



MIT Center for
Transportation & Logistics



Pre-Read for the MIT Future Freight Flows Symposium 11 – 12 March 2010

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1. Overview

The future rarely moves in predictable, incremental ways. Often seemingly small changes in technology, demographics, regulations, economics, or a myriad of other factors have dramatic and unintended impacts on how companies source, manufacture, distribute and operate in general. These non-linear impacts are very difficult to predict using traditional forecasting methods and techniques since they, by definition, do not follow any historical patterns.

For example, few in April 1956 would have foreseen the global trade implications of Malcolm McLean's small experimental move of 58 metal containers on the ship the *Ideal-X* from Newark to Houston. What had been intended as a way to reduce traffic congestion on the highways through short sea shipping along the East Coast ended up playing a key role in making off-shoring of manufacturing in low-cost locations across the globe economically viable. While this impact might seem obvious in retrospect, it certainly was not at the time.

Are we facing a similar situation today? Ten, twenty, thirty years from now, will people look back and be amazed that we were unable to predict the full impact that some new innovation had on the economy? Probably. It is never easy at any point in time to be able to predict which, out of all of the possible future outcomes, the single one that will actually happen and that you should therefore plan for.

For example, consider the effect of digitization. We are all familiar with the impact that digitization has had on recorded music, movies, and now books. What was once a physical product that had to be sourced, manufactured, and distributed has been transformed into a pure digital form that can be reproduced and delivered almost instantaneously at close to no cost. The reduction in the number of physical retailers, increased incidence of piracy, and the collapse of much of the logistics supporting these industries has been well reported. All information-based products seem to be headed in the same direction.

However, what about physical products? Will personal micro-fabrication technology become widely adopted and transform the CPG industry in a similar fashion? Imagine if each consumer had the ability to manufacture (and personalize) the majority of the products they use every day within their own home – using only basic raw materials. How would that change the industry, the logistics providers, and the retailers? Or will it never take hold?

It isn't just technology. Consider the impact of changes in government regulations. Suppose that environmental regulations within the next 20 years require the tagging and tracking of potentially hazardous or recyclable materials with the retailer being responsible for safe disposal? What new challenges and market opportunities would this create?

Or demographics. The percentage of people worldwide living within urban areas has increased from 30 percent in 1950 to almost 50 percent today – with forecasts putting this at 60 percent by 2030. How will this increased concentration of residences impact the way products are manufactured and distributed? Will this mean that the urban governments will need to take ownership of the last mile distribution?

There are countless other examples of potential changes in economics, energy, regulations, technology and other areas that could have tremendous impacts on how businesses operate in the future. While it is a very difficult thing for a *company* to try to plan for these different potential outcomes, it is even more difficult for the *government* to do so – especially when it comes to infrastructure investment.

While most firms are fairly adept at adapting and adopting to changing conditions in the market, the federal, state, and local governments are not as agile. Public sector investments require consensus across a wide variety of diverse and competing stakeholders. The planning lifecycle of public infrastructure projects needs to be measured in years and often decades, as opposed to months as is the case for most businesses. For example, one of the most successful freight infrastructure projects is the Alameda corridor. This 20-mile long partially sunken intermodal corridor links the ports of Long Beach and Los Angeles to the transcontinental rail lines near Los Angeles. While initial planning began in 1981, approval did not occur until 1994, construction began in 1997, and it was finally opened for traffic in 2002. It took over 20 years from concept to open and is considered to be a very successful project! Similarly, the Big Dig or Central Artery/Tunnel Project in Boston took slightly over 25 years from planning to opening.

This lengthy gestation time is not a reflection on the quality of the planners or officials involved – it is the nature of building public infrastructure. Also, the design life of these structures are very long – so the time spent in planning is obviously worthwhile. In any case, it makes the government’s task of trying to forecast and plan in an uncertain future exceptionally difficult.

A project that is entering the planning stage today will probably not be ready for use until 2020 at the earliest and most likely 2030 or later. And then it is expected to have a life of fifty years beyond that. So the idea of trying to develop a better planning method for uncertain events in the future fits very well to the planning horizon that the government is required to live with.

