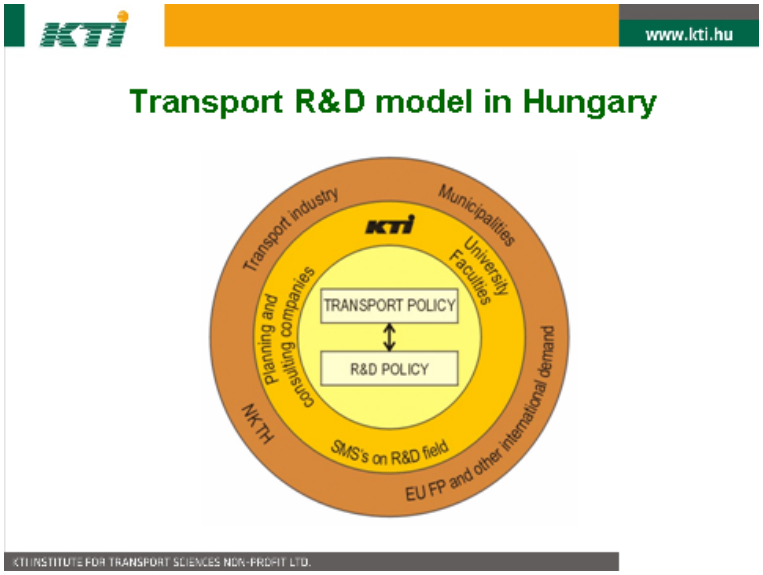


Figure 10 Transport R&D Model in Hungary

Academic partners are integral to transport research performance. In every host country academic partners in transport R&D had a more integral and integrated role in research activities than is seen in comparable U.S. research efforts. In Europe, academics were always incorporated into an innovation group which also included industry and government/policy players. Countries included the academic expertise for determining agenda priorities, creating knowledge, accomplishing research, evaluation, and importantly creating the future workforce.

THEME: Conduct of Research: Performance, Quality, and Value

Project evaluation and review techniques varied in complexity and effectiveness. For the most part every research program included some process for evaluating the results of the conduct of research. Some programs were more successful than others, and in some risk adverse contexts, the issue of failure of a project was not an acceptable solution. VINNOVA and KICTEP provide two examples of well-proven evaluation processes. (See Figures 11 and 12.) VINNOVA conducts evaluations at a variety of stages during the research project activities: a pre-project assessment, during the conduct of the research (performance monitoring), midterm or at the completion of the research performance, and after implementation, an impact analysis. [11]

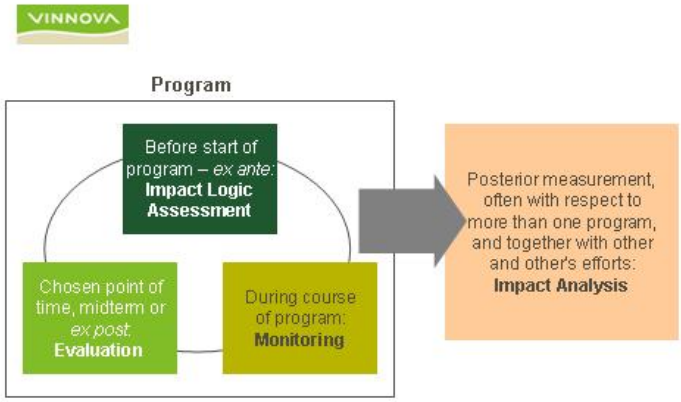
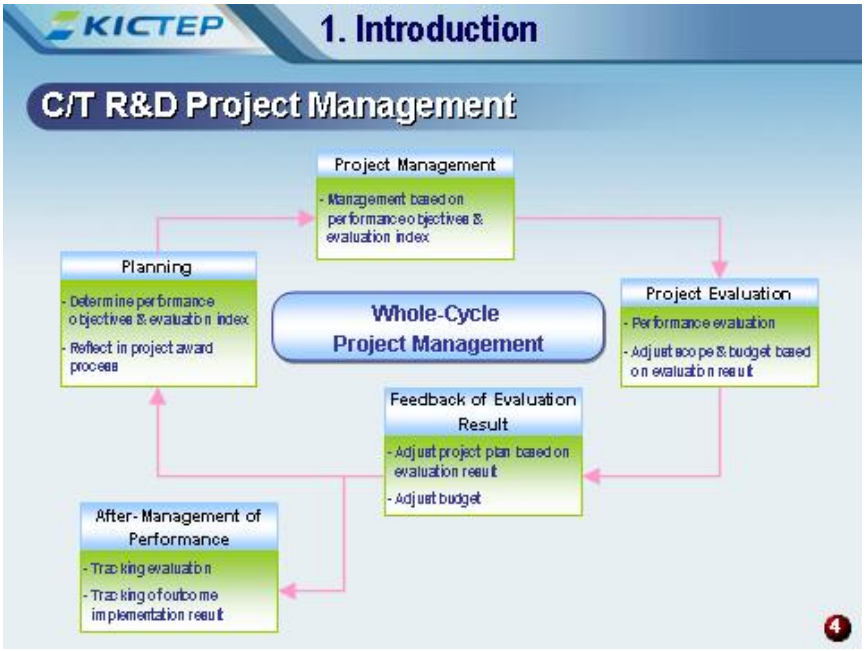


