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Research

Insight in a Quagmire

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STUDIES

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This paper is a story of a search for research that pays off. There is a common assumption that investment in transportation infrastructure brings economic returns. Sometimes those returns are exaggerated; sometimes those returns are double counted; sometimes those returns do not happen; sometimes society is worse off. There is great interest in justifying public infrastructure expenditures in the name of economic development. This paper explores how can we prevent transportation/economic development research from becoming a mound of exaggerated benefit claims by demonstrating how and why we can keep from relegating societal impacts to a sinking bog. The paper recommends research which tells a more accurate story of the linkage between economic development and transportation investment.

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INSIGHT IN A QUAGMIRE: LEVERAGING SOCIETAL FACTORS IN TRANSPORTATION RESEARCH

Final Report

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EXECUTIVE SUMMARY

This paper explores why transportation/economic development research is conducted and what has it taught us. It is an outgrowth of my research project for the Minnesota Department of Transportation (MnDOT) entitled: "The strategic plan for research on transportation/economic policy." MnDOT expressed a dissatisfaction with previous research transportation/economic development research efforts funded by the agency in large part because the policy and investment implications were unclear. My task called for three actions:

1. Review and assess current relevant research being funded by public agencies in Minnesota.
2. Identify and recommend needed studies to fill gaps in knowledge required for policy decisions.
3. Create a framework for evaluating future research proposals in light of current strategic directions established by MnDOT.

Added to this effort was a directive assuring close coordination between the University of Minnesota's Humphrey Institute and the Center for Transportation Studies.

My research follows traditional lines of analysis but adds an emphasis on the need to pay attention to the societal impacts of policy and investment. I urge that transportation researches doing work for MnDOT expand their tool box to include least cost planning and the agency's public involvement process contained in the area transportation partnerships. To support this conclusion I bring G. Edward Schuh's arguments about the economic inefficiencies of current investment practices.

The paper concludes with five recommended actions developed in coordination with the project's technical panel:

1. *Call for research which goes further in adapting and targeting existing economic analysis tools needed to determine least cost planning, net present value, the benefit cost ratio, and/or the internal rate of return.*
2. *Prepare a number of case studies that take into account the community vitality and negative externality factors.*
3. *Since the area transportation partnerships process is in place, we should build upon it.*
4. *The governor should convene a public dialogue about transportation investment in the broader context of the state's economic development strategies.*
5. *MnDOT should invite the formation of a transportation/economic development research consortium made up of academic partners and private research firms.*

These five actions support a more comprehensive understanding of the impact of transportation investments by employing both the scientific analysis of the economists and the story knowledge gained from those who witness and narrate the first hand daily impact of those investments.

INTRODUCTION

In public policy research, there are no certainties. Our knowledge develops by pushing at the margins, by examining the edges, by stepping beyond explored boundaries. Often our search brings us to a rediscovery of old, solid ideas that have long shaped public policy. That is the nature of re-search; our search brings us back again to the basic foundations of human understandings. Our search causes us to expand our inner and our outer margins.

The title of this presentation, "Insight in a Quagmire: Leveraging Societal Factors in Transportation Research," suggests that we are trapped in some kind of bog -- a place where, if we sink, we will experience a darkness that will extinguish us and our efforts. I happen to believe that unless we are willing to step in and become submerged, we will not emerge with the comprehensive understanding necessary to leverage public policy.

I come to this task of writing this paper, a critical analysis of transportation and economic development research, as a student of literature and former legislator. As a student of literature, I cannot resist a story. As a former legislator, I remain curious about the public policy implications in research on the economic impacts of transportation investments and how it is that the public will be affected by those implications. Research needs to be both basic and applied. In order for research to affect decisions, it needs to be relevant, timely, accurate, accessible and believable.

If we are striving to come to a more comprehensive understanding of the impact of transportation investments and have an impact on policy makers, we have much to gain both from the scientific

analysis of the economists and from the story told by those who witness and narrate the first hand daily impact of those investments.[1] "In the first place, scientific knowledge does not represent the totality of knowledge; it has always existed in addition to, and in conflict with, another kind of knowledge, which I will call narrative.... I do not mean to say that narrative knowledge can prevail over science, but its model is related to ideas of internal equilibrium and conviviality next to which contemporary scientific knowledge cuts a poor figure..." (Lyotard, p. 7). If we are looking for ways to fill the gaps in knowledge about our understanding of how transportation investments affect communities and their economies, we need to be open to the paths of both scientific knowledge and narrative knowledge.[2]

Donald Schon makes the case for two paths to knowledge:

> There are those who choose the swampy lowlands. They deliberately involve themselves in messy but crucially important problems and, when asked to describe their methods of inquiry, they speak of experience, trial and error, intuition, and muddling through.
>
> Other professionals opt to the high ground. Hungry for technical rigor, devoted to an image of solid professional competence, or fearful of entering a world in which they feel they do not know what they are doing, they choose to confine themselves to a narrowly technical practice (p. 43).

David Whyte suggests in *The Heart Aroused*, if we want to learn anything, we must be willing to go on a journey to the edge, step in and sink beneath the surface to do battle with darker

forces in order to understand and articulate a fuller comprehension of life's possibilities. We must be willing to live in ambiguity, in uncertainty, in order to discover knowledge new to us. We must, in fact, descend into the quagmire before we gain insight.

Whyte has an illustration of this exploratory journey in his chapter on Beowulf -- the old English story of a trouble shooter who hears that "Hrothgar, the King of Denmark, was suffering predations of Grendel, a diabolical swamp creature" (p. 36). Beowulf shows up in the King's hall to solve Hrothgar's swamp monster problem. He is successful, but not without diving into the swamp. After mulling over the nature of doing research, I have decided that the researcher must also dive into the swamp.[3] The researcher is tied to the human condition that limits all of us: "... human existence is half light and half dark, and our creative possibilities seem strangely linked to that part of us we keep in the dark" (p. 33).

As a researcher, I assure you I have observed that researchers have a tendency to walk around the edge of the swamp in the fullness of daylight and to avoid stepping into the darkness, into the muck. I contend that we will not be able to leverage public policy research unless we first immerse ourselves in the swamp. The swamp we must descend into is the murky waters of discovering how transportation investments impact people's lives. The light of past research has told us the story of how many jobs were created or how incomes were increased. But, research on the economic impact of transportation investments has largely avoided looking at the dark side -- the negative impacts of these investments.

The kind of knowledge that Whyte and his fellow poets draw us to is a different knowledge than that which Jean-Francois Lyotard describes in *The Postmodern Condition.* Lyotard sees

knowledge as "an informational commodity." For the purposes of research, the knowledge for consumption, for computer processing certainly lends itself more to the needs of scientific research than the narrative of the poet. Lyotard asserts that knowledge has "two principal functions .... research and the transmission of acquired learning." Research has already been influenced by cybernetics, the mechanical, systematic cranking out of information. The transmission of knowledge ("acquired learning") has been transformed by "information-processing machines." Again in contrast to the dominant narrative of the poet, Lyotard tells us the knowledge of the present and the future must take the form of "quantities of information:"

> We can predict that anything in the constituted body of knowledge that is not translatable in this way will be abandoned and that the direction of new research will be dictated by the possibility of its eventual results being translatable into computer language. The "producers" and "users" of knowledge must now, and will have to, possess the means of translating into these languages whatever they want to invent or learn. (p. 4)

This transformation of knowledge into a commodity is good news for engineers and those accustomed to processing data. Looking for data in swamps is murky business; it has more often been the task of the poet to put into language our darker human experiences. If researchers can (and they are beginning to) find a way to quantify societal impacts of transportation investments, then these new "commodities" will enhance our understanding and our ability to incorporate those factors into the formula of allocating spending. For now, swamp knowledge is mostly intuitive.

Lastly, transportation researchers talk too much to each other. Extended internal conversations between researchers have led to a distorted impression of and an exaggerated assessment of the extent to which transportation investments shape our society. Transportation is only one of many factors which contribute to both the benefits and the costs of living in society. In addition to sinking into the dark side of transportation investments, we need to further refine the economic analysis tools that will give us a more realistic picture of benefits and costs.