In order to ensure that transportation practitioners and planners are equipped to deal with these and other future challenges facing the industry over the next 30 plus years, the American Association of State Highway and Transportation Officials (AASHTO) set aside funds to study these issues. Specifically, AASHTO created a series of research projects called the National Cooperative Highway Research Program (NCHRP) 20-83 series: Long-Range Strategic issues. Administered by the Transportation Research Board (TRB) of the National Academies, the seven research projects within this series are:

- 20-83(01) *Economic Changes Driving Future Freight Transportation*
- 20-83(02) *Expediting Future Technologies for Enhancing Transportation System Performance*
- 20-83(03) *Long-Range Strategic Issues Affecting Preservation, Maintenance, and Renewal of Highway Infrastructure*
- 20-83(04) *Effects of Changing Transportation Energy Supplies and Alternative Fuel Sources on Transportation*
- 20-83(05) *Climate Change and the Highway System: Impacts and Adaptation Approaches*
- 20-83(06) *Effects of Socio-Demographics on Travel Demand*
- 20-83(07) *Sustainable Transportation Systems and Sustainability as an Organizing Principle for Transportation Agencies*

The MIT Center for Transportation & Logistics (CTL) was awarded the contract for the 20-83(1) project entitled “Economic Changes Driving Future Freight Transportation.” The **Future Freight Flows Symposium** that you will be attending on 11-12 March 2010 represents the first step towards the identification of the key driving forces and critical uncertainties impacting the US freight transportation system over the next 30 plus years. It is hoped that this project will provide the planners and decision makers at the federal, state, regional, and local levels with a better method of strategic planning for freight infrastructure investments.

The purpose of this pre-read document is to familiarize you, the symposium attendee, with freight transportation infrastructure planning as well as the project as a whole. The rest of the document is organized as follows. Section 2 details the activities and objectives of the **Future Freight Flows Symposium**. Section 3 provides background on freight planning challenges. Finally, section 4 gives an overview of the entire 20-month project.

2. Details on the Future Freight Flows Symposium

The symposium will run from 9:00 AM to 5 PM on Thursday 11 March and then from 9:00 AM to Noon on Friday 12 March. There will be a social on Thursday evening following the general session.

Our objective over the course of the two days is to generate and validate a working list of potential key drivers and critical uncertainties of the US freight transportation infrastructure over the next 30 plus years. We will do this in two steps. The first step consists of exposing you, the attendees, (all of whom are experienced freight transportation practitioners) to a wide array of future facing presentations and talks. This is intended to open up your thinking to consider potential changes to your current practices and operations. The second step involves the group conducting a deep-dive into the most critical issues raised in the first step through an intensive and interactive set of exercises. This second step will flesh out the ideas and thoughts brought out in the first step.

Day One

On Thursday, we will hold seven 45-minute presentations from thought leaders in various disciplines. These talks are intended to get the attendees to think beyond current business and operating conditions and to consider other potential futures. While we cannot possibly cover every potential aspect of the future, we believe that these seven talks will definitely expand your thinking. The scheduled presentations are as follows:

- **A Nation of Floridas: Aging, Changing Lifestyles & the New Future of Freight.** Dr. Joseph Coughlin, MIT AgeLab, will discuss how the demographic trends in the United States, as well as across most established markets, are shaping consumer tastes, demand, and expectations.
- **After the Storm: New Challenges for the Global Economy in 2010-2030.** Sara Johnson, IHS Global Insight, will provide an overview of the global forces that could be shaping our economy over the next twenty years.
- **Public Policy and Freight: History, Trends, and Issues.** Dr. David Luberoff, Harvard University Kennedy School of Government, will provide an overview of how public policy and freight have interacted in the past as well as provide insights into how this could change going forward. All attendees will receive a copy of Dr. Luberoff's book, [Mega-Projects](#).
- **Transporting Bits and Atoms.** Professor Neil Gershenfeld, MIT Center for Bits and Atoms, will present his recent work in the development and deployment of personal fabrication technologies. The ability to manufacture virtually anything at the micro level could potentially revolutionize how consumers acquire products. All attendees will receive a copy of Prof. Gershenfeld's book, [Fab](#).

