

REALITIES OF TRANSPORTATION RESEARCH IN DEVELOPING COUNTRIES

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INTRODUCTION

The authors wish to congratulate the organizers of Special Session 25: TRANSPORTATION RESEARCH FOR DEVELOPMENT at the 6th World Conference on Research for creating a forum for discussion of the many issues for conducting transportation research in developing countries. Announcement of the session stated that:

"This session is concerned with transport research targeted at the specific problems of developing countries, and the problems/solutions entailed in organizing, conducting and applying that research--whether by organizations in developed countries or in developing countries. It will address issues such as:

- the role of research center in a developing country--does it differ significantly from its developed country counterpart?,
- establishing transport and road research centers in developing countries (funding and institutional problems),
- the place of "Third World Transport Research" in the overall spectrum of international/global transport research,
- the place of research within the aid programs of the bilateral and multilateral donors--objectives, scale, relevance, effectiveness, etc.,
- defining research needs for Third World countries and regions,
- the prospects for collaborative research in and for the developing countries,
- turning research results into good practice--the problems of application and 'technology transfer'."

Obviously these issues are of significant importance if we have assumed and accepted that there should be well-structured organizations to conduct transportation research in developing countries. The announcement, in fact, has implied in a quite straight forward manner that formal organizations such as research centers, whether in developing countries or in a developing countries, should be the conduit through which transportation research could be conducted and results applied. This assumption is probably quite natural because transportation research centers have played a very important role in advancing the state-of-the-art of transportation development in developed countries.

The authors would like to argue, however, that there are environmental conditions necessary for a research center to function properly and to fulfill its intended missions. Such conditions definitely exist in developed countries and probably exist in countries

that are fast approaching the developed status. However, for most developing countries, conditions for an organized research center to function properly does not fully exist or may not exist at all. Under these circumstances, the major issues perhaps are not how to structure a center, but should be focused on how to create the necessary conditions based on which research centers could function successfully.

In order to illustrate the authors' point, the paper first presents a case example. The authors then conduct a philosophical analysis to produce a list of conditions, in the authors' opinion, that are necessary for a transportation center to function properly. They later suggest several feasible ways to bring the developing countries into the global transportation research spectrum.

1. THE CHANGING FACE OF TRANSPORTATION RESEARCH IN A COUNTRY: A CASE HISTORY OF TAIWAN

In this section, the observed developmental path of conducting transportation research and institutional changes of research organizations in Taiwan is chronologically discussed. Of course, one reason that Taiwan's case was presented is because the authors have participated in the development path and therefore have had the privilege of having first hand information. The more important reason is that Taiwan has gone from a fairly low degree of development to almost that of a developed country in a short period of time. The rapid development offered us an opportunity to examine which conditions are important to organized research in a closed system.

Before the mid-1960s, Taiwan did have professional people who were involved in road (rail) building and there were people operating rail and bus agencies. In a strict manner, they were traditional engineers and administrators and perhaps only a handful of people could marginally be called transportation professionals. When the Taiwan government started a series of four-year and six-year economic plans in the mid-1960s, some people began to engage in transportation work in the economic planning agency. A few persons were actually sent to the United States through International Road Federation (IRF) scholarships for training. The role of these people was basically to assist in setting up the transportation portion of the economic plans.

In 1970, this planning function was formalized and an organization called Transportation Planning Board (TPB) was created within the Ministry of Communications. Roughly twenty people, mostly young engineers, were initially recruited to perform transportation planning functions. Most of the young professionals are leaders in the transportation field in Taiwan today (Dr. Wilson Chen, co-author of this paper, was one of them). Many of these young professionals were educated abroad later when they believed that their training was no longer adequate to perform their duties well. In 1972, a graduate program in transportation was established in the Civil Engineering Department at the National Taiwan University by Prof. C.F. Wang. In 1975, Prof. Wang moved to the National Chiao Tung University and established a graduate transportation program in its College of Management. From a historian's

perspective, it may be quite appropriate to state that transportation research did not exist in Taiwan prior to 1974 or 1975.