WHY DO WE DO RESEARCH AND WHAT HAS IT TAUGHT US?

Research as a way to get more money

A cynical approach to the analysis of transportation research might tell us that the reason a public agency wants research to be conducted on the economic impacts of transportation investment is get more money from the legislature. "The State spends large amounts of money to enable science to pass itself off as an epic: the State's own credibility is based on that epic, which it uses to obtain the public consent its decision makers need" (Lyotard, p. 28). Lyotard helps to make the case that state agencies will seek researchers who will tell the story that affirms the findings they have selected; they "play by the rules of the narrative game" to legitimate their own behavior, in this case, their transportation investments. Economic development sells; mentioning economic development as a justification for taking action is an assertion that often goes unexamined by law makers. If an agency proves that spending money for transportation infrastructure is beneficial to the public, the legislature may approve higher transportation dedicated taxes. Much quantitative research up to now affirms and often overstates those benefits. Most of the research I have reviewed seldom speaks to negative impacts and primarily tells us that transportation investments have a positive effect on the economy.

Transportation's dark side: a means of extraction

Transportation researchers have not spent a great deal of effort and time asking, what happens to people when public capital is spent? Here is the dark side. Ironically, people from rural America are just awakening to the fact that the rail roads and highways that were so welcome

fifty and a hundred years ago go both ways. On the bright side, those transportation corridors were once a means of bringing people and goods to the hinter lands. On the dark side, those rail lines and roads were also a means of extracting resources -- both the wealth generated and the best educated from the rural areas. The roads led to and from the big cities. Similarly, as access to the suburbs is built, inner city resources are drained.

Transportation research does provide spending direction, but ...

Quantitative research has taught us much. Econometric measurement of what adds material value in a society is a worthwhile research activity. In fact, without such measurement, there would neither be direction for nor accountability for public infrastructure expenditures. Determining net present value of investments is an effective means of establishing economic impact. But we find ourselves in a quagmire when we ignore the impact transportation investments have had on people. The shortcoming in quantitative economic analysis is that by measuring "economic development" separate from community vitality, we ignore part of an investment's impact on the community. We need a broader definition: "Economic development is not the process of creating new facilities; it is the process of stimulating new activity -- by individuals, by small companies, by large companies, by community development corporations, by chambers of commerce, even by local governments."[4]

Strategic planning picks winners and losers

Another research problem may be that past research findings have been used to implement *strategic* planning for transportation investment. The tactics of the strongest prevail in any

strategic effort. In a market driven economy, the greatest strength lies with those who already have the most. If economic development means rewarding those who already are the haves, conducting "strategic planning" may be at odds with efforts to develop equity within communities. Jean-Francois Lyotard adds a further caution: "The very idea of development presupposes a horizon of nondevelopment where, it is assumed, the various areas of competence remain enveloped in the unity of a tradition and are not differentiated according to separate qualifications subject to specific innovations, debates, and inquiries" (p. 19). The implementation of a "development" may be the undoing of an existing vitality. I sense there is a danger that "strategic planning" may be a means of assuring that those who are already winners will continue to win at the expense of those who are already the losers.[5]

Those darn externalities

Research on how community vitality interacts with community development is less quantifiable -- it requires talking to people, it requires assigning values to what has been expressed as unquantifiable. The traditional model for conducting economic development research leaves out the analysis of variables, the externalities, that resist quantification. For example, more jobs may be generated but those jobs may exist far away from the communities where unemployment is the highest.

If researchers bracket transportation investments in isolation from other factors which contribute to an economy, the economic impacts may be measurable, but the findings are distorted. If economic development and transportation infrastructure are seen as components in the life of a community, then researchers should be recommending that before any transportation infrastructure

investments are made, "we should first create the vision of what the region should look like and then develop the flexible, efficient and cost-effective transportation options that fit that vision."[6]

What's needed: Emerging from the dark

Research that creates tools for transportation decision makers to consider both the traditionally defined quantifiable economic variables with those less quantifiable community vitality variables will improve the chances for better investments. Research that tells the whole story of investment impact will advance the opportunity for public policy makers to implement more politically acceptable transportation policy. Knowledge must not be divided into two camps -- that one is the "right" knowledge and other "wrong."

While I am critical of the absence of information about the impact of negative externalities in the economic development equation, I do not believe that transportation economists nor transportation engineers were given the "negative externality" assignment in the first place. New meanings about negative externalities might better be captured in more narrative forms such as case studies. When knowledge about societal impacts is combined with knowledge gained from economists, transportation decision makers will have a better chance to make more equitable investment decisions.

THE PLAYERS

For those unfamiliar with the acronyms and terminology commonly used by folks who live and talk transportation and transportation research in Minnesota, here is a list of some of the key players:

Area Transportation Partnerships (ATP): A public involvement/decision making process which is made up of MnDOT officials meeting periodically with selected local representatives such as area planners, county and city engineers and elected officials. Together, these people review and recommend transportation projects eligible for programming in the state transportation improvement plan required by Congress.

Center for Transportation Studies: An independent research, education and outreach unit within the University of Minnesota. A focal point for strengthening knowledge in transportation, using interdisciplinary approaches that address transportation issues especially through a number of public councils which review and recommend research activities.

Community: People and their environment. The word community or communities is used in contrast with the more traditional terms associated with economic development studies that tend to target specific measurable interests such as jobs created or increased wages.

David Forkenbrock: Director of the Public Policy Center of the University of Iowa, 1994 Chair of Transportation Research Board's Committee on Transportation and Economic Development, author, teacher and researcher. Transportation and economic development policy guru.

Federal Highway Administration (FHWA): The federal agency which coordinates highway planning and policy efforts among the states; FHWA serves as a fiscal agent and overseer of research projects funded by Congress.

Intermodal Surface Transportation Efficiency Act (ISTEA): Signed by President Bush in 1991, this is the federal transportation legislation which guides federal, state and local policy makers beyond the era of building the interstate highway system.

Minnesota Department of Transportation (MnDOT): The state agency responsible for planning, designing, building and maintaining of Minnesota's highways, and holding various responsibilities regarding airports, waterways, rail, pedestrians, bike riders, and metropolitan and rural transit.

State and Local Policy Program: A unit within the Hubert H. Humphrey Institute of Public Affairs of the University of Minnesota. The program focuses upon improving state and local policy by bringing together the knowledge and research resources of the public and private sectors to assist public and private leaders to address state and local issues especially through a consultation process. Primary research areas include transportation and the community; regional economic development; science and technology policy; and government finance and productivity.

Technical panel: Fifteen to twenty people respected for their knowledge about transportation issues who are invited to guide a principal and his or her research project.

Transportation Research Board (TRB): A unit of the National Research Council serving as an independent advisor to the federal government on scientific and technical questions of national importance. Volunteer advisory committees meet twice annually to review and recommend research related to transportation.

DESCRIPTION OF MY RESEARCH PROJECT

Background

In 1991, prior to the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA), the United States Congress funded a grant to the Federal Highway Administration (FHWA) which enabled the State and Local Policy Program of the University of Minnesota's Hubert H. Humphrey Institute of Public Affairs, together with the Center for Transportation Studies, to conduct a multi-state project to explore transportation and infrastructure finance policy. The project is entitled *Transportation and Economic Development in the Upper Midwest: New Models for Federal, State and Local Cooperation in Infrastructure Investment.* The timing of the project created an opportunity for the five states involved--Iowa, Minnesota, Montana and North and South Dakota--to inform the provisions of ISTEA.

Led by the Humphrey Institute and its academic partners, a series of consultations were held in each state with representatives of the Federal Highway Administration, Congressional staff members, state transportation officials, state legislators and legislative staff, United States and Canadian transportation industry representatives, shippers, government officials representing agencies other than departments of transportation, academic researchers, tribal representatives, representatives from business and agriculture and other citizens.