- **The New Age of Sensing.** Professor Sanjay Sarma, MIT Mechanical Engineering, will give a glimpse of what the future of sensor technology could mean for all aspects of mobility. This builds off of Prof. Sarma's earlier work as the founder of the AutoID Lab at MIT.
- **Wired for Innovation: How IT is Reshaping the Economy.** Professor Erik Brynjolfsson, MIT Sloan School of Management, will give insights into how information technology in the workforce will change how companies form and operate. All attendees will receive a copy of Prof. Brynjolfsson's book, Wired for Innovation.
- **Measuring and Managing Sustainability.** Professor Jon Johnson, The Sustainability Consortium, will discuss the challenges that firms face trying to actually measure and manage environmental performance.

During each presentation, the attendees will be asked to capture the two to three most critical driving forces and uncertainties that the talk uncovered. These forms will be collected, harmonized, and tabulated by the MIT team and used as a starting point for Friday's activities.

Thursday will end, as all good days should, with a social hour. We hope that all of the attendees will use this time to network with the other attendees, MIT faculty and staff, as well as the speakers. Often times, these informal discussions will spark more thoughts and insights than the planned presentations!

Day Two

We will begin the day by recapping the previous one. The driving forces collected from the previous day will be presented and briefly discussed. Also, we will open the floor for any critical factors or areas that the group missed.

After this session, the group will be divided into five to six breakout groups. Each breakout group will be assigned one or two of the identified driving forces and will go through a facilitated exercise to probe this individual factor a little deeper. This is the most exciting component of the symposium in that the methodology has only recently been developed by the research team and is being used for the first time. The thought is that some of these processes and techniques could be incorporated in the final product for the project as a whole.

After the individual breakouts, we will reconvene to discuss the interactions between the different driving forces. A brief wrap up and an optional lunch will follow this final session.

Registered Attendees

The research team spent a lot of time selecting and choosing the expert speakers coming on the first day. We believe they are all outstanding thought leaders in their areas. But, it is important for everyone to understand that we spent even more time

selecting and inviting the attendees to this symposium. We purposely kept the size of the group small and the quality very high. I am more excited by the caliber of the attendees of this symposium than the actual presenters! But don't tell them that when you meet them.

We will distribute the full list of names of the attendees at the conference. For confidentiality reasons, we prefer not to distribute that electronically ahead of time. Here is a list of the companies and organizations that will be attending, however.

Army & Air Force Exchange Service	MeadWestVaco
Arkansas Best Corporation	Massachusetts Institute of Technology
adidas Group	Michelin North America, Inc.
American Presidents Line	Michigan Technological Institute
Armada Supply Chain Solutions	Minnesota DOT
Burlington Northern Santa Fe Corp.	Mohawk Industries
Boyle Transportation	Norfolk Southern Corporation
California DOT	NxStage Medical, Inc.
Chiquita Brands International	OOCL
Con-way	Penske Logistics
Covidien	Pepsi Bottling Group
CSX	Port Authority of NY/NJ
D&M Global	Race Trac Stores
Damco International	Schwab Food Company
Dell	Starboard Alliance
EMC Corporation	Starbucks
Fairchild Semiconductor	Target Corporation
Heineken USA Inc.	TJX Companies
Federal Highway Administration	Transplace
Hewlett-Packard Company	Transportation Research Board
Hutchinson Port Holdings	Tyco International
Illinois DOT	United Parcel Service
J.B. Hunt Professional Services	USTRANSCOM
Kraft Foods	Volpe Center
Limited Logistics Services	Wal-Mart Stores
Logyca / CLI	Washington State DOT

3. Freight Infrastructure Planning

This section provides a very brief introduction to the challenges that freight planners face. As you all know, the United States freight transportation network is a highly complex system serving a diverse set of stakeholders and facing tremendous uncertainties and risk. It is also massive; consisting of almost a million miles of Federal-aid highways, over a hundred thousand miles of mostly privately maintained railroad, over ten thousand miles of inland waterways, and more than a million miles of pipeline. The system, as a whole, moves fifty million tons of freight valued at over thirty billion dollars each day.