The transportation professionals' role was mainly assisting the government to draw up economic development plans. If information was needed, it came primarily from foreign sources or from foreign consultants and aid agencies. Professor Joe Lee remembers when he needed transportation information and data about Taiwan for a term project in an urban transportation planning course taken at Ohio State University in 1968, he could not get any pertinent transportation information except some old road specifications issued in the 1940s.

The time from 1974-75 to 1985 perhaps could be termed another distinctive era for transportation research as well as for the development of the transportation field in Taiwan. In this period, the number of universities offering transportation programs, both graduate and undergraduate, increased from two to about eight or nine including one in the Police Academy and one in the College of Oceanic Studies. This period was also a time when the government engaged in a massive construction program. This program included the building of a north-south freeway, an international airport, several harbor projects and several traffic improvement projects in urban areas. Although these construction projects required a large quantity of technical information, the information needs had not necessarily caused an increased need for transportation research.

The reasons that transportation research was not able to play a role in providing needed information perhaps could be attributed to the following observations. First, there was no market to induce the development of needed technical information. The few domestic consulting firms and supervising agencies were weak both in manpower and skills. They were eager to learn the advanced technical skills to accomplish their assignments which can only be provided by foreign consulting companies in a direct and timely manner. Domestic research, in its infancy, could not provide the wholesale knowledge that the market needed.

Second, the university system in Taiwan was such that it was not sensitive to external needs. Because of the Chinese cultural emphasis on education, no education institution was worried about attracting enough students or about the students' career needs. Students were just happy if there was a place to learn. In addition, graduate students were provided with governmental scholarships so that professors did not need to secure external research grants. Moreover, the reward system is such that only more theoretical work was treasured.

These factors resulted in a gap between knowledge needed for practical work and the transportation research work produced at universities. In this period, we saw parallel developments of Taiwan's physical transportation facilities and its universities' research capabilities in transportation. These paths seldom cross. It was also observed that, although universities had expanded their research capabilities, the strong research areas concentrated in planning-related fields due to influence of the early planning work. Facility design, traffic engineering, and more practically-oriented areas were still fairly weak. There just were not enough human resources in all the diversified transportation areas to support a more comprehensive research approach in transportation.

During this time, the government was either unaware or chose to ignore this situation because of its own resource limitations. It was unable to use policy changes or funds to influence the development directions in transportation research. Professors Lee and Chen collaborated on several research projects in this period. Issues revealed in the theme of this special session were often on our minds but remained unresolved even today.

In 1985, two important occurrences related to transportation research took place in Taiwan. TPB was reorganized, expanded and was given new missions to promote transportation research in addition to planning work. The new organization was named the Institute of Transportation (IOT) with an annual initial study and research budget of about two million dollars. Recently, in addition to its more traditional research areas, it won approval to further expand to include a research center on highway materials and engineering. It has a staff of about 120 people currently and soon will be expanded to around 200 people. The second event was the development of a professional association, the Chinese Institute of Transportation. The organization regularly conducts professional activities and hosts an annual meeting with research paper presentations. Currently, it has over 700 members.

Because of these two occurrences in 1985 and the continuous development on all fronts, an organized transportation research effort in Taiwan is taking shape. In 1990, IOT started an affiliation with TRB of the United States and a cooperative agreement between the United States Department of Transportation and the Taiwan Ministry of Communications is currently under consideration.

The above description was quite brief and lacks detail. However, it demonstrates one important fact: Taiwan is now starting to have an organized effort on its transportation research and is about ready to be involved in international transportation research. The authors believe strongly its role in research could not have happened sooner and it is not surprising that Taiwan's developing status is also approaching that of a developed country.

In this case example, many problems in the transportation research development path of Taiwan were revealed. It illustrates the conditions which are not amicable to an organized transportation research effort. On the other hand, it also tends to point out that a transportation research center may become feasible only when a market for transportation research exists and when there are enough people in the profession to supply the talent. However, this one case may not be universal and the authors describe another attempt from a more philosophical approach to demonstrate the necessary conditions for a transportation research center.