PRINCIPAL FINDINGS

- Strategic investment in efficient transportation systems brings productive returns.
- The greatest barriers to productivity are institutional and political; therefore multi-state regional cooperation and collaboration are necessary to having a sustainable and prosperous economy.

Transportation and Economic Development in the Upper Midwest
Humphrey Institute

The principal findings and policy recommendations which emerged from the consultation process were closely linked to work of researchers reported in a research symposium on transportation infrastructure as public investment. It was this research activity for the Federal Highway Administration and Congress that led to my contract with MnDOT to perform this research project's evaluation of transportation/ economic development research. A re-examination of the principle findings of that project reveals a strong bias toward economic efficiency and little emphasis on equity; investment costs to society were seen as externalities. A key factor was missing from the research equation.

The strategic plan for research on transportation/economic policy

My research task for the Minnesota Department of Transportation was a further exploration of implications of the recommendations of the Humphrey Institute's State and Local Policy Program's project *Transportation and Economic Development in the Upper Midwest.* MnDOT's Office of Research Administration's evaluation of previous economic development research performed by researchers at the University and elsewhere was:

1. The research on the economic impact of transportation spending is inconclusive.

2. MnDOT is not satisfied with the results of the economic development research to date and wants to spend its economic development research money on research efforts that will give the agency clearer direction regarding the economic consequences of its transportation investments.

As a result, the University of Minnesota's Humphrey Institute, with myself as the principle, was asked to prepare "the strategic plan for research on transportation-economic policy issues" in Minnesota. The research project called for these actions:

1. Review and assess current relevant research being funded by public agencies in Minnesota.

2. Identify and recommend needed studies to fill gaps in knowledge required for policy decisions.

3. Create a framework for evaluating future research proposals in light of current strategic directions established by MnDOT.

1. Review and assess

Under the guidance of a panel of transportation professionals from the private and public sector, I have reviewed a range of transportation and economic development research literature and

activities. Transportation spending advocates might view my findings as heretical. My review of the literature and my listening and observations tell me that most transportation spending does not create economic development, or if it does, its positive effects are small.

I have come to realize that transportation investments are also a means of extracting resources from communities. The road which was built to provide access goes both ways. As much of rural Minnesota becomes depopulated, the population which remains is largely much older and has less formal education. The infrastructure of those communities has become the object of disinvestment strategies.

Contrary to my indoctrination by transportation spending boosterism, and in support of my own analysis of the theoretical limitation of most of the research I have read, I have come to the conclusion that spending money on transportation infrastructure is often not economic development. Transportation spending is sometimes a mere transfer of funds from a broader public to an individual town or business. This finding comes as a shock to some one who served for ten years on the Minnesota Senate's Transportation Committee where spending money on the transportation infrastructure **was** *economic development* -- no ifs, ands or buts. Voters and politicians were certain of it.

My research at the University has taught me that when transportation infrastructure spending is a part of an overall strategy to enhance the lives of all who live in a community, then, and only then can transportation investments be a key element in the economic-vitality equation.

Literature review: Four traditional approaches

A review of existing literature on transportation and economic development reveals these categories of research: aggregate models and national-level relationships; statistical and quasi-experimental approaches; input-output models; and industrial location analyses.[7]

David Forkenbrock comments that "almost no research has focused on when and why investing in better access can actually contribute to increases in income at the local level. Likewise, we know of no study that has systematically evaluated a state-level program intended to facilitate local economic development" (1990, p. 31). Forkenbrock's later study, *Transportation and Iowa's Economic Future,* sets forth a "state-level program."

Aggregate models and national-level relationships

Under this category of study, researchers have generally used "production function" approaches which have shown a "generally positive" effect on the economy. The studies are limited because they are drawn upon assumptions about productivity that are difficult to defend -- for example, that "an increase in aggregate output can result only from an increase in capital or labor employed, unless productivity is assumed to rise exogenously"(1990, p. 32). "Macro-level models are of limited use to state-level decision-makers" because they are "simplistic," they are based upon past investments that may not be related to today, and the studies are of "little practical use at the state or local-level" (p. 32).

David Aschauer's studies (1988, 1989)[8] assert that "public sector capital" can boost productivity by 14.0 to 14.8 percent. These numbers make road builders and elected official/transportation advocates happy. But research critics like Henry Aaron say that Aschauer "has greatly exaggerated its (public capital investment) quantitative importance."[9] Locally, Yorgos

Stephanedes of the University of Minnesota's Department of Civil Engineering prepared a time-series study in 1989 entitled "Transportation and Economic Development: Transportation and the Minnesota Economy." I found that this study is widely referred to by the State's Department of Trade and Economic Development,[10] but has had little attention within transportation discussions and research that I am familiar with. The study asserts that:

> Inadequate transportation investment may hamper the effectiveness of development policies and, further, may encourage economic decline. Conversely, effective transportation projects could improve the competitive position of a region and induce or accelerate its economic development. In order to aid governmental decision makers in estimating the possible impacts of transportation investment on economic development, the current project was undertaken.[11]

The study's focus was upon northeastern Minnesota, but it is intended to have statewide application. This time series study by Stephanedes shows that the road does go both ways; expanded access generally means that larger communities are likely gain at the expense of smaller communities.

Statistical and quasi-experimental approaches

In this type of research, control groups are created after transportation projects are in place. Forkenbrock states:

> Quasi-experimental approaches can be criticized on several grounds. First, the selection of control treatment groups often is difficult, and the results are highly

> sensitive to the choice made. Second, many studies use only a few variables to explain the differing growth rate of each group.... Finally, any relationships found by these studies is mainly one of association, not causation. (1990)

The Willmar area regional development commission prepared a recent comparison of economic activity along State Highway 169 and State Highway 12. The study indicates that expansion of capacity of Highway 169 to four lanes led to economic gains in the form of new jobs created in the towns along the road. The study successfully proves that job growth did occur, but it is questionable to assume that the four lane expansion was the primary reason for communities along Highway 169 adding more jobs than those along Highway 12. Highway 12 advocates are fond of the results that suggest that they too should have a four lane highway.[12]

Econometric approaches have two shortcomings. "First, establishing causality between investment and development is still elusive." We cannot be certain whether highways cause growth or growth leads to additional highways. Second, these studies tend to use "only a few variables to explain growth" (1990, p. 36).

Input-output models

Input-output models use "past patterns of industrial and geographic trade to forecast the effects of the policy decisions" (p. 37). The real strength of the input-output models is "their ability to show the effects of changing transportation costs" (p. 37). Most of the transportation and economic development studies which have been funded by MnDOT are research grounded in input-output models.

David Forkenbrock describes the difficulties with input-output studies:

> Perhaps of greatest concern is that the models are only mechanisms for gauging the magnitudes of impacts; they provide no real insight into why, for example, lower transportation costs due to highway investments lead to economic growth in the affected area. Because linear relationships are assumed, input-output models typically are ill-equipped to distinguish between the effects of an upgraded highway on a small community versus a larger metropolitan area. The spacial reordering that may occur, whereby smaller places may actually lose jobs to larger areas as a result of the better highway, is not reflected in the results of the input-output models. (1990, p. 38)

Investment strategies based upon the results of these studies need a broader context. A primary example of an input-output study is the work of David Braslau, Candace Campbell and Wilbur Maki; "The Changing Structure of Local Economies: Implications for Public and Private Investment in Transportation Infrastructure in the Upper Midwest" was a paper developed as a part of a larger research input-output study.[13] The paper is rich in trade flow analysis as it relates to four commodities -- grain, printed matter, computers and transportation equipment. The summary of findings states that the transportation industry "is undergoing significant changes nationally and within the Upper Midwest region" Major shifts are:

> 1) greater use of trucking and a move to intermodal and multi-modal service, 2) increasing use of new data and communications technologies to manage shipments from supplier to producer to market, 3) acceptable delivery times are

> shortening resulting in growing use of air freight and increasing substitution of electronic media and telecommunications for delivery in printing and publishing industry. (p. 62)

These are trends that may determine what MnDOT or any agency or private interest will do with setting spending priorities. Unfortunately, because the scope of the data used for the study is necessarily limited, it is very difficult to make broad spending decisions based on the recommendations that come from this input-output study or any other such study. Forkenbrock makes the case for great skepticism in decisions based upon the findings which emerge from this methodology: "Input-output models show which industries are likely to benefit by lower transportation costs, but they do not specify what portions of increases in employment or value added are offset by losses elsewhere" (p. 39). Or as one of my technical panel members said about this input-output study, "If you are looking for the pony in the pile, it isn't there."