The complexity arises from more than size, however. Most shipments traveling through the system usually involve two or more organizations, cross multiple borders (municipality, state, or international), and utilize a mix of both public and private infrastructure. One of the defining characteristics of freight transportation is the incredibly diverse set of stakeholders engaged in its design, planning, management, and operations. This set of stakeholders include shippers (ranging from retailers to manufacturers to distributors and beyond), carriers (across all physical and economic modes such as full truckload, less than truckload, parcel, national rail, short-haul rail, air, barge, and pipeline), third party firms (such as brokers, forwarders, and third party logistics providers), and governmental agencies (at the federal, state, regional, and metropolitan planning organization (MPO) levels). It is estimated that over twenty five million business establishments and almost one hundred thousand units of government are involved in freight transportation every day.¹

Unfortunately, planning and strategic development conducted by these key stakeholders (shippers, carriers, third parties, and government agencies) is usually insular and does not involve the other stakeholders. There is tremendous “silo-ing” within freight transportation. Each stakeholder group tends to hold their own conferences, belong to different professional organizations, and lobby independently. This separation is even worse when considering the gap between the private and the public sectors. A 2005 survey of over 500 shippers, carriers, third party providers, and government officials from the federal, state, and local levels found that two thirds of shippers and more than half of the carriers had never met with any government official at any level!²

¹ Statistics on the US freight transportation system come from [Freight Story 2008](#), U.S. Department of Transportation, Federal Highway Administration.

² Caplice, C. and E. Blanco, 2006 “Freight Transportation Infrastructure Survey: Causes and Solutions to the Current Capacity Crisis,” MIT Center for Transportation and Logistics (CTL) Working Paper Series.

Challenges Faces by Freight Planners

In a globalized world, the nature of the freight demand knows neither jurisdictional nor modal limits. Freight flows from one country to another, moving within one country from states to states, municipalities to municipalities. Intermodal traffic is expected to grow from 6.9% of total traffic by value in 2007 to more than 21.4% in 2035.³

However, the public agencies with regulatory roles have historically been divided across jurisdictions (local, state, federal) and modes (road, rail, air, water and pipeline). See Figure 1. The jurisdictional and modal segmentation previously made sense in a geographically and economically growing country. Yet, it now generates misalignments within the public stakeholders but more importantly with the nature of the freight demand itself.

* = Role X = Role at some organizations

	Agency	Infrastructure Development, Operation or Maintenance					Regulatory and Oversight					System Planning					Funding				
		R	T	A	O	W	R	T	A	O	W	R	T	A	O	W	R	T	A	O	W
Federal	U.S. Treasury/ U.S. Customs						*	*	*	*	*										
	Federal Highway Administration	*	*					*				*					*	*			
	Federal Aviation Administration			*					*					*					*		
	Maritime Administration											*	*		*						
	Federal Railroad Administration	*					*					*					*				
	Motor Carrier Safety Administration							*													
	Economic Development Administration		*			*												*			*
	Transportation Security Administration						*	*	*	*											
	Army Corps of Engineers				*					*					*					*	
Surface Transportation Board						*															
State	State Departments of Transportation	*	*	X	X		*	*	X	X		*	*	X	X		*	*	X	X	
	State Economic Development Agencies																				*
Regional and Multi	Port and Airport Authorities	*	*	*	*	X	*	*	*	*	X	*	*	*	*	*	*	*	*	*	*
	Metropolitan Planning Organizations											*	*	*	*	*	*	*	*	*	*
Local	Local and Municipal Governments	X	*	X	X		*	*	X	X	*	X	X	X	X	X	*	X	X	X	*

R – Railroads
T – Trucking
A – Air Cargo
O – Ocean/Waterborne Cargo
W – Warehousing

Figure 1 The Roles of Public Agencies in the U.S Freight System⁴

Although the private sector shares the same historical evolution –with carriers mainly starting with one mode in a given geography, consolidations and the pull from more and more demanding shippers quickly pressed the industry towards an intermodal multi-jurisdictional approach where third party firms (i.e. brokers, forwards and third party logistics providers) emerged to facilitate the emergence of such a system.