Figure 11 VINNOVA Assessment, Monitoring, Evaluation, and Impact Analysis



A similar example is shown in the KICTEP model for project management.[12] Project evaluation is an important aspect of the conduct of research. Notable among the various research programs is the criteria upon which evaluations are based. In Asia, considerable focus was directed toward the contribution to societal needs.

Figure 12 KICTEP Project Evaluation Process

Quantifying the benefits of research results is a continuing challenge for all host countries. As with the efforts in the U.S., the host countries are also struggling with quantifying benefits of research activities. The efforts committed to determining the benefits varied, and no country had a solution with which it was satisfied. While the information from such benefits analysis will be valuable for the respective research programs, the focus on justifying the program based on the analysis was not a critical concern for any of the countries. In fact, the value of research is fully accepted. The issue of cost/benefit in Japan, for example, was not a tool that was perceived as needed or considered as part of the assessment processes. Because the research funding structure is changing in Japan, with organizations such as PWRI moving toward a more competitive funding process, the issues of cost/benefit may become more important in the future. A number of the host countries considered the U.S. as a leader in quantifying benefits for research results. Several expressed an interest in the U.S. sharing its research program performance measurement process that is in development through the National Cooperative Highway Research Program.

Transport R&D is accepted as a valuable contribution for the national or societal good. Transport research programs and their outcomes are seen in the host countries as an important contribution to society. Transport R&D is especially considered an economic growth generator and an essential element in global competitiveness. The programs reviewed did not have to continually justify the expenditures on short-term bases as do most U.S. research programs. In fact, the acceptance of the value of research in the host countries promotes strong research programs, which in turn develops greater value – a virtuous cycle. For example, academic partners, in particular, are focused on knowledge creation and understand the contribution this makes to producing societal and economic value. Value is received through research programs that are closely aligned with the priority agenda and address essential problems for the country and society. Additionally, value is an outcome of research collaboration, which provides for more efficient use of resources by using the unique contribution of each member of the partnership. Furthermore, value of research is considered in the broad context of the quality of life where benefits from transport R&D translate into for example, healthier and safer citizens, cleaner environment, and sustainable economies.

A variety of successful techniques and processes are potential options for consideration in the U.S. Some of the items noted by the TRPA team are as follows:

- In Japan, success measures were determined by the project sponsor, customer surveys were used to determine whether the research results worked as planned.
- Research institutes and academia play a significant role in determining the specific projects that are to be researched; they provide a broad perspective about what research is needed to fulfill strategic agendas.
- Programs developed longer term plans with multi-year programs ranging from 3 to 5 years depending on the country.
- LCPC in France supports 10 percent of the researcher's time for "blue sky" (topics selected at the researchers' discretion) research activities.
- In some countries researchers had very close contacts with industry, e.g., education paid for by industry, research funding contribution by industry. This close connection facilitates implementation of research results.
- Because of the government's close association via R&D collaboration with its partners – independent institutes and industry in particular – these partners are sufficiently informed to be effective advocates with legislative bodies. R&D collaborations are a means to incorporate technical expertise into the legislative process.

Funding levels for transport R&D appear to be substantially greater in host countries than in the U.S. for comparable program activities. Substantial program funding is committed to transport research in the host countries, and in Europe the EU 7th Framework Program adds an additional large funding source. Making a direct comparison to the U.S. research funding schemes is not an easy task because U.S. programs are more segmented than those in the host countries. For the most part the transport research programs of host countries are significantly more integrated into broad research arenas such as model city, urban regeneration, or impact of climate change. Funding for surface transportation research in the U.S. is directly linked to the specific surface transportation topic. While the differences in the funding schemes exist, the funding for R&D in host countries is generally increasing to match the interest in achieving economic sustainability and global competitiveness.