2. NECESSARY CONDITIONS FOR A SUCCESSFUL TRANSPORTATION RESEARCH CENTER IN DEVELOPING COUNTRIES

2.1 Are There Necessary Conditions for a Successful Transportation Research Center?

Let us first put the story about Taiwan in the back of our minds for a while and concentrate on the search on whether there are necessary conditions for a transportation center to operate properly and what those condition are. On first thought, the question seems to be simple. A further examination has found that this is really a very difficult question to answer.

There are examples of successful, viable, and properly operated transportation centers in developed countries. But how do we quantify success, viability, or other adjectives which describe a well-functioning center? How do we identify and quantify the factors that contribute to the success of a center, many of which are perhaps culturally related? The Taiwan story seems to hint that there are conditions pertaining to the success of an organized effort, but are they universal? How can we isolate them? All these difficulties led the authors to employ a perhaps not quite objective approach, i.e., a logical but quite philosophical approach emphasizing just rational thinking. In order to make such an approach more persuasive, the authors utilized three different thought processes: a backward-thinking process, a forward-thinking process and a dictatorial-thinking process, each of which is discussed in subsequent sections.

2.1.1 The Backward Thinking Process

In this process, the authors first define a successful transportation research center and identify its essential elements in a rather qualitative manner. They then logically attempt to see if there are universal conditions needed to support the essential elements. If some conditions can be identified, they then attempt to identify further conditions which are supportive of the initially identified conditions and this chain of thinking could go on until meaningful results are obtained.

The authors believe there are four essential elements for a research center to be successful. They are (1) people in adequate number and quality; (2) money in adequate amount with reliable sources; (3) a research agenda which is well defined and useful; and (4) adequate equipment, information/data and information channels to carry out the research agenda.

When we look for supportive conditions for these essential elements, we first find that a talent pool is needed to provide the number and quality of needed researchers. This, in turn, would mean that you need to have a large number of people who are already in the profession, and there should be training programs, both domestic and foreign, that could replenish the talent pool. This also means that there should be a good educational system for the particular profession.

Second, we have to have adequate and consistent funds for research, the fund has to be allocated through a political process in which such use is justified or there exists a market in which some player is willing to support the research activity. In either case, there should be end users of the research product who are willing to support the research. In other words, there has to be a market for research results.

Third, to establish a well defined and useful research agenda, we need good research leaders who understand the market needs and are able to set meaningful priorities. This, in turn, points to a need of good education and training programs.

Finally, in order to have adequate equipment, information/data, information channels to carry out research, the transportation community as a whole needs to possess a certain degree of development and sophistication so that such conveniences are available. This also means that the society has to have a sizeable professional community and frequent activities.

As a summary, the backward-thinking process seems to point out that a successful transportation center needs to be supported by a sizeable and active transportation community. This serves as the user of the research product and provides needed talent and the environment for doing the research.

2.1.2 The Forward Thinking Process

In this process, the authors first attempt to establish the development path of a society and then to see under what circumstances that such a path could lead to a successful transportation research center. Following this line of thinking, the authors believe that once a society is engaged in an economic development path, it will note that it needs a well structured transportation system. This, in turn, means that they need people and technical expertise. When the transportation community develops to a certain extent, its sophistication tends to require creation of new knowledge in transportation. When such needs become frequent and diversified, a transportation center becomes a natural establishment to supply these needs.

This thinking process seems to suggest that a transportation research center has to be based on needs. This need, in general, is represented by the size and sophistication of the transportation community.

2.1.3 The Dictatorial Thinking Process

In this process, the authors attempted theoretically to impose a transportation research center on a society and to examine the consequences. It is not only an attempt to identify conditions missed in the previous two thinking processes, it is also an attempt to verify the conditions identified previously as logical ones.

We first assume that a transportation research center with a certain size and stature is established in a country by a dictatorial process. The center is not only given adequate resources and staffed with adequate people, but it is also mandated with a research agenda. If such cases exist, many questions become apparent. Can this center survive long if there is no market for the research results? Where are the researchers coming from? If there is not a large talent pool from which they could be drawn, would they be taken away from other functions such as education or professional practice? Would this affect the well being of the transportation profession? When we keep asking these questions, it soon becomes obvious that indeed there are conditions which are necessary to the success and maintenance of a transportation center. These conditions tend to be the same as those defined in previous sections.