³ Office of Freight and Management Operation, DOT, “Freight Facts and Figures: 2008”

⁴ Robins E., Strauss-Wieder A. (2006). “Principles for a U.S. Public Freight Agenda in a Global Economy,” The Brookings Institution Series on Transportation Reform

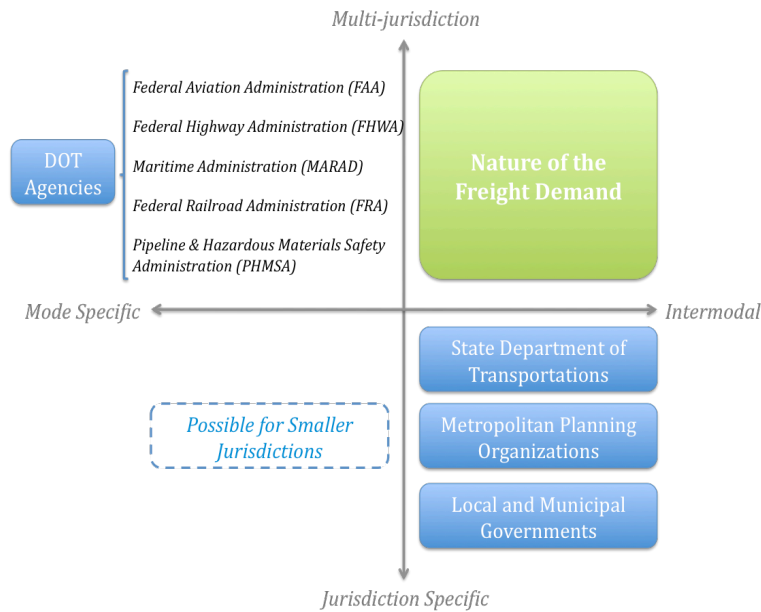


Figure 2 Mapping of the public stakeholders

The evolution of the private sector is indicative of where public freight planning processes are heading as entities with a slower clockspeed often look up to faster clockspeed institutions for innovation and best practices.⁵ The clockspeed of an organization is meant to capture the speed of innovation and adoption.

Indeed, the dynamics within the most recent regulations build up towards an intermodal and multi-jurisdictional planning.

Recent Freight Regulation

An analysis of the most recent federal transportation laws reveals that the transition from mode-specific detailed freight regulations to the facilitation of a multimodal planning is under way –albeit limited.⁶

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) started the process by becoming the first piece of legislation to encourage State Departments of Transportation (State DOT) and Metropolitan Planning Organizations (MPO) to include freight as an input to their planning process. In addition, it created an Office of Intermodalism within the Department of Transportation (U.S. DOT) to coordinate projects involving more than one mode. Without real power, the Office of

⁵ Fine, Charles (1998), “Clockspeed – Winning industry Control in the Age of Temporary Advantage”, *Basic Books*.

⁶ Robins E., Strauss-Wieder A. (2006). “Principles for a U.S. Public Freight Agenda in a Global Economy,” The Brookings Institution Series on Transportation Reform

Intermodalism focused on research and data analysis and as such, was detached to join the Research and Innovative Technology Administration in 2004.

The Transportation Equity Act for the 21st Century of 1998 (TEA-21) succeeded ISTEA and reinforced the emphasis on freight by inviting the involvement of the private sector in planning processes at the state and local level. Under TEA-21, the Transportation Infrastructure Finance and Innovation Act (TIFIA) introduced the funding mechanisms necessary to promote multimodal projects, authorizing the U.S. DOT to provide loans and lines of credit.

The Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users of 2005 (SAFETEA – LU) “addresses the many challenges facing our transportation system today – challenges such as improving safety, reducing traffic congestion, improving efficiency in freight movement, increasing intermodal connectivity, and protecting the environment.”⁷ It built on previous acts like TIFIA by lowering the threshold required for the total project cost. It also created the Freight Intermodal Distribution Pilot Program to “provide \$30 million through 2009 for grants to facilitate intermodal freight transportation initiatives at the State and local level to relieve congestion and improve safety, and to provide capital funding to address infrastructure and freight distribution needs at inland ports and intermodal freight facilities.”⁸

The future of Federal regulation remains uncertain with some more other pieces of legislation capturing most of Congress attention span. As a consequence, Senate extended SAFETEA-LU till February 28th, 2010.

Although a limited yet genuine push for intermodalism and freight planning exists at the Federal level, the reality differs at the state and local level where political intent fails to translate into actions. State DOTs and MPOs tend to replicate the federal model with a separate office or division for each mode. Such “silo-ing” is all the more detrimental for freight planning as many State DOTs and MPOs lack the resources both in quantity and quality to support freight planning initiatives. In most smaller State DOTs and MPOs, there is not a single, designated “freight planner.”⁹

Despite all those potential hurdles, examples from across the country demonstrate that intermodal projects can find funding and that local agencies can evolve to integrate freight as a critical dimension in their transportation planning. Although the critical importance of freight in the economic development of their respective regions is a key factor to explain those successes, we will argue that coordination and communication across stakeholders made them a reality.

⁷ “A Summary of Highway Provisions in SAFETEA-LU,” Federal Highway Administration, Office of Legislation and Intergovernmental Affairs, August 25, 2005

⁸ Ibid.

⁹ “Integrating Freight in the Transportation Planning Process,” FHWA-NHI-139006

Case Studies

In the literature¹⁰, examples abound of projects or even entire planning exercises that were financed through collaborative funding and coordination across multiple stakeholders from both the public and the private world.

- The Puget Sound Regional Council recognized freight as a key to competitiveness in a globalised market and decided to create a partnership with the Washington State DOT as well as 26 local cities, counties, ports, federal, state and regional transportation agencies, railroads and trucking interests.¹¹ As a result, it has assembled \$568 million of public and private funding to build strategic infrastructures like railroad grade crossing and port access projects.
- In collaboration with the Union Pacific, the City of Reno created momentum both at the local, state and federal level to secure funding for the suppression of 11-railroad grade crossing by the construction of a 2.25-mile trench. In addition to the benefits in terms of traffic congestion and safety, the effect on the economy from construction on newly freed land is estimated to be \$360 million.¹²
- The Alameda Corridor stands out as one of the largest and most famous intermodal project in the U.S. The \$2.4 billion construction of a 20-mile rail link between the Port of Los Angeles and Long Beach to a transcontinental rail transfer facility east of downtown Los Angeles is to trigger improvements both in terms of efficiency and safety, thus securing funding from both public and private sources.¹³

Some State DOTs and MPOs have identified the need to formally integrate freight dimensions into their planning exercises. This has led to structural changes to their organizations, generating examples of what a successful freight-planning program looks like.¹⁴

- The California DOT created an Office of Goods Movement to drive the agenda on strategic plan developments such as the Global Gateways Development Program.
- Acknowledging the need to approach freight from a holistic perspective, the Maine DOT abandoned the modal silos, inherited from the past (highway, rail, transit, water and air), and divided responsibilities into the newly formed Offices of Freight and Passenger Transportation.

¹⁰ "Integrating Freight in the Transportation Planning Process," FHWA-NHI-139006, provides several of them

¹¹ Puget Sound Regional Council website, <http://www.psrc.org/transportation/freight/fast>, accessed December 22nd, 2009

¹² City's website, <http://www.cityofreno.com/Index.aspx?page=353>, accessed December 22nd, 2009

¹³ "Integrating Freight in the Transportation Planning Process," FHWA-NHI-139006

¹⁴ Appendix E, Publication No. FHWA-NHI-05-151

- The MPO for the Philadelphia/Camden/Trenton region, the Delaware Valley Regional Planning Commission, recognized the importance of freight in regional development and committed two staff resources to freight planning activities under its Urban Goods Program.