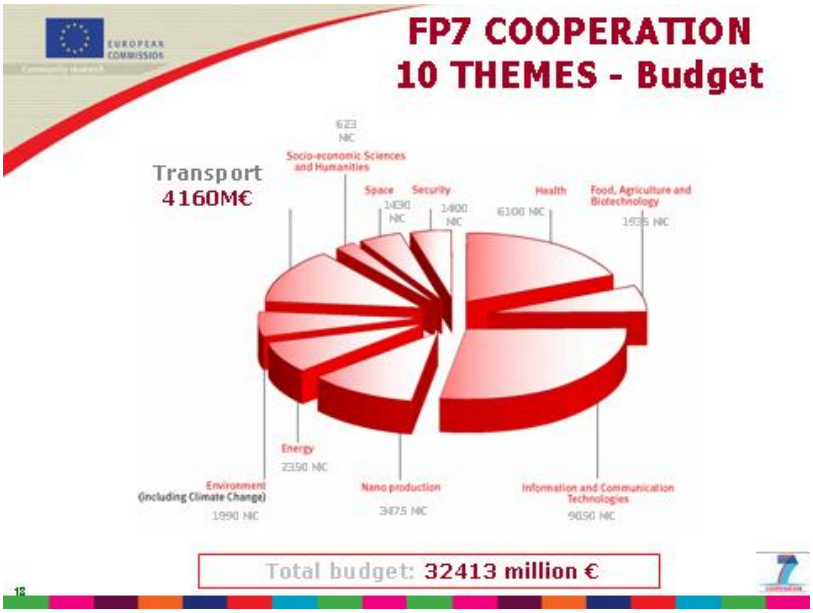


Figure 13 EU 7th Framework Program Budget

Some representative budget figures that were included in the respective countries' TRPA meeting presentations are:

- The 7th Framework Program (2007-2013) transport R&D budget is 4.1 B€ ($6.4 billion), however, this figure includes aeronautic R&D. (See Figure 13.)
- The budget for PREDIT, the French national platform for research and experimentation and innovation support for 2008-2012 is 360M€ ($560 million)
- The Netherlands annual budget for infrastructure research is 150 M€ ($235 million)
- The KICTEP budget for transport and construction R&D for 2008 is $347 M

(Using 1€ equals $1.56.)

THEME: Delivery: Getting the Research Results into Widespread Practice

Addressing intellectual property rights (IPR) is a common practice that facilitates the delivery of transport research results. Europeans have a decidedly different perspective than the U.S. on the ownership of intellectual property generated from government funded transportation research. IPR is addressed before the transport research is initiated and included in the research partnership contract. In general in Europe, IP development is seen as an opportunity to build a business based on the specific IP, and thus to create an economic engine for the country. There is no barrier to the government funded organizations seeking patents, in fact for France's LCPC, the number of patents is a performance measure used to evaluate the program. Japan's PWRI also tracks and uses as an indication of "practicalization" (application to practice) of its research efforts the number of patents owned and its applications for patents and registrations.

One of the items that came up in discussions with European host countries is the need for the U.S. to "figure out its IP issues." In particular, the U.S.'s methods for addressing IPR for surface transportation do not fit well within the European context. This issue can be a barrier to U.S.-European collaborative activities.

Development of common platforms among U.S. and international R&D organizations will facilitate research results delivery in all countries. The development of common platforms for a variety of elements in the research cycle will substantially reduce barriers for R&D collaboration and international partnerships, and consequently will promote a more widespread use of research results. Items such as the IPR discussion above, sharing of research expertise for peer review activities, and development of common access portals for information exchange are just a few of the areas that could benefit by having common platforms among global R&D collaborators. Information management is a prime area for developing some common platforms. Sweden's VTI Library and Information Center is already establishing contacts with the Transportation Research Board Library. Items for cooperation focus on incorporating research reports into the countries' respective information databases through the use of common platforms for information sharing. [13] (See Figure 14.)