There is too much left out of consideration from the typical input/out model: "The decision makers, however, attempt to manage these clouds of sociality according to input/output matrices, following a logic which implies that their elements are commensurable and that the whole is determinable" (Lyotard, p. xxiv). Did the transportation economists who performed the research for MnDOT indicate this potential shortcoming up front? Lyotard argues that there are troublesome consequences. "They allocate our lives for the growth of power. In matters of social justice and of scientific truth alike, the legitimation of that power is based on its optimizing the system's performance -- efficiency. The application to all our games necessarily entails a certain level of terror, whether soft or hard: be operational (that is commensurable) or disappear" (Lyotard, p. xxiv). The Humphrey Institute's study on "Transportation and Economic

Development in the Upper Midwest" puts forth efficiency and productivity as its top recommendation for transportation agencies to implement. The "clouds of sociality" do not come off well in the input/output models. If certain communities or studies of communities do not play by the predetermined rules, they are in a state of "terror" or dismissed from the "productivity" game (p. 63).

If "performativity" is the criterion of acceptance, "performativity is defined by an input/output ratio." There are certain presuppositions that may not match reality: the system is "stable," the system follows a "regular 'path'" that makes "it possible to express as a continuous function possessing a derivative, so that an accurate prediction of the output can be made" (p. 54). Absent societal impacts, input-output models are distorted; investments which ignore those negative impacts could be disastrous for some communities.

Industrial location analyses

The importance of highway access in industrial location decisions is an ongoing object of study. Quality of labor, climate, proximity to markets, living environment, proximity to research universities and a number of other factors tend to find their way to the top of the "reasons why we located here" list. Forkenbrock (p. 39) and others who have presented at TRB gatherings have stated that the role of transportation is not likely to be sufficiently dominant to establish a causal relationship in the location decision. Better highways "will not foster economic growth if other critical factors are not present" (p. 39). Forkenbrock adds:

> Perhaps the most useful insight comes from Mohring (1976) who argued that transportation investments should be judged only on the transportation cost savings they bring, not on associated land value changes or other effects (p. 39).

Each of the four categories of research has short comings. Economic research which does not include societal factors will lead to transportation investment decisions which suffer from gaps in knowledge.

2. Identify and recommend needed studies to fill gaps in knowledge

This research project has been a two year process of defining the "right" research questions that will lead to a more accurate picture of when transportation spending is merely a transfer from one pocket to another, and when investments are truly investments. When all economic benefits are seen as equal, there may be times when transportation decision makers will need to determine what is the most desirable economic transfer.

The project's technical panel adopted a criterion developed by David Forkenbrock, originating with Herb Mohring[14]: **Transportation investment can contribute to economic development only to the extent that it promises to reduce the transportation costs which we would otherwise incur. Redistribution of benefits are just that; they are not net contributions to economic growth.** When Forkenbrock presented to the project's technical panel, he put forward five forms of cost savings: safety improvements, reduced travel time, lower inventory and production costs, more efficient logistical patterns and reduced air or noise pollution. The following are examples of research problem statements considered by the panel:

RURAL

A. What is likely to happen to infrastructure needs in rural counties suffering from population loss? What should happen to transportation investment? Would investment in telecommunication and air services be smarter than trying to preserve every state road that is out there?

B. Will there be a cost savings if rural highway investments are shifted to linking regional market centers by constructing super-twos[15] rather than trying to maintain the entire state-funded rural trunk highway system?

METROPOLITAN

C. What is happening to land values and the economy in the southwest metro area of the Twin Cities as a result of improved and proposed transportation facilities? How can those values be captured for reinvestment in the infrastructure? Should the values be captured?

D. What costs are imposed upon the inner city and the suburbs as corridors for single occupancy vehicles are extended further and further into the urban fringe and the rural areas which surround the metro area?

STATEWIDE

E. National Cooperative Highway Research Program (NCHRP) report #362, "Roadway widths for low-traffic-volume roads," states that "designs for new construction and major reconstruction of low-traffic-volume roadways may be excessive." Forkenbrock, Foster and Pogue's "Safety and Highway Investment" espouses the concept of "willingness to pay" as a criterion for determining

safety standards. Where are we under-building and where are we over-building? When we have a fixed or diminishing pot of revenues to invest in roadways, should we move on in tiny increments with costly high standards, or do we re-assess standards and needs? What are the financial and societal impacts of doing business as usual?

F. Effective January 1, 1995, Congress ended all state economic motor carrier regulations.[16] If our motor carrier laws are one of the greatest barriers to productivity in moving goods in Minnesota, should not this de-regulation enhance our state's economy? Or does economic regulation enhance our state's economy?

A strategic plan for research on transportation and economic policy must call for research which includes the five Forkenbrock factors, plus a means of calculating the impact of societal factors

3. Create a framework for evaluating future research proposals in light of current strategic directions established by MnDOT.

Current strategic directions

In order to achieve Minnesota's strategic vision for transportation, the Minnesota Statewide Transportation Plan was prepared by a MnDOT team who met for 10 months and selected three strategic directions from a list of ten strategic directions: access, intermodal and values.[17] Future research proposals that support these strategic directions may be able to build on reports and research already in place. However, before I formulate research on transportation's impact on

the economy, I think it is necessary to first critically analyze the contents of these strategic directions.

The strategic direction on access states: *Minnesota's transportation system should provide a minimum level of critical access to goods and services for all; sustain and enhance regional centers; exploit the strength and utility of all modes; and maximize total access within given resource constraints. The strategic direction suggests that MnDOT must change its role from reactive implementor to proactive shaper* (p. 4-1). The Citizens League report on "Effective Transit: Access to Jobs and Services" offers a caution that would be helpful when framing this strategic direction: there is a need "for a vision for livable communities that informs the development of transportation policies and infrastructure.... (W)e should first create the vision of what the region should look like and then develop the flexible, efficient and cost-effective transportation options that fit that vision" (p. 1).

An example of a decision that shows MnDOT as a "reactive implementor" is their role in creating the Mall of America. Studies were called for and brought forward to the legislature and the public to demonstrate widespread economic benefit. In order to demonstrate the wisdom of building the Mall of America, developers were able to call forth proof of the need for investment. As evidence of historical precedent, Lyotard refers to Descartes' call for laboratory funds: "No money, no proof -- and that means no verification of statements and no truth. The games of scientific language become the games of the rich, in which whoever is wealthiest has the best chance of being right. An equation between wealth, efficiency, and truth is thus established" (p. 45).

Here we see that setting aside funds from the entire construction budget to benefit one project may create disadvantages elsewhere -- witness the creation of the highway and transit access system to the Mall of America. John Adams and Barbara VanDrasek of the University of Minnesota have commented:

> The competitive threat that the megamall poses to the downtowns and to other suburban malls is difficult to assess.... Some expect at least one quarter of the mall's business to be drawn from downtown St. Paul, Mendota Heights, Eagan, and Bloomington's other retailers, and about 5 per cent from downtown Minneapolis. Another 25 percent from the remainder of the seven-county metropolitan area[18]

To build this mall, millions of dollars from the overall construction budget were concentrated into one economic development project in one part of the Twin Cities. The Mall has attracted out-of-state shoppers that have added to the overall economy. But, the high number of closed store fronts in downtown St. Paul and Minneapolis may attest to the fact that providing easy access to one part of the metropolitan area was an economic transfer for those certain investors. A systems or network analysis of economic development tells us that our transportation system is a network. The State of Minnesota, in order to attract the Mall's investors, transferred funds from other construction projects to create an economic enterprise that favors those who have the most capital to invest.