Summary

While this section has emphasized the silo-ing effect of jurisdictions and modes, it has not covered another line of demarcation between stakeholders: time horizon. By nature, the private sector, looking at its quarterly results, will struggle to relate with state agencies decade-long planning, which in turn may not align with the yearly cycles of reelections for local officials. The time dimension does not change our analysis; it only exacerbates the fault lines between the stakeholders and reinforces the need for cooperation and communication across those various groups.

Many successful programs, such as the Puget Sound Regional Council¹⁵, build on relationships developed from outreach efforts and private sector participation, like the Puget Sound Regional Council Regional Freight Mobility Roundtable in this case. The MIT Team hence invites you to consider the Future Freight Flows Symposium as an opportunity to lay the foundations of future successful programs.

¹⁵ "Integrating Freight in the Transportation Planning Process," FHWA-NHI-139006

4. Description of Project NCHRP 20-83-(01)

This section provides some background on the larger project that the Future Freight Flows symposium is part of. It is intended to provide context on how the symposium fits into the plan and what the next steps are.

The two primary objectives of the NCHRP 20-83-(01) research project are to:

- (1) Determine and analyze the driving forces and key uncertainties behind economic, business, and societal changes that may affect the U.S. freight transportation system over the next 30 plus years, and
- (2) Enable informed discussions of national, multistate, state, and regional freight policy and system investment priorities.

As a side benefit, it is hoped that this research and the resulting methodology will engender more productive interaction between the diverse stakeholders of the US freight transportation system.

It is important to point out that this project will not develop the “official version” of the future for the US freight transportation system to be used by all decision makers. As mentioned above, the system is too large and complex and faces too many uncertainties for this to be possible. Also, the planning and assessment of policy and management strategies should be an on-going process involving as many stakeholders as possible – not a one-time event. Therefore, the project will not simply provide a static list of actions that a federal, state, or local Department of Transportation (DOT) planner should undertake to prepare for the future. Instead, it will provide a set of customized tools and procedures that can be adopted and immediately implemented by the various decision makers across the stakeholders. The primary methodology that we will be adopting is called Scenario Planning.

The research project has four phases – which we will describe in turn.

Phase 1: Identify Driving Forces

In the first phase, we are seeking to identify the key driving forces and critical uncertainties affecting the US freight transportation system. The Future Freight Flows symposium is the first step in this phase. The 60 attendees to this symposium (including you) have been individually invited in order to provide a breadth of coverage but still allow for a depth of discussion. While the specific activities and participants of the symposium have been covered in Section 2, we will give a brief overview here.

On the first day, there will be a series of presentations from thought leaders in key areas ranging from demographics, economics, government regulations, technology and sustainability. Each presentation will address potential future trends in their

specific area. The MIT team will lead the attendees through a formal process of translating these future trends and outcomes into potential implications for freight flows and business in general. On the second day, the attendees will participate in a series of interactive exercises in small groups to flesh out the critical factors and uncertainties identified on the previous day. Essentially, the first day is there to open everyone's mind up to various potential future situations, while the second day clarifies and better defines the identified driving forces.

The insights and factors identified during the symposium will then be vetted and prioritized across a larger cross-section of stakeholders through the use of a survey. The end result of this phase is a prioritized set of potential driving forces and key uncertainties facing the freight transportation industry.