2.1.4 The Necessary Conditions for a Transportation Center

From the above analysis and by examining the Taiwan story again, we could probably state that a successful transportation center requires the country in which the center is located must have "a sizeable and active transportation community." In addition, this transportation community must be supported by an education system which is able to produce the number and quality of young transportation professionals. Moreover, the transportation community must serve a need and play a role in the society so it can survive and grow.

Of course, there may be secondary conditions such as the existence of a transportation community with a certain level of sophistication, good governmental policies, foreign assistance, leadership, etc.

2.2 Do Developing Countries Possess the Necessary Conditions for Transportation Research Centers?

After establishing the necessary conditions for a transportation research center, the next question is whether developing countries have those conditions so that we can argue if promoting an organized transportation research center is a good idea. The authors believe that in most developing countries these conditions do not exist and it would be premature to promote organized transportation research in these countries. For example, oil-rich countries such as Arab countries and some OPEC countries may have adequate personal income and a real need for transportation development. However in general, they do not have a sizable transportation community. Therefore, they would not be places in which transportation research centers would be successful. Countries like India, China, or the Philippines may have a large number of professionally trained transportation people, but the development status of the country is such that they have not created a real need for advanced and sophisticated expertise. Therefore, an organized transportation research center may not be successful.

3. A POSITIVE THOUGHT ON HOW TO INCORPORATE DEVELOPING COUNTRIES INTO THE GLOBAL TRANSPORTATION RESEARCH COMMUNITY

Up until this point, the authors have argued that it is perhaps unwise and premature to establish transportation centers in developing countries because they do not have the necessary conditions to do so. However, readers should be reminded that a transportation research center in our argument is implied to be a place which is well organized, adequately staffed and conducts research in many and diversified transportation fields. If such transportation research centers are not considered, the authors are very much in favor of incorporating developing countries into the a global transportation research community. The following are more feasible and perhaps more sensible approaches to accomplish this purpose in the authors' opinion.

- a. For countries that have a large number of transportation professionals, but professional activities are not as frequent, it might be desirable to promote the creation of affiliated transportation research centers that paired with transportation research centers in developed countries. The affiliated centers could assist the centers in developed countries to conduct research activities in exchange of funds and/or information.
- b. For developing countries in general, it might also be desirable to promote the creation of smaller, single subject (or a limited subject areas) oriented transportation research units. If the subject(s) is chosen that has local market and needs, the smaller research unit could flourish and may be developed into a full-fledged transportation research center in the future.
- c. Establish a worldwide technology transfer network for developing countries. Currently, the U.S. Federal Highway Administration has established a technology transfer center for Latin America and is in the process of negotiating one with China. The U.S. Federal Highway Administration also has cooperative programs with Arab countries. If these connections could be incorporated into the communication network among the developed countries, it is possible to establish a well-organized technology transfer network involving both developed and developing countries. This network could facilitate information movement between countries. Over time, this information movement can help create the needed transportation professional communities in developing countries. In the long run, transportation research centers will exist in developing countries.

4. CONCLUDING REMARKS

The authors feel very much privileged to have a chance to participate in the discussion of incorporating transportation research in developing countries into the global transportation research spectrum. However, they feel promoting the creation of full-fledged transportation research centers may be premature for most developing countries without an adequate-sized transportation community. For some countries that have a good-sized transportation community, their developing status prevents the community from having an active role in the society. Without a large and active transportation professional community, transportation research centers are unlikely to be viable and successful.

To incorporate transportation research of developing countries into the global research system, the authors suggest that smaller single-subject (or limited subjects) oriented transportation research units should be encouraged in developing countries. For developing countries with a large number of transportation professionals, the authors suggest that developed countries should encourage their transportation centers to create liaison and affiliation relationships with research agencies in developing countries.

Last but not least, the authors believe we should attempt to create a worldwide technology transfer network including the developing countries. Through this network,

we could facilitate an exchange of information and allow developing countries to develop their transportation communities. Given time, a global transportation research community will flourish.

