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THE ECONOMIC IMPACT OF TRANSPORTATION PUBLIC POLICY ON SUPPLY CHAIN CAPABILITIES AND PERFORMANCE

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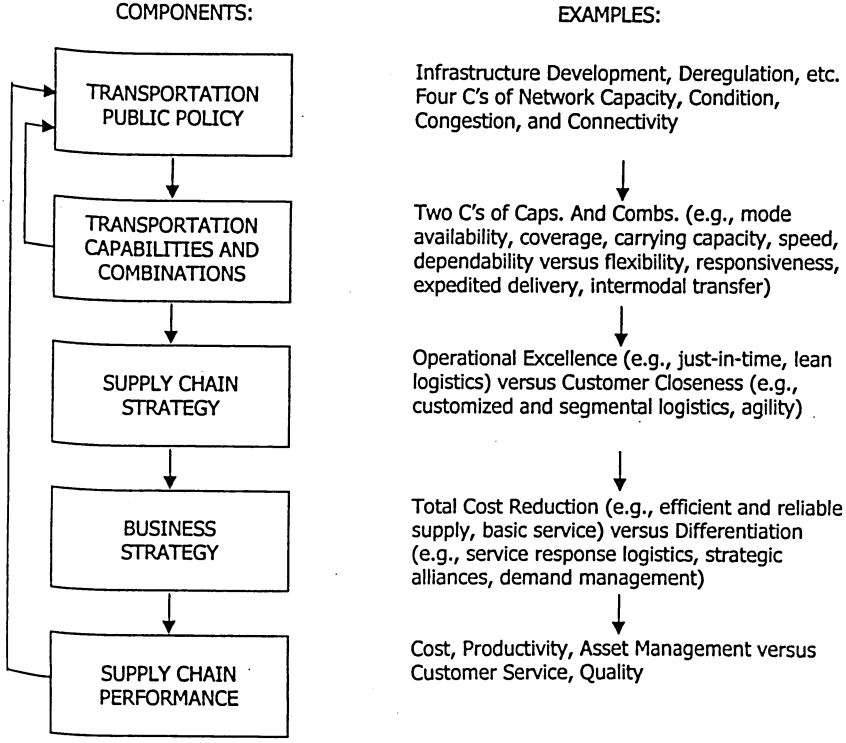
I. INTRODUCTION

In a global and deregulated logistics environment, public transportation policy needs to be closely linked with market-defined transportation capabilities and private sector performance measurement. Without such links, public policy and private enterprise will pursue contradictory objectives and public-private partnerships will not be successful. In essence, everyone should "row in the same direction." As such, public transportation policy needs to be both responsive to constituencies and market driven.[1] This can be accomplished by concentrating on and facilitating improvements on those transportation capabilities and performance dimensions deemed most important by the private sector and most readily available as metrics. The degree to which transportation capabilities and performance metrics are evaluated as relevant, important, and available to private enterprise will be investigated in the present study.[2]

Transportation infrastructure and intermodal hubs have a great deal to do with economic growth, productivity improvements,[3] and the global competitiveness of a nation.[4] There is also potential for transportation public policy to unobtrusively "piggyback" on industry performance measures for public policy oversight, performance evaluation, governmental agency self-assessment, and private sector data sharing. It has been observed that the less obtrusive the data collection measures and methods (e.g., website data retrieval), the less likely the invocation of excess-paperwork regulations and/or the wrath of already survey-bludgeoned potential respondents such as shippers, carriers, and consignees.[5] For example, recent legislation requires all governmental agencies such as FAA and FHWA to develop outcome-related goals and focused performance indicators for their respective annual performance plans.[6] These

FIGURE 1

SCHEMA OF THE IMPACT OF TRANSPORTATION PUBLIC POLICY ON STRATEGY AND PERFORMANCE



perspective, modes, rights-of-way, access connectors, terminals, and equipment are not of particular import or relevance. Rather, what is important to users is the combination of modal capabilities (e.g., combining large carrying capacity with delivery flexibility) that best meets their distinct needs, supports the supply chain strategy, and adds value for their customers. What is relevant and required is seamless service that is transparent to users and their customers and that facilitates their success. Further, it is transportation public policy that creates the requisite conditions for such seamless combinations (the sixth "C").