Phase 2: Develop Scenarios

The second phase uses these driving forces and key uncertainties as part of the Scenario Planning process. Scenario Planning is a form of long-term strategic planning that involves the development and use of future scenarios or states of the system at hand. A scenario is simply a vision of a possible future state of the world and the relevant environment. This is not necessarily the future state that a planner *prefers* to occur, nor is it necessarily the most *probable* future state. Instead, each scenario is a methodically constructed story about an alternative future in which today's decisions might play out. A good scenario must be plausible, internally consistent, and challenging for strategic purposes. It should make the decision makers see the future in new ways and question their unspoken assumptions. A Scenario Planning engagement, thus, typically involves the use of multiple, mutually exclusive scenarios. A classic and very readable reference on the details of Scenario Planning is Peter Schwartz' "The Art of the Long View."¹⁶

MIT CTL has been advancing and applying the Scenario Planning methodology to freight transportation and supply chain management since 2005 under the Supply Chain 2020 (SC2020) initiative. In the last three years alone, CTL has conducted over two-dozen Scenario Planning workshops involving more than 700 individuals representing over 150 different organizations. These engagements typically involved development or embellishment of three specific global scenarios called Synchronicity, Spin city, and Alien Nation. Brief summaries of these scenarios are shown at the end of this section.

During this phase, we will develop a series of future stories or scenarios that can be used by DOT planners and officials when establishing national, multistate, state, and regional freight policy and system investment priorities. This will include collateral such as multi-media presentations and documents as well as a process for translating the large macro-scale future trends to relevant factors that could impact the infrastructure investment decisions being considered. Mapping and quantifying these future outcomes to usable and actionable decisions, is one of the major

¹⁶ Schwartz, Peter (1991), "The Art of the Long View," *Doubleday*.

challenges involved in using Scenario Planning. We have developed five Flow Implications that any future trend can have on the freight system¹⁷:

- Impact on Sourcing Patterns – where will the freight enter the system,
- Impact on Flow Destinations – where are the products being consumed
- Impact on Routing – how does the freight move through the network,
- Impact on Flow Volume – how does the magnitude of volume change, and
- Impact on Product Value Density – how do the characteristics of the actual freight moving through the system change.

The final results of this phase will be the development of the complete Scenario Planning process to include full collateral and methodology.

Phase 3: Identify consequences and Implications

The third phase of the project will apply this methodology in six Scenario Planning Workshops conducted by the CTL team in different cities across North America. Each single day workshop will be facilitated by the CTL team and will involve 40 to 60 participants drawn from all four of the stakeholder groups from that area. We will be using realistic investment decisions that are relevant to each area in the Scenario Planning exercise for that region. This will let us test the process under a wide variety of conditions and uses.

We are in the process of selecting the locations for these workshops, but at least one will be held outside of the United States. We will provide more information to you as the plans progress.

Phase 4: Synthesize and Communicate

Finally, the fourth phase will involve the collection, categorization, synthesis, and critique of the key insights, impacts, and other factors influencing the US freight transportation system over the next 30 to 50 years. Additionally, a ready to use set of tools and collateral will be developed for decision makers to use on an on-going basis to continue the Scenario Planning process. This activity will further engender interaction between the disparate stakeholder groups and will place the state DOTs as the nexus for all future freight transportation planning and strategy development.

Summary of SC2020 Global Scenarios

Three scenarios were developed as part of MIT CTL's SC2020 initiative. They were based on the idea that there are three major driving forces in the world: economic or market, social, and government. At any one time two of these three will be dominant – thus resulting in three potential combinations: Alien Nations (Government & Society), Spin City (Government & Market), and Synchronicity (Market & Society). These three scenarios are briefly described below. In actual

¹⁷ This is similar to the “Mobility Implications” that were developed by Zegras, C., J. Sussman, and C. Conklin (2004), “Scenario Planning for Strategic Regional Transportation Planning,” *Journal of Urban Planning & Development*.

engagements, much more in depth stories and descriptions are developed to help the participants better understand the future state.

Scenario 1: Alien Nations

Citizens of the Alien Nations world think and act locally. Foreign peoples and governments are mistrusted or even disdained; globalization does not even warrant lip service from a political establishment hemmed in by nationalism. Energy is a hot-button issue because countries are in competition for dwindling natural resources. Conservation and energy efficiency policies are being pursued with vigor. The lack of standardization across global trading and commercial systems makes international expansion risky and expensive. Trade barriers are strewn across the world. Not surprisingly, companies focus their endeavors on