When policy makers, pressured by developers, tell MnDOT what to build, MnDOT is a "reactive implementor." Before exploring the role of being a "proactive shaper," MnDOT needs to ask the

question: Should and do transportation investment decisions drive community development? Would it not be more appropriate to have a metropolitan wide agency, such as the Metropolitan Council, taking the lead on shaping the vision for access to jobs, to services and to the total life of the community? The Citizens League report on "Effective Transit: Access to Jobs and Services" asserts that MnDOT's role as a " proactive shaper" must be taken in concert with others who shape the direction of our communities.

The strategic direction on intermodal states: *Minnesota will build partnerships to develop an integrated, multimodal transportation system which provides for the efficient movement of goods and people* (p. 4-2). Susan Binder from FHWA's Office of Policy presents an excellent case for a system approach to transportation investment: "I put out a challenge to you, given the interdisciplinary nature of your program, to consider encouraging those who have thought about networks (but not in terms of the highway program or the transportation infrastructure) to apply those thought processes to transportation network productivity."[19]

If we think of transportation as a system, a network, then we are less likely to make broad, exaggerated claims about improvements to any one part of the system. The Mall of America decision supports Binder's assertion. But we also know that the entire Intermodal Surface Transportation and Efficiency Act initiative has moved transportation decision making into a network-systems framework. Research that supports that legislative initiative will make for smarter transportation decisions. That research must be conducted in the context of the knowledge that each transportation mode has a different economic conceptual basis.

The strategic direction on values states: *MnDOT needs to develop meaningful transportation alternatives that link and balance personal, social, economic and environmental issues* (p. 4-2). In 1993, MnDOT's Office of Strategic Initiatives hosted a causal loop/system thinking project which identified the necessity of learning more about this linkage. Participants in this systems thinking effort discovered that MnDOT was ill prepared to take on many of the societal issues that have come to the forefront of transportation decision making. In February of 1995, MnDOT acted on the findings of that 1993 effort by funding "A Proposal to Create a Dialogue between MnDOT and Non-traditional Transportation Stakeholders." Before MnDOT can "develop meaningful transportation alternatives," the agency must first listen to those who have traditionally been excluded from the process.

The traditional winners in the stakeholder listening process, like the Mall of America proponents, have made off like bandits. The non-traditional stakeholders have been left out. This proposal for a dialogue in effect admits that the past efforts have been a failure; but from this failure, MnDOT will learn how to involve those who have least benefitted from past investment decisions.

Create a framework for evaluating future research proposals: Using A Primer

Center for Transportation Studies Acting Director and member of my project's technical panel, Robert Johns, sent me "A Primer on Transportation Investment and Economic Development" prepared for the Transportation Association of Canada. There are likely many how-to-do-it transportation investment guides, but I found this document to be clearly written and

understandable for a non-economist. It summarizes the relationship between transportation infrastructure and the rate of economic growth. It also offers an evaluation framework for transportation investments to be assessed in the context of economic growth. The philosophy of the Primer's writer corresponds to Susan Binder's and David Forkenbrock's suggested guidelines: "Investment in transportation infrastructure combines with other investments to provide a key boost to the nation's economy.... Improved infrastructure lowers transportation costs and positively impacts the competitiveness of Canadian goods in both domestic and foreign markets"(pp. 1-2).[20]

The Primer's description of the specific role of public investment in transportation follows nicely the same evaluative criteria we have found in the writings of Forkenbrock et al:

> "Public works are fundamental and necessary components of the nation's total capital stock. Chosen and planned carefully, transportation investments can generate time savings and reductions in vehicle operating expenses that yield productivity and safety gains well in excess of the investment and environmental costs" (p. 6).

The Primer goes on:

> In the private sector, profit seeking market forces help executives and decision makers ensure that investment will be good investment. In the public sector, where market forces are weak and objectives multi-faceted, executives and decision makers need to make special efforts to ensure transportation investments

> yield productive gains to the economy and that the value of these gains exceed the costs of achieving them (p. 6)

Public transportation decision makers are being called upon to produce "economic development results." Formerly, providing access was enough to satisfy critics -- the added measurement of productivity has opened a relatively new field of transportation research. The Transportation Research Board, an arm of the National Research Council, only recently added a Transportation and Economic Development Committee. Because economic development research is a relatively new field of research, there is a quagmire nature about this research. There is a need to more fully develop the epistemological grounding for economic development research -- the application of economic theory alone leaves too much out of the equation.

I believe there is an unexamined public assumption that economic development "just happens" when transportation investments occur. For people fond of having transportation revenues pour in and spent on concrete, pavement or other facilities, that assumption is welcome. However, for public figures, under increasing public scrutiny, there must be an accounting for the impact of transportation spending.

The Primer offers two challenges to the decision makers: The first is to ensure that objectives are "properly targeted." "Policies should not aim to influence aspects of the economy over which transportation has little effect or to achieve aims better served by non transportation initiatives." Secondly,

> (T)he executive must ensure transportation policy and investment opportunities are appraised, quantified and qualified through methodologies appropriate to the

> objectives at hand. Externalities, both positive and negative, must be explicitly identified in order to estimate the dollar value of the project revenues or required subsidies relative to the initial goals and objectives of the project (p. 6).

Too often employment or income gains are used as a measure of investment productivity. In fact, research papers are still being delivered at TRB to show employment or income gains. More in-depth investigation of these investments generally show little impact in the bigger economic picture; in fact, one region often gains at the expense of another. Trouble enters the scene at this point -- have we now dispelled the myth of economic development? Does this mean that economic development does not follow transportation investment? No, but we learn that we must look for new means of measurement of productivity. These new analytic tools for "growth testing" are now being developed.

> Growth, whether defined in terms of productivity, gross output or the standard of living, can only occur if more value is put into the economy than is taken out (spent).... An appropriate methodology to assess this value is discounting benefit and cost streams to ascertain the net benefit of a proposed project (p. 9).

Three Investment Decision Criteria

The Primer suggests that there are three decision criteria for investment decision making: net present value (NPV), the benefit cost ratio (B/C), and the internal rate of return (IRR).

> The net present value test permits decision makers to discern whether transportation policies and investments make a worthwhile contribution to

productivity and economic growth. This requires the use of a procedure called "discounting" to account for the significance of the time value of money.

To establish present value, there is consideration of inflation plus risk premiums, long term borrowing rates, or social opportunity costs. "The social opportunity cost is the rate of return that funds utilized in the public sector could have earned if the funds were left in the private sector and probably represents the best choice for analyzing public sector projects. The net present value is the summation of the costs and benefits stream (p. 11). The Primer defines Benefit Cost Ratio "as the present value of benefits over the present value of costs expressed as a ratio." IRR indicates "the extent to which the expected return on investment exceeds or falls short of the minimum-required rate of return." An application of a combination of these measures of productivity and economic growth creates a decision matrix (see Table I).

Table I

Key Measures of Productivity and Economic Growth		
Measure of Worth	**Definition**	**Interpretation**
Net Present Value	Present-day value of benefits minus present-day value of costs	NPV greater than zero means project is economically efficient. Projects are ranked according to NPV
Internal Rate of Return	The discount rate at which NPV=0	Rate of return should exceed pre-set hurdle rate to qualify for consideration.
Benefit-Cost Ratio	Present value of benefits divide by the present value of cost.	A ratio greater than one means that the project qualifies for consideration.
Transportation Association of Canada. *Primer.* p. 13.		

Investment analysis should also include optimal timing -- when is it economically appropriate to invest? (See Table II)

Table II

Key Measures of Productivity and Economic Growth		
Measures of Timing	**Definition**	**Interpretation**
First-Year Benefit	Benefits in the first year after construction divided by costs to date, including interest paid during construction, expressed as a percent	A ratio equal to the hurdle rate means the project is optimally timed. A ratio below the hurdle rate means the project is premature. A ratio above the hurdle rate means the project is overdue.
Pay-Back Period	Number of years until capital recouped through the flow of benefits	A short pay-back period means less risk.
Transportation Association of Canada. *Primer.* p. 13.		