It is common in the current supply chain environment for producers to outsource their transportation and other logistical services to independent third-party logistical providers. Based on these partnerships, producers can presumably then concentrate on their core competencies. These third party logistics providers may have multimodal capabilities and may or may not own the transportation assets. Since it is the overall package of transportation capabilities that is most important to users, the term "amodal transportation" can be used.[10] Further, the reassignment and innovative reconfiguration of network capabilities implies agile interorganizational management of supply chain roles and collaborative relationships in order to create new value for users and their customers.[11] Transportation firms can take key leadership roles in these agile networks. Strategic alliances provide noteworthy examples of such interorganizational arrangements.[12] Yet it is transportation policy and infrastructure which enable and facilitate these capabilities and their combinations.

Paradoxically, although transportation modes should be seamless and perhaps invisible to users, commodities themselves must have continuous in-transit visibility. Users need instantaneous real time information as to commodity location, quantities, SKU inventory levels, shipment status, condition, and the ability to alter these. This visibility is necessary to achieve

supply chain integration across firms and process integration that optimally links transportation with procurement, production, marketing, and distribution. In essence, the information must be visually assessable, although the physical transportation network itself should be largely transparent. In a sense, virtual inventory information and innovative transportation operations become substitutes for physical facilities, actual inventory, and other logistical assets such as warehouses, depots, and distribution centers. This point will be elaborated upon next in relation to supply chain strategies.

Supply Chain Strategies

Transportation capabilities can be the building blocks for supply chain strategy and a source of competitive advantage. This is represented in Figure 1. Two major categories of supply chain strategies are operational excellence versus customer closeness.[13] Operational excellence strategies tend to support a business strategy of total cost reduction, efficient and reliable supply, and high levels of basic service.[14] One would expect supply chain operational excellence to be aligned with transportation capabilities of availability, distribution coverage, carrying capacity, convenience, delivery speed, and dependability. In contrast, customer closeness strategies tend to support business strategies of differentiation, including service response logistics, relationship leveraging through strategic alliances, and demand-based management as suggested in Figure 1. One would expect supply chain strategies involving customer closeness to be aligned with transportation capabilities such as delivery flexibility, customer responsiveness, expedited deliveries, intermodal transfers, versatility, and again, dependability.

Both supply chain strategies of operational excellence or customer closeness add value for end users. As shown in Figure 1, examples of operational excellence include lean logistics[15] and time-based strategies[16] which may involve just-in-time (JIT) deliveries.[17] JIT supply chains emphasize time-definite deliveries (i.e., known lead-times of low variability). This can reduce buffer inventory and safety stocks. JIT may also involve more frequent deliveries of smaller shipments which can lower in-transit inventory and cycle stocks. Other contemporary transportation operations that can facilitate JIT and thereby also reduce inventories include cross-docking operations, postponement strategies, in-transit acceleration and deceleration, and direct delivery. Furthermore, it is transportation policy such as infrastructure development that makes these operating practices possible.

Turning to lean logistics, lean supply chains reduce all types of waste, errors, unnecessary assets, and cycle times by continuously seeking perfection and operational efficiencies throughout the supply chain.[18] Types of transportation-related waste that can add cost but no value include waiting, rectification of mistakes, excess processing, unnecessary warehousing, extra handling, excess transport and terminals, and excess stock.[19] Innovative logistical solutions may involve outsourcing, synchronizing and sequencing transportation with production, flexibly positioning commodities with flexible transportation equipment and containers, eliminating redundant parallel production and thereby reducing transportation, redesigning processes, optimally locating facilities, reducing or redeploying network assets, and having resident suppliers' production lines on your own premises through early supplier involvement and development. These practices may require unique transportation capabilities that are enabled by transportation public policy.

As indicated in Figure 1, examples of customer closeness as supply chain strategies include customization/segmental logistics and agility. These practices also reflect core competencies of the supply chain.[20] Customization tailors transportation capabilities and other value added services to specific customer needs. However, this does not necessarily mean a proliferation of transportation service offerings. Supply chain firms can offer a predetermined service menu of value-added services, capabilities, and attributes.[21] From this service menu, customers can choose their preferred services and attributes. Although the combination may be unique to that customer, the inputs and capabilities themselves are not unique since they were thought out, prespecified, and developed beforehand.

Agility takes this one step further by quickly adjusting supply chain capabilities and their combinations to changing customer needs and evolving competitor offerings.[22] Third-party, intermodal, or multimodal companies can potentially become the organizer and coordinator of this dynamic network that recombines and sequences logistical capabilities in changing and creative ways. Information on required capabilities and performance tracking become crucial to success.