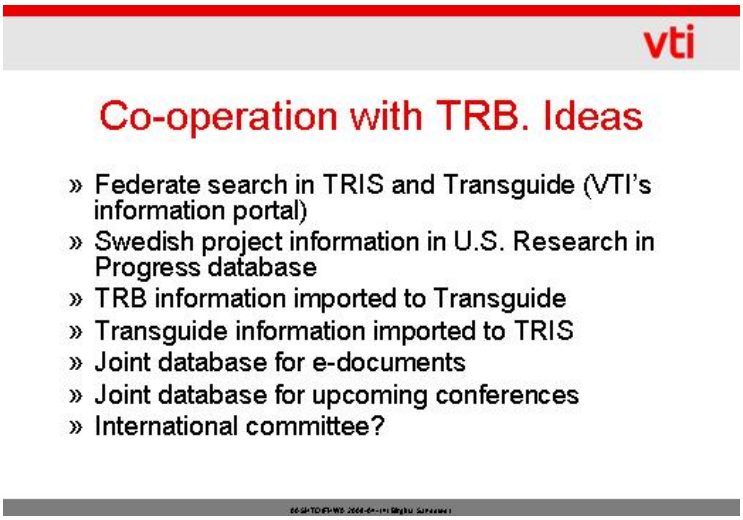


Figure 14 VTI's Ideas to Create Common Platform for Information Sharing

There are many research forums for international sharing of research results that are not currently apparent to U.S. research managers. ECTRI as well as many of the host countries, identify a variety of venues not currently used by U.S. research managers that could substantially increase the use of research results.

Forums exist in a variety of contexts, within industry and the scientific community, through strategic research initiatives and political bodies, in connection with unique research themes and based on geographic location. [14] (See Figure 15.)

Korean researchers use their research institutes as a vehicle to create forums for international sharing of research results using workshops, showcases, and demonstration of research activities.

International academic forums are additional venues that focus on technology transfer and educational opportunities that enhance the potential for increased implementation of research results.

Figure 15 ECTRI Forums for International Sharing of Research Results

Implementation Strategies

The team identified a number of successful transportation research program administration practices in other countries that can be applied in the U.S. Findings and best practices obtained from the scan will be aggressively disseminated through the transportation research community through a series of presentations, workshops, reports, articles, and web-based activities and discussions. Some of the preliminary recommendations contained herein can be implemented within the existing transportation research infrastructure. Others may require policy-level decisions or even legislation to realize the desired outcome and benefits. The final Scan Implementation Plan developed by the team will include more detailed action items for achieving these goals.

1. **Promote the development and implementation of a national, coordinated, multi-modal transportation research agenda.** A renewable forum (continuing and able regenerate as necessary) should be established to bring together transportation stakeholders from government, academia, and industry to create a framework for transportation research in the U.S. The agenda must be collaborative and not directive, and will not preclude the continued delivery of research programs focused on more local or regional needs.

   The team observed a number of examples of effective agenda platforms, including the EC framework, Japanese MLIT technology basic plan, and Korean roadmaps. Effective models such as those utilized by the U.S. National Institutes of Health should also be benchmarked. The team believes that an effective forum will be characterized by a fusion of top-down and bottom-up needs. Cross-pollination with other sectors will ensure that overall societal and economic goals are articulated and met. Thematic working groups (e.g. environment, energy, quality of life, asset management) would allow key ideas and perspectives to be collected. Citizen involvement can be obtained through periodic capture of public input. Finally, the agenda-building cycle should include measurable goals, continuous assessment and renewal – improvements based on the assessments.

2. **Perform an analysis and disseminate information outlining the relative degree of investment in transportation R&D in the U.S., Europe, and Asia.** The team observed a strong conviction in each of the visited countries that knowledge and research are fundamental to quality of life, vitality of society, economic growth, and global competitiveness. The link is articulated at the most essential levels of government, for example, the 2000 Lisbon Strategy, a primary action and development plan for the European Union. In the U.S., science and medicine R&D are looked at as progress; in the rest of the world transportation is also viewed in this way. Identification of the key political and economic differences between this and other countries' perceptions toward transportation research is the first step to a sustainable investment in technology.

3. **Strengthen the innovation process by addressing the missing links between knowledge creation and knowledge application.** The team recommends that a policy study be conducted to review the structure of federal transportation research in the U.S., with a focus on the "research institute" model employed in other parts of the world. Such institutes have been shown to provide a bridge that 1) enables successful and highly productive use of the three primary partners in surface transportation research -- government, academia, and industry, and 2) facilitates implementation through economic and societal incentives. Should the study conclude that such a model provides the desired collaborative goals in the U.S., recommendations need to be included outlining how the structure might be established among existing or new U.S. organizations.

4. **Investigate the effects, applications, and future potentials for intellectual property (IP) rights in the U.S. and abroad.** The influence and impacts of both vertical (results not disclosed to competitors) and horizontal (shared) elements play a role in effective research program delivery. Pre-competitive policies can provide incentives for collaboration and implementation. In the U.S., such issues are largely controlled by the Bayh-Dole Act. However, a lack of understanding exists among many U.S. practitioners regarding the limits and treatment of existing law. For the use of federal money, a national-level standard operating procedure should be created for the application of IP, and a forum should be established promoting an international IP platform for the economic and societal benefit of all.