> Transportation executives need to be aware that the optimal year to commission an investment is the start-date that maximizes the project's net present value. Alternatively, the first year benefit ratio, defined as the sum of all benefits accruing after construction divided by all costs incurred to date including the interest paid during the construction period, expressed as a percent, could be used to indicate timing. If the value is more than the minimum required rate of return, then the project could be considered overdue (p. 16).

Transportation agency officials and legislators need to know when transportation funds should be spent in order to have maximum benefit. These decision makers must have in mind both the measure of worth (Table I) and the measure of timing (Table II).

Find the externalities: The swamp monster lurks in the shadows

The traditional forms of economic analyses, net present value, benefit cost ratio and internal rate of return are essential to discovering gaps in knowledge about investments. However, externalities have mysterious and transcendent powers. An economist can prepare all the rate of return computations for a project decision and the transportation decision maker can still be blind-sided. The *Primer on Transportation Investment and Economic Development* recommends an additional tool, shadow pricing, a technique commonly used to attach a monetary value to non-monetary externality. Where monetary values cannot be reasonably assigned, the impact should be quantified in other units (p. 14). I have been cautioned that the Primer's use of "shadow pricing" is not the generally accepted economist's interpretation of the meaning of the term. Herb Mohring provided me with the following economists' definition of "shadow pricing" taken from *Public Sector Economics*: "The need for shadow pricing arises when market prices do not reflect social values. A simple example of this occurs when a project uses an input purchased on a distorted market where the distortion takes the form of a divergence between the demand price and the marginal cost." The authors go on to provide three applications: Shadow price of labor, shadow price of foreign exchange, and the social opportunity cost of public funds (pp. 198-205). The Primer allows for a broader interpretation of shadow pricing; behind the shadows and beyond the usual margins which define the boundaries of what economists allow in the equations, we can search for those factors formerly dismissed.

Because transportation decision makers are typically engineers, they are often uncomfortable assigning any form of numerical value to what is not in the traditional construction formulae. The term "shadow pricing" is an affirmation of the need to look beyond and beneath where researchers have traditionally explored.

In today's political climate, it is those often ignored marginal forces that will trigger the failure of a project. MnDOT has learned a lesson from the reaction to its proposal to expand I-35W leading into downtown Minneapolis from the southern suburbs. The neighborhood communities along the way that would be affected by the expansion of the roadway have been a large part of the effort to bring the project to a halt. MnDOT has learned that it is essential to go through computations of all the components that must be valued in planning a project. A quagmire is created when the externalities are assigned a value of zero. It is essential to involve the public in the discovery of the existence of and the impact of externalities. In light of MnDOT's strategic directions, a framework for evaluating future research proposals must include a means of bringing the impact of societal factors to the equation.

An Additional Criterion: Will the public buy it?

In addition to net present value, benefit cost ratios, internal rate of return, and shadow pricing forms of analyses, I would add another criterion for evaluating investments -- Does this research help to enhance the public's understanding of transportation investments? Will researchers, and the public agencies which sponsor research, be able to reassure the public that all relevant factors were considered in order to make a sound transportation investment? I do not believe the public expectations have been fully met. As a reformed policy maker who was made to answer to constituents at the polls, I believe transportation decision makers need to add an additional tool

to the economic development analysis tool box. Agencies need to talk and listen to the public; hold extensive public dialogues with people to determine their expectations of what adds value to their lives, to their community. Policy makers are waiting for researchers to design the tools which will translate those public expectations into quantifiable factors to fed into the equity equation.

> "This way of inquiring into sociopolitical legitimacy combines with the new scientific attitude: the name of the hero is the people, the sign of legitimacy is the people's consensus, and their mode of creating norms is deliberation. The notion of progress is a necessary outgrowth of this. It represents nothing other than the movement by which knowledge is presumed to accumulate -- but this movement is extended to the new sociopolitical subject. The people debate among themselves about what is just and unjust in the same way that the scientific community debates about what is true or false..." (Lyotard, p. 30).

In order to legitimate its actions, MnDOT has turned to a process of involving more of the public in its investment policies. A number of traditional agency employees have raised great concern about this dangerous expansion of decision making; however, because federal law (ISTEA) requires a broadening of the decision making process; the agency is left with little choice. Generally, the ATP process is dominated by transportation engineers and transportation planners, most investment decisions go unquestioned. Critics from within MnDOT have said that the ATP process is a rubber stamp legitimation of what would happen anyway.

MnDOT's most recent dialogue effort, "A Proposal to Create a Dialogue between MnDOT and Non-traditional Transportation Stakeholders," is an effort that may overcome years of neglect and may reap political approval. Internally, traditional pre-project planning leaders will likely resist this dialogue -- to say that it is necessary to conduct this research is to admit that past procedures have been insufficient, that past efforts were a failure.

However, if the agency does not involve the public in its economic development research, transportation investments will be made with only a part of the necessary decision making information. For an agency traditionally led by engineers who make their living by exact quantifications, public dialogue and outreach is messy business. It's swamp work.

Least cost planning: a step from the quagmire

Transportation decision makers, urged on by ISTEA, are awakening to the need to involve the public in the investment process. The Institute for Transportation and the Environment located in Seattle, Washington has developed a public investment tool called least cost planning:

> A comprehensive, technically consistent planning method that provides an economic framework to assess the cost-effectiveness of all transportation modes and management strategies, while taking into account all societal costs.[21]

This planning method operates in a personal computer and "weighs the benefits and costs of a large number of transportation options" by including both supply and demand and an option's "effect on the baseline cost of the surface transportation system over a 30 year planning period." The model allows for its users to calculate "the net social benefit of each option measured in

dollars" and future dollars "are discounted to take into account the higher value of present investments" (p. iii). The least cost planning method, as applied in Washington, is directed at new construction, at capacity expansion. This method of analysis needs to be modified to meet a "preservation" investment option for rural areas with declining populations and states facing funding shortages. Because it attempts to bring "all societal costs" to the table, it goes beyond the margins of traditional benefit-cost methodologies.

This least cost planning prototype suggests that useful knowledge is knowledge that is accessible to the public when the "transmission of acquired learning" takes the form of quantities of information used to predict that anything in the constituted body of knowledge that is not translatable into computer language will be abandoned (Lyotard). The least cost planning model does allow for "knowledge" about societal factors to become "computer language," and therefore legitimate (Lyotard, p. 4).

The fact that least cost planning can be performed on a personal computer makes it marketable to public consumption and increases the probability of public acceptance that the model will deliver knowledge which will lead to greater "justice" in transportation investments (p. 67). The least cost planning method is a means of calculating "narrative knowledge" so that it can be combined with the traditionally accepted "scientific knowledge."

ATP process: building societal factors into transportation programming

MnDOT, in 1993, initiated its own public involvement/decision making process called the area transportation partnerships (ATP). The ATP process is a means of involving transportation stakeholders in picking actual transportation projects. MnDOT officials, together with elected

representatives of local communities, engineers from local governments and planning professionals who serve regional organizations, look over project candidates, then evaluate those projects in the light of criteria that include the traditional technical concerns like traffic characteristics and pavement or bridge condition. A new dimension, community or "regional" has been added to the equation; this newest dimension is a formalized means of assigning value to societal factors as a part of the decision making criteria (See attached Exhibit I).

I have observed in one MnDOT District, in the Willmar area, that the decision makers have added to their criteria "regional significance" which includes societal and economic factors such as agricultural and commercial activities; tourism; growth factors -- is the area growing? health, social and environmental factors; and intermodal access.