Recently, some supply chain firms have experimented with mixed strategies that attempt to combine operational excellence with customer closeness. These innovative practices are generally becoming known as mass customization.[23] Since mass customization may require particular transportation capabilities, these evolving innovations highlight the necessity for transportation public policymakers to monitor market requirements for transportation capabilities and performance over time. This is represented in Figure 1 as two feedback loops and will be addressed again in this study's conclusions and implications section.

Supply Chain Performance

Supply chain performance is the "bottom line" for public policy, business strategy, supply chain strategy, and organizational effectiveness.[24] As such, transportation capabilities with their matching supply chain strategies eventually devolve into logistical performance (see Figure 1).[25] It is therefore critical that public policy continuously monitor private sector performance to determine those performance measures deemed most important by the private sector. Such an assessment is accomplished in the present study. However, since supply chain strategies are likely to evolve over time, the importance of individual performance measures and capabilities are also likely to change over long periods of time. Furthermore, current law requires transportation agencies such as FHWA and the FAA to annually evaluate their own performance using performance measures preferably linked to their customers' needs and satisfaction.[26] Thus, although public policy can have profound effects on the economy, the performance targets can change over time.

It is clear that supply chain and business strategies necessitate particular transportation capabilities that result in logistical performance. However, it is public transportation policy which enables transportation capabilities and partially determines logistical performance. For example, public transportation policy encourages private sector performance improvements through infrastructure investment and development, creative financing arrangements, tax incentives, deregulation, public/private partnerships, intermodal and trade policy, and special programs and projects. Five important private sector performance categories that are strongly influenced by public policy are cost, productivity, asset management, customer service, and logistical quality.[27] These types of performance measures are represented in Figure 1. They are also assessed in the present study as to their importance, relevance, and availability in the private

sector. For example, evaluated transportation costs include not only freight costs but also the costs of damage, returned goods, and service failures. In turn, productivity measures in this study relate to both transportation labor and equipment productivity. Transportation policies which improve congestion, waiting times, road conditions, delays, etc. can potentially increase productivity and lower costs.

In terms of asset management in this research, public transportation policy can affect performance measures such as inventory turns and inventory levels since transportation policies impact transportation speed, lead times, dependability, direct routing, location decisions, safety, etc. For example, JIT systems often substitute transportation for inventory and warehousing in order to remove inventory from the supply chain. In contrast, poor performance on these policy dimensions increases in-transit inventory stored in the transportation "pipeline," increases the necessity for safety stock, and increases cycle stocks through longer lead times and other inefficiencies. In essence, asset management becomes debilitated.

Public transportation policy can also impact customer service performance such as on-time delivery, cycle time, and delivery consistency, as well as quality measures such as damage frequency. These measures are all assessed in the present study as to their relative importance and availability in the private sector. Such performance measures are strongly influenced by infrastructure condition, congestion, safety problems, mode availability, intermodal connectivity, and trade barriers which can create variability in customer service and quality. Variability is an especially serious problem for management since it makes it difficult to plan and coordinate supply chain activities.[28] Overall performance measures such as customer satisfaction or proportion of perfect orders are also theoretically appealing, and are evaluated in this research.

The present paper investigates the relative importance and availability of transportation performance measures in the five preceding major performance categories. It also evaluates the transportation capabilities which give rise to these performance measures and that are impacted by public transportation policy. The relationships of transportation capabilities to supply chain success and global excellence are also covered for approximately four thousand firms from the three global regions of North America, Europe, and the Pacific Basin. After briefly describing the methodology in the next section, the performance and capability results are described, followed by a conclusions and implications section.

II. METHODOLOGY

To identify and compare global logistics best practices, the research methodology had four phases.[29] In the first phase, a survey instrument termed the base-line survey was mailed to approximately twenty two thousand firms in order to assess logistical trends in North America, Europe, and the Pacific Basin. The base-line questionnaire was developed in conjunction with the Council of Logistics Management type associations in each of eleven countries that have comparable group and industry memberships. For the Pacific Basin countries, the questionnaire was translated into each country's language, and then back-translated to ensure meaning equivalence across countries. The survey was field pretested and then adjusted based on the new knowledge.