5. **Build capacity to avert the looming crisis related to the aging work force and loss of knowledge.** The issue of attracting and retaining the best students, and the link between today's researchers and tomorrow's practitioners, was a common theme during the scan. Some countries have implemented programs that combine financial incentives, curriculum enhancements, or other promotions to draw students and prepare for the future. Such practices need to be investigated and integrated into U.S. policy.

6. **Build international relationships and institutionalize cooperation in transportation research to achieve global goals and leverage scarce resources.** A number of short- and long-term activities were discussed and will be investigated to implement sustainable collaborative efforts between the U.S. and countries abroad, particularly around global issues such as climate change and highway safety. Among these are meetings and agenda-building workshops; web conferencing; international agreements or memoranda of understanding; committees or working groups; exchange of researchers; newsletter collaboration; and development of standard operating processes for use of cooperative research and development agreements. Accompanying these activities is also a desire to foster use of enhanced technology or other mechanisms to allow collaborative teams to communicate effectively across the world in different time zones without the benefit of face-to-face meetings.

7. **Integrate and enhance accessible Internet forums, portals or other tools to coordinate information and knowledge resources at a global level.** Such a resource is needed to improve awareness of research agendas, ongoing research, and existing collaborations. It should build on existing and ongoing initiatives such as Transportation Research Information Service and the Research-in-Progress database and transportation knowledge networks as promoted under NCHRP 20-75 (Implementing Knowledge Networks). International resources such as those presented in Sweden and the Netherlands should be integrated. Related to this effort, the team envisions a tool that will manage all aspects of the research cycle, for example calls for proposals, inventories of technical knowledge and human expertise, available research opportunities, needs statements, opportunities for collaboration, wiki elements, and cataloging capabilities. The ability to translate materials to other languages will remove barriers and enhance more effective collaboration and information sharing.

8. **Promote a systematic and consistent practice for continuous research program evaluation and improvement.** Practices such as internal and external audit/peer reviews, extended post-implementation evaluations, and impact analyses will enable the transportation community to continually improve on its research investment.

9. **Obtain documentation of the various collaboration models presented to the TRPA team and engage our international hosts in participating in action items of interest.**

References

[1] International Highway Technology Scanning Program Overview, Federal Highway Administration Office of International Programs, U.S. Department of Transportation. Website, http://international.fhwa.dot.gov/scan/overview.cfm

[2] Roine, M., Setting the Research Agenda, Transport Research in Finland, TRPA Scan Tour presentation, ECTRI Meeting, Brussels, BE, April 17, 2008.

[3] Prista, L., Research panorama in Europe, the EU System, focus on Transport, EU, Brussels, Belgium, April 16, 23008.

[4] Poot, H., Strategic Knowledge and Innovative Agenda, Thinking for Tomorrow, TRPA Scan Tour presentation, The Netherlands, Ministerie van Verkeer en Waterstaat, April 15, 2008.

[5] Cho, D.Y., R&D Planning, KICTEP, Korea, TRPA Scan Tour presentation, KICTEP, April 24, 2008.

[6] van Houtte, B., Transport research in FP7 and its policy dimensions, TRPA Scan Tour presentation, EU, April 16, 2008.

[7] Ueda, S., An Outline of PWRI, TRPA Scan Tour presentation, PWRI, April 22, 2008.

[8] Mallejacq, P., ERA-NET ROAD, Coordination and Cross Border Funding of Road Research in Europe, TRPA Scan Tour presentation, April 16, 2008.

[9] Lundberg, M., VINN Excellence Center, "Centers of Excellence in Research and Innovation," TRPA Scan Tour presentation VINNOVA, April 14, 2008.

[10] Mallejacq, P., ERA-NET ROAD, Coordination and Cross Border Funding of Road Research in Europe, TRPA Scan Tour presentation, April 16, 2008.

[11] Stern, P., VINNOVA's Focus on Impact, A Joint Approach for Impact Logic Assessment, Monitoring, Evaluation, and Impact Analysis, TRPA Scan Tour presentation, VINNOVA, April 14, 2008.

[12] Cho, D.Y., R&D Planning, KICTEP, Korea, TRPA Scan Tour presentation, KICTEP, April 24, 2008.

[13] Sandstedt, B., Information management and access, VTI's Library and Information Centre, TRPA Scan Tour presentation, VTI, April 14, 2008.

[14] Giannopoulos, G., Getting research results into "widespread" practice, TRPA Scan Tour presentation, ECTRI, April 17, 2008.