The Willmar District ATP process assigns a value of two thirds percent to the technical or engineering factors and one third percent to societal factors when calculating the overall total score. On a regular basis, people with different concerns, but common interests in transportation, sit together and have a discussion about transportation investments. It is this process of dialogue that builds MnDOT's overall State Transportation Improvement Program (STIP). Research that enhances the ability to take into account those formerly unquantified transportation variables -- those externalities -- will be research that will answer the questions about how transportation will contribute to community vitality. It would seem that the least cost planning project of the Puget Sound is a public participation decision making model that may help to advance the goals of the ATP process.

A CASE FOR ASSIGNING VALUE TO COMMUNITY FACTORS

The greatest gaps in knowledge come from the dark and unexplored side of research. We know that economic development efforts can tip the scales of economic advantage and disadvantage. But we have much more to learn about how and why these inequities and inefficiencies occur.

G. Edward Schuh, Dean of the Humphrey Institute, in his second annual report to the University of Minnesota's Rural Development Council, describes the migratory process of capital:

> In a sense, what the migratory process does is to take capital from poor areas and give it to the higher-income urban centers. That is hardly the way to encourage or promote the development of economic activities that would help raise the incomes of rural people (p. 6).[22]

We might say that there is also a migratory process from inner city neighborhoods to suburban areas, a process of extraction which is enhanced by the transportation system. Schuh adds:

> There are large subsidies -- both implicit and explicit -- for commuting from residences to places of employment.... In addition, the accumulation of people and economic activities in large urban centers imposes significant negative externalities on those centers. These externalities are reflected in traffic congestion and the loss of time in moving from one place to another. They are also reflected in pollution that has its own costs (p. 6).

Unless researchers examine and account for the broader impacts of transportation investments, we will miss the fact that "negative externalities sacrifice higher rates of economic growth and cause per capita incomes to be lower" (p. 6) in metropolitan and rural settings. Dr. Schuh recommends:

> In effect, what is needed is a comprehensive approach to the problem of community and economic development, one that views it in its larger context and which considers all the multiple forces at work (p. 7).

Researchers must observe all the "multiple forces," including those submerged, when estimating the impact of transportation investments, including the swamp of negative externalities.

In order to observe all the forces at work in transportation and economic development research, researchers must reach for opportunities to collaborate with those within their own institutions, those in other academic and governmental institutions, and those researchers in the private sector. C. Michael Walton's 1995 TRB paper, "Deployment of Transportation Research: An Enterprise in Transition," makes the case:

> In today's environment, knowledge is viewed as the new strategic resource. Knowledge-based technology linked with global markets suggest the need for collaboration and cooperation on many fronts and on an international scale. It has been noted that "collaboration not separation" leads to economic growth... (p. 22)

Teamwork can improve the quality of investment decisions.[23]

CONCLUSION

State transportation agencies have rewarded transportation/economic development researchers who have kept them out of the swamp. These agencies have an affinity for researchers who tell them what the agencies want to hear. The general assumption has been, if we build it, benefits will come. Therefore, there has been very little research done by transportation researchers on the negative economic impacts of transportation investments. In addition to researchers who are traditional economists, we need researchers familiar with public dialogue and researchers who can bring community values to the equation.

Based on the findings of this project, I have asked the technical panel which helped to guide this project to recommend the following five actions:

1. *Call for research which goes further in adapting the economic analysis tools needed to determine least cost planning, net present value, the benefit cost ratio, and/or the internal rate of return. We need to learn the art and skill of making better use of the tools we have -- so that MnDOT and other transportation agencies can make smarter spending decisions. We need to have a clearer picture of how much transportation actually contributes to the overall equation of what makes for a healthy community.*

2. *Prepare a number of case studies which push the margins of existing tools to take into account the community vitality and negative externality factors. These case studies should not just re-confirm existing tools but expand our knowledge and become a means of education.*

3. Since the ATP process is in place, we should build upon it. MnDOT and researchers should learn more from what the ATPs are already doing, then develop, advance, and coordinate this decision making process already in place.

4. The panel recommends that the governor should convene a public dialogue about transportation investment in the broader context of the state's economic development strategies.

5. The Minnesota Department of Transportation should invite the formation of a transportation/economic development research consortium made up of academic partners and private research firms.

As transportation researchers, we can no longer walk alone around the edge of the swamp in the light and avoid stepping into the darkness. I contend that we will not be able to leverage public policy research unless we immerse ourselves in the swamp. Unlike Beowulf's individual effort to take on swamp monsters, we transportation researchers are better off if we invite our partners to join us in taking on the swamp monsters. But we should not look for consensus among all the members of our team; diversity of informed opinions and efforts will continue to broaden our knowledge.[24]

The work of researchers will never be done. Transportation researchers must be open to new possibilities and decision makers must not expect final answers, nor agreement on final answers. "Consensus has become an outmoded and suspect value. But justice as a value is neither outmoded nor suspect. We must arrive at an idea and a practice of justice that is not linked to

that of consensus" (Lyotard, p. 66). If researchers can discover ways of bringing greater equity to the distribution of capital available for investment, then justice will be served.

As suggested by Michael Walton, we have an opportunity to join together in a multi-disciplinary exploration of those darker but critical issues which demand shadow or community values pricing. So that public policy decision makers can make better decisions, transportation researchers must be willing to stories from the swamp. A strategic plan for the economic impacts of transportation investments which includes societal impacts will serve as a guide for smarter, and more just transportation investments in the future.

Endnotes

1. In January of 1995 I was invited to give an earlier paper at The Electric Utility Customer Research Conference sponsored by the American Marketing Association at the Palmer House in Chicago in April, 1995 to discuss the relationship of research to public policy. I received the title for my Chicago presentation in the mail: "Insight in a Quagmire: Leveraging Public Policy." When the title for this paper arrived, the word "quagmire" evoked an image of one of my favorite narratives: the old English tale of Beowulf going after the swamp monsters as metaphor for researchers searching for "truth." Simultaneously, I was reading the works of a number of postmodern, poststructuralist philosophers such as Michele Foucault and Jean-Francois Lyotard regarding the nature of knowledge in contemporary society. This postmodern way of looking at the world -- always looking for another way of framing reality -- allowed for an irresistible convergence.

2. *The Reflective Practitioner,* p. 43. Schon later on makes the case that the traditional model of "Technical Rationality is incomplete.... Let us search, instead, for an epistemology of practice implicit in the artistic, intuitive processes which some practitioners do bring to situations of uncertainty, instability, uniqueness, and value conflict" (p. 49).

3. In *Metaphors We Live By*, George Lakoff and Mark Johnson in their chapter on "How Conceptual System is Grounded" make the case that a metaphor can express a systematic correlation because we experience the world around us as having "distinct boundaries, and, when things have no distinct boundaries, we often project boundaries upon them -- conceptualizing them as entities and often as containers..." (p. 58). In order to penetrate those research areas that are yet unexplored or that are not yet considered legitimate, the metaphor of researcher as Beowulf entering the swamp allows for a mental picture of a systematic correlation. The metaphor also allows for an openness to "new meaning" that our "conventional conceptual system does not make available" (p. 141).

4. This statement appears as a chapter heading in Lee Egerstrom's *Make No Small Plans*, a story of how the formation of cooperatives can lead the charge in shaping economic development efforts, especially in rural areas. Lee found this quote by David Osborne in *Economic Competitiveness: The States Take a Stand*, Economic Policy Institute, 1987.

5. In Southwest State University rural studies Professor Joe Amato's *The Decline of Rural Minnesota*, Amato makes the case that economic development efforts will be "chaotic" and often ill-defined. He suggests that economic development advocates "predictably, will propose a new, elaborate highway system to link rural and metropolitan Minnesota." Amato's book demonstrates that decline has an historic pattern that seems irreversible. He offers one salvation: "If, however, rural society declines, as now appears likely, then both self-interest and fairness dictate that rural citizens receive a good education to equip its youth and adults for their eventual migration" (p. 23-24).

6. *Effective Transit: Invest in Access to Jobs and Services.* Citizens League Policy Statement. 1995.

7. Road Investment To Foster Local Economic Development. (1990) David Forkenbrock, Thomas Pogue, Norman Foster, and David Finnegan. Public Policy Center: University of Iowa. Chapter 4.