From a transportation policy viewpoint, there are several advantages to focusing on transportation users. First, a transportation user overall perspective reflects carrier, proprietary business, and third-party transportation offerings which are otherwise often viewed alone in isolation and/or with arbitrary distinctions and blurred definitions. Second, supply chain integration implies that members and policymakers should have a user focus. Third, a user focus

outbound freight cost measures, although outbound freight cost is rated as both more important and more available as a performance measure. The other transportation cost measures are in the predicted direction of greater importance and availability for the top third of firms, although the differences do not achieve statistical significance.

The same is true for customer service and quality measures of on-time delivery, delivery consistency, and damage frequency. These measures are rated as more importance and more available by the top third on the excellence index, but the differences do not achieve statistical significance given the sample sizes. However, cycle time measures are significantly more available for the upper third of index excellence scorers. For productivity, equipment downtime measures are significantly more important and more available to the top third of excellence scorers. Transportation labor productivity does not display the typical pattern, in that it is no more important to the top third and is less available to them than for the bottom third.

Table 3 also implies generally that what is perceived as more important tends to be more frequently measured. The top four transportation performance measures in order of importance include on-time delivery, outbound freight cost, inventory turns, and delivery consistency. Thus, these findings in Table 3 provide guidance for public transportation policy. Notable exceptions in Table 3 include global service measures such as cost of service failures and the customer service measures of overall reliability and overall customer satisfaction. Although rated important to management and conceptually appealing, firms apparently have difficulty in generating these measures.

D. Importance of Logistical Capabilities for Firm Success

Table 4 shows the relative importance of seven major logistical capabilities for supply chain success. Somewhat surprisingly, the ranks for North American firms versus European and

TABLE 4

IMPORTANCE OF LOGISTICAL CAPABILITIES FOR SUPPLY CHAIN SUCCESS IN NORTH AMERICA, EUROPE, AND THE PACIFIC BASIN

	North American Firms		European and Pacific Basin Firms	
Logistical Capabilities:	Score	Rank	Score	Rank
1. Customer Service	1.11	1	1.20	1
2. Delivery Dependability	1.19	2	1.25	2
3. Information Systems Support	1.57	3	1.45	3
4. Flexibility For Customers in Delivery.	1.85	4	2.10	7
5. Low Logistics Cost	2.04	5	1.69*	4
6. Logistics Standardization	2.31	6	2.06	5
7. Delivery Speed	2.33	7	2.06	6

Source: Michigan State University, Global Logistics Research Team

Scale: 1=Important, 5=Unimportant

* Difference is statistically significant at the .10 level of significance.

Pacific Basin firms are quite similar. Customer service is ranked first by both North American and European and Pacific Basin firms. Recall that earlier findings in Tables 2 and 3 showed that transportation can have a strong influence in this customer service area. Interestingly, delivery dependability, which is one of the performance areas most directly impacted by public transportation policy, ranks a close second in importance for supply chain success. In contrast, delivery speed, which is also impacted by public transportation policy is ranked last in importance by North American firms and next to last by European and Pacific Basin firms. Essentially, transportation dependability and on-time performance appear to be more important than speed of transportation performance. This finding provides guidance for public freight transportation policy makers in identifying which transportation capabilities should be encouraged by transportation public policy.

For the importance of low logistical costs, this is ranked in the lower middle by the interview firms. This finding is consistent with prior research in other subject areas: e.g., third-party and carrier selection research where cost is also ranked below the top. The North American firms rank it fifth out of seven while the European and Pacific Basin firms rank it fourth in importance. This difference is statistically significant. The somewhat higher European and Pacific Basin ranking which reflects a greater cost orientation is also consistent with the regional differences found in this study's Table 1.

For rankings alone, the biggest difference between North American firms and European and Pacific Basin firms is for flexibility in delivery, which was ranked fourth in importance by North American firms and last in importance by European and Pacific Basin firms. The best North American firms are also substantially improving delivery time flexibility at the present time. Apparently, flexibility in delivery is less important for European and Pacific Basin firms

(or less possible given congestion and spatial conditions for European and Pacific Basin firms). In total, these results provide guidance for policy makers in terms of establishing priorities for policy goals, objectives, programs, and performance measures.

E. Logistical Capabilities Of Top Third Firms

Table 5 shows the performance of North American firms on a broader list of 32 logistical capabilities for the top third and bottom third on the logistical excellence index. In general, the top third of excellent firms perform better on most logistical capabilities. These results imply the strategic importance and potential of global logistics for productivity gains, supply chain global competitiveness, and economic growth.