8. Why is Infrastructure Important?" is an essay combining Aschauer's previous essays and is contained in: *Is There a Shortfall in Public Capital Investment.* (1990) Alicia H. Munnell, Ed. Proceedings of a conference held at Harwich Port, Massachusetts, sponsored by: Federal Reserve Bank of Boston.

9. Ibid. Henry Aaron's "Discussion."

10. Phone interview by author with Abigail McKenzie, Minnesota Department of Trade and Economic Development. 1994.

11. Final Report -- Appendix II. Prepared by Yorgos J. Stephanedes and submitted to the Research Administration and Development Section of the Office of Materials and Research of the Minnesota Department of Transportation.

12. Summary taken from report, "Highway 12 Corridor Economic Study" prepared by Craig Molstad and Donn Winkler, Economic Development Specialists for Mid-Minnesota Development Commission, Willmar, Minnesota. February, 1988.

13. Presented at the Humphrey Institute and Center for Transportation Studies October 1992 Research Conference.

14. *Transportation Economics,* 1976.

15. "Super-twos" is a term developed in Iowa by David Forkenbrock in order to respond to the public cry for four lane roads when a high quality two-lane would do. Super-twos are two-lane roads with passing lanes where there is limited visibility, limited access for traffic to enter the roadway, wider shoulder widths and built to move at least 7,500 vehicles per day.

16. Policy Recommendation V from the Humphrey Institute's 1993 final report "Transportation and Economic Development in the Upper Mid-west" report to FHWA and Congress states: "Encourage uniformity of regulations and implement a national/international electronic data interchange system to allow transparent borders between states and nations."

17. Minnesota Statewide Transportation Plan: A Work in Progress. (November 1994, Preliminary Draft) Minnesota Department of Transportation.

18. *Minneapolis -- St. Paul: People, Place and Public Life.* p. 114.

19. "Overview of Approaches and Findings on Transportation Infrastructure Investment and Economic Development." From the 1992 Transportation Research Conference sponsored by the University of Minnesota's Center for Transportation Studies and the Humphrey Institute.

20. Lynch, Mark. *A Primer on Transportation Investment and Economic Development.* Transportation Association of Canada. (1993) Ottawa. This same information, in an expanded form, is contained in NCHRP Report 342.

21. "Applying Least Cost Planning to Puget Sound Regional Transportation" by Dick Nelson and Don Shakow. The Institute for Transportation and the Environment. Seattle, Washington. Phase II Report, December 1994. Page 1.

22. Second Annual Report, Rural Development Council. G. Edward Schuh, University of Minnesota. January 1995.

23. Lyotard argues, "teamwork is especially successful in improving performativity" if it that teamwork is conducted under "certain conditions" (p. 53).

24. Lyotard argues for "a heterogeneity of elements," "a pragmatics of language particles" rather than "Newtonian anthropology." If policy makers are waiting for consensus and are only willing to reward research that builds upon that anticipated consensus, then researchers are in trouble. "Is legitimacy to be found in consensus obtained through discussion, as Jurgen Habermas thinks? Such consensus does violence to the heterogeneity of language games. An invention is always born of dissension. Postmodern knowledge is not simply a tool of authority; it refines our sensitivity to differences and reinforces our ability to tolerate the incommensurable" (pp. xxiv-xxv).

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ADDITIONAL MATERIALS

In October of 1992, the University of Minnesota Center for Transportation Studies and the State and Local Policy Program of the Hubert H. Humphrey Institute of Public Affairs conducted a research symposium entitled "Transportation Infrastructure as a Public Investment Strategy" as a part of a research project for the Federal Highway Administration. The following is a list of the proceedings from that symposium:

Session I: Policy Research in Transportation and Economic Development, Issues and Overviews

Infrastructure Investment and Productivity: Perspectives on the National Macroeconomic Debate

Randall Eberts, Federal Reserve Bank of Cleveland

Overview of Approaches and Findings on Transportation Infrastructure Investment and Economic Development

Susan Binder, Federal Highway Administration

Maximizing, Measuring, and Not Double Counting Transportation-Improvement Benefits: A Primer on Closed- and Open-Economy Cost-Benefit Analysis

Herbert Mohring, University of Minnesota

Issues in Cost-Benefit Methodology for Transportation Infrastructure Decisions

David Forkenbrock, University of Iowa, *(paper not submitted)*

Commentary on Session I

Starr McMullen, Oregon State University

Commentary on Session I

David Luberoff, Harvard University

Session II: National and Regional Economies and Trade Flows

The Demand for Transportation Services: An Alternative Perspective

Michael Bell, Johns Hopkins University

The Changing Structure of Local Economies: Implications for Public and Private Investment in Transportation Infrastructure in the Upper Midwest

Wilbur Maki, University of Minnesota

David Braslau, Regional Econometrics Inc.

Candace Campbell, University of Minnesota

Commentary on Session II

Thomas F. Jackson, Iowa Department of Transportation

Session III: Upper Midwest Transportation Investment Alternatives/Non-Metropolitan

Waterway and Railroad Shipment of Agricultural Commodities: Alternative Investment Strategies

C. Phillip Baumel, Iowa State University

Prospects for Major Highway Projects in Iowa and the Region (Reprinted)

David Forkenbrock, University of Iowa

Rural Roads: Investment and Disinvestment in a Minnesota County

Jerry Fruin, University of Minnesota

Commentary on Session III

David O. Rafter, Mankato State University

Session IV: Public Finance, Pricing of Transportation Infrastructure, and Alternatives to Capacity for Efficient Transportation

Pricing in the Evaluation of Transportation Infrastructure Investments

Thomas Pogue and Frank A. Walsh, University of Iowa

User Charges and Demand Management

Herbert Mohring, University of Minnesota

Public Infrastructure (Reprinted)

Clifford Winston and Barry Bosworth, Brookings Institution

Commentary on Session IV

Starr McMullen, Oregon State University

Session V: Emerging Trade Corridors and Regional Cooperation

Emerging North-South Trade Corridors: Role of Enhanced Transportation and Jurisdictional Cooperation

Larry Swanson, University of Montana

Comments on Canadian Prairie Trade Patterns, Transportation Infrastructure and Federal/Provincial Cooperation

Gordon MacMichael, Transport Canada, Manitoba-Saskatchewan

Session VI: Metropolitan Transportation Policy Research: Land Use, Environment, Equity and Quality of Life Interactions

Metropolitan Transportation Infrastructure and Distribution of Jobs: Empirical Approaches

Marlon Boarnet, University of California, Irvine

Geography, Political Economy, Equity and Other Complexities of Urban Transportation Decisions

David Hodge, University of Washington

Commentary on Session VI

David Luberoff, Harvard University

Exhibit 1

Area Transportation Partnership Process

Factors considered during decision making process (in MnDOT's Willmar District):

ECONOMIC FACTORS:

Agriculture related: dairy routes, elevators, livestock buying stations, sugar beet dumps, fertilizer distribution centers, farm implement dealers, large livestock/poultry operations, etc.

Manufacturing and wholesale business: > $1 million, employee payroll > $500,00, employers of > 30, etc.

Retail, tourism, other: > $1 million, service industries > $1 million, regional centers, CURA rating, casinos, UPS, tourism: state and county parks, historic sites, natural preservation routes, scenic by-ways, resorts/camping, etc.

Special facilities: fuel pipelines, mining (kaline, sand, gravel) etc.

GROWTH FACTORS:

Will the project assist the area to grow, to expand? Is the area growing and does it need the project? Will the project help congestion?

Health, Social, Environmental Factors:

Hospitals, pharmacies, clinics, DACs, senior centers/meal sites, waste hauling routes, etc.

Access Factors:

Interstate routes, water crossings, bikeways, airports, rail, intrastate bus routes, alternative route or application, intermodal, school route or site, etc. (safety aspects considered here).

OTHER FACTORS:

Prior commitment to state transportation improvement program (STIP), mandated projects, political commitments, multiple partners in project, staged construction, etc.