For the transportation measures most directly impacted by public transportation policy, again labeled with double asterisks in Table 5, the top one third of excellent North American firms perform significantly better than the bottom third on delivery dependability, delivery speed, selective distribution coverage, and avoidance of supply disruption. The highest performance scores for the top third of excellent North American firms are for delivery dependability (4.35 out of 5), widespread distribution coverage (4.24), low cost logistics (4.17), and expedited delivery (4.0). These findings possibly imply that in the current deregulated environment, North American firms must exhibit high levels of reliability and customer service yet at relatively low logistics cost (rather than exhibiting a tradeoff mentality from the regulation era).

F. Relationships Between Logistical Capabilities And Firm Excellence

Table 6 shows the direct correlation between the 32 logistical capabilities and the overall index of firm excellence. The logistical capabilities most impacted by public transportation policy are again highlighted by the double asterisk (**) on the left side of Table 6, while

TABLE 5

CAPABILITIES OF TOP THIRD EXCELLENCE INDEX FIRMS VERSUS BOTTOM THIRD

	Upper	Lower
1. Product Flexibility	4.10	3.40*
2. Volume Flexibility	3.80	3.40
3. Process Flexibility	3.71	3.39
** 4. Low Logistics Cost	4.17	3.83
** 5. Delivery Speed	3.71	3.06*
** 6. Delivery Dependability	4.35	3.78*
7. Problem Avoidance	3.82	3.44*
8. Problem and Complaint Resolution	4.06	3.78
9. Responsiveness to Key Customers	4.06	3.61*
10. Order Fill Capacity	4.24	4.17
11. Value-Added Service	3.82	3.33*
** 12. Widespread Distribution Coverage	4.24	4.00
** 13. Selective Distribution Coverage	3.82	3.12*
14. Customer Service Flexibility	3.76	3.50
15. Product Introduction	4.12	3.61*
16. Product Phase Out	3.29	2.72*
**17 Disruption in Supply	3.94	3.50*
18. Product Recall	3.94	4.06
19. Product Flexibility During Logistics	3.33	2.82*
** 20. Location Flexibility	3.65	3.35
** 21 Reverse Logistics Timing	3.53	3.43
22. Differentiation	3.59	3.28
23. Product Innovation	4.18	3.72*
24. Order Flexibility	4.06	3.12*
** 25. Delivery Time Flexibility	3.94	3.94
** 26. Expedited Delivery	4.00	3.94
27. Advanced Notification	3.65	3.06*
28. Advanced Shipment Notification	3.35	2.94*
29. Substitution Flexibility	3.59	3.33
30. Innovativeness	4.00	3.61*
31. Operational Simplification	3.41	3.18
32. Operational Standardization	4.00	3.29*

Source: Michigan State University, Global Logistics Research Team
Scale: 1=Performance worse than competitors; 5=Performance better than competitors
** Strongly impacted by Transportation Public Policy
* Difference is statistically significant at the .10 level of significance

TABLE 6

RELATIONSHIPS BETWEEN LOGISTICAL CAPABILTIIES AND THE FIRM EXCELLENCE INDEX

Correlation of World Class Index With:	Correlation	p-value
Product Flexibility	.394	.002*
Volume Flexibility	.106	.231
Process Flexibility	.218	.030*
** Low Logistics Cost	.179	.068*
** Delivery Speed	.122	.147
** Delivery Dependability	.268	.001*
Problem Avoidance	.155	.091*
Problem and Complaint Resolution	.140	.113
Responsiveness to Key Customers	.214	.035*
Order Fill Capacity	.218	.029*
Value-Added Service	.289	.005*
** Widespread Distribution Coverage	.127	.139
** Selective Distribution Coverage	.120	.155
Customer Service Flexibility	.247	.015*
Product Introduction	.337	.001*
Product Phase Out	.076	.255
** Disruption in Supply	.178	.062*
Product Recall	.107	.181
Product Flexibility During Logistics	.193	.059*
** Location Flexibility	.106	.185
** Reverse Logistics Timing	.129	.153
Differentiation	.159	.088*
Product Innovation	.200	.041*
Order Flexibility	.397	.001*
** Delivery Time Flexibility	.013	.455
** Expedited Delivery	.144	.108
Advanced Notification	.186	.053*
Advanced Shipment Notification	.099	.197
Substitution Flexibility	.088	.226
Innovativeness	.080	.247
Operational Simplification	.053	.325
Operational Standardization	.151	.099*

Source: Michigan State University, Global Logistics Research Team
** Strongly impacted by Transportation Public Policy
* Difference is statistically significant at the .10 level of significance

significant correlations are indicated by the single asterisk (*) on the right side. Significant transportation correlations between individual capabilities and the overall logistical excellence index include low logistics cost, delivery dependability, and avoiding disruption in supply. Delivery dependability has the highest correlation with firm excellence in Table 6. One interpretation of these results is that these transportation capabilities are most characteristic and predictive of excellent global firms. A related interpretation is that public transportation policy should concentrate on and facilitate improvement on these transportation capability dimensions.

IV. CONCLUSIONS AND IMPLICATIONS

In an era of global logistics and global competition, public transportation policy must be linked to private sector transportation capabilities and performance in order to improve the nation's productivity, global competitiveness and economic growth. Although public policy should primarily be concerned with these particular linkages, efficient and effective supply chains are the vehicle through which much of these increased benefits are likely to be achieved in the near future. As such, deregulation and global competitiveness also require close collaboration and cooperation between all policy actors including government, academicians, transportation providers, and users, so that they all buy into the established policy and don't work at cross-purposes.

Public policy influences logistical capabilities and performance through policy initiatives such as infrastructure development and maintenance, intermodal connectors, economic deregulation, trade policies, social regulation, safety enforcement, and investment policy. The results of these policies can largely be summarized by the 4 C's of capacity, congestion, condition, and connectivity. In turn, these 4 C's give rise to the two additional "C's" of transportation capabilities such as dependability and speed, and combinations of capabilities;

e.g., large carrying capacity combined with delivery flexibility. Intermodal or third-party combinations of logistical capabilities also imply an agile alliance network that best assigns and matches interorganizational capabilities with customer needs.

Transportation capabilities and their combinations are important to private enterprise since they support different supply chain strategies for customer value creation. Two major classes of supply chain strategies include operational excellence and customer closeness. Examples of operational excellence are "lean" logistics and time-based strategy which may include "just-in-time" (JIT) deliveries. Examples of customer closeness include logistical customization or logistical agility which also reflect core competencies of the supply chain. Operational excellence strategies are likely to stress and be supported by transportation capabilities of availability, carrying capacity, distribution coverage, convenience, delivery speed, and dependability. In turn, customer closeness strategies are likely to be supported by transportation capabilities such as delivery flexibility, value-added services, responsiveness to special requests, versatility, intermodal transfers, and again, dependability. Thus, beyond minimum thresholds for order qualification, different transportation capabilities must be aligned with different supply chain strategies. In essence, individual transportation capabilities and their combinations can become a basis of supply chain strategy and a source of global competitive advantage. Yet, it is transportation public policy that is the enabler of many of these capabilities.

At the present time, some supply chains are experimenting with "mass customization," which is a mixed strategy combining operational excellence with customer closeness. Transportation examples include spatial postponement and acceleration or deceleration of flows. There is also a trend toward greater reliance on customer closeness strategies in general. Most recently, the very best world-class firms have been substantially improving their capabilities of

delivery time flexibility, followed by responsiveness to customers, shipment information, and delivery speed, in that order. Other capabilities do not show increasing emphasis. In terms of 4 C transportation policy, these results show a priority on congestion and connectivity. These results also imply the importance to transportation public policy of continually monitoring shifting market requirements for changing transportation capabilities and performance indicators over time. The legislative requirement that each governmental agency must submit an annual performance plan showing outcome-related results for customer-oriented performance indicators is consistent with this conclusion.

What is most important for transportation users is the ability to choose that package of transportation capabilities which best meets their needs and best supports their supply chain strategy. Transportation policy can have profound effects on these transportation capabilities such as delivery dependability and speed. The present study found that North American, European, and Pacific Basin firms are in remarkable agreement as to what transportation capabilities are most important for supply chain success. Customer service is ranked first in importance, while delivery dependability is ranked a close second in importance by all global regions. Out of 32 logistical capabilities, delivery dependability is also the most strongly related statistically to the excellence index. The suggested interpretation is that dependability is extremely important to support both strategies of operational excellence or customer closeness. Also influenced by transportation policy, low logistics cost and delivery flexibility are ranked in the middle for success, although cost is rated significantly higher by European and Pacific Basin firms and flexibility is rated somewhat higher by North American firms. As previously indicated, delivery flexibility also appears to be increasing in emphasis over time for the very best North American firms. Analogously, European firms also more frequently use Total Cost

Analysis and activity based costing (ABC) in making their decisions, while North American firms are more likely to use external customer satisfaction measures. Similarly, North American firms' use of customer service flexibility, responsiveness, and value-added service is significantly related to the excellence index. Somewhat surprisingly, delivery speed is ranked last in importance by North American firms and next to last by European and Pacific Basin firms for success.

In terms of setting capability priorities, the previous results imply that public transportation policy should stress delivery dependability followed by flexibility of delivery and then delivery speed. In fact, a recent Conference on Federal Highway Administration (FHWA) performance indicators for the FHWA Annual Performance Report recommends strong consideration of dependability type performance measures that reflect delays, congestion, or reliability.[31] In terms of "4 C" transportation policy, the present study's results again imply in order of decreasing priority, policy attention to infrastructure congestion, connectivity, condition, and capacity.

The present study also found that transportation performance measures that are most impacted by public transportation policy are some of the most readily available and perceived important global logistics measures in the private sector. This private enterprise availability is true for the four major performance categories of asset management, cost, customer service, and quality, but is surprisingly less true for transportation productivity measures. These readily available and most important transportation measures are good candidates for public policy monitoring, promotion, performance assessment, or for unobtrusive policy "piggybacking" on private sector measures. This would help ensure intended policy consistency with external markets, practices, and performance.

The most common transportation measures from the first four categories are readily available to approximately 90 percent of leading firms, and are judged especially important by the best firms on the excellence index. These public policy impacted measures include inventory turns and inventory levels for the asset management category; outbound freight cost for the cost category (but not inbound freight cost); on-time delivery performance and delivery consistency for the customer service category; and damage frequency for the quality category. In contrast, transportation productivity measures are surprisingly of less importance and less availability to top firms, in that transportation labor productivity measures are only available to about 50 percent of manufacturers and equipment productivity measures are only available to slightly more firms. One possible partial explanation is that carriers may monitor transportation productivity much more closely than users, but this hypothesis deserves future research. Although rated important, overall service performance measures such as cost of service failures, overall customer satisfaction, and proportion of perfect orders are also less available despite academic enthusiasm for them.

In general, however, the results show that what is perceived as most important tends to get measured by firms. Other research has recently established that "what is measured tends to get done."[32] These findings have important implications for public transportation policy in terms of linking policy with private sector measures. For example, governmental transportation policy can be market driven in terms of stressing what is most important to the private sector. It can also create incentives for specific performance measures through investment policy, financing arrangements, tax policy, infrastructure improvement, and the like. The biggest challenge appears to be linking performance measurement and results to intended policy.

The overall implication for public policy is to promote, "piggyback," partner and perform with those transportation capabilities and performance measures deemed most important by the private sector and most associated with supply chain and firm success. Variability measures such as dependable delivery are particularly important to private enterprise since they allow for supply chain planing, network optimization, and total cost minimization. Transportation flexibility can be especially important for those firms pursuing a supply chain strategy of customer closeness and unique accommodation, which is currently the fastest growing market trend. The very best world class firms in North America are also currently emphasizing delivery time flexibility. In contrast, ubiquitous capacity measures such as location flexibility and widespread distribution coverage do not distinguish excellent supply chain firms. Thus, public policy should consider, facilitate, and encourage the former transportation capabilities which are related more to the policy 3 C's of improving network congestion, connectivity such as intermodal connectors, and condition rather than adding large increments of new capacity. This conclusion may also help define the nature of collaborative network relationships and the future of public-private partnerships in an environment of increasingly scarce public resources.[33]

In a deregulated global environment, top firms also appear to be able to provide both high levels of service and at low logistics cost rather than tradeoff thinking which may be more appropriate for a regulated regime. This trend of simultaneously increasing value-added services without price increases appears to be intensifying over time. Deregulation and global logistics also means that over time, interacting transportation institutions should explore policies that foster new logistical capabilities and innovative combinations of these capabilities to achieve greater supply chain efficiency, effectiveness, global competitiveness, and economic growth. In total, it is anticipated that the present research will contribute to the ongoing dialogue concerning

a "specific vision to guide future transportation policies and investment decisions."[34] More broadly, it is hoped that the study results will provide useful input and guidance to facilitate collaboration among various policy actors for informed public transportation policy and to assist in formulating appropriate policy goals, objectives, programs, and performance indicators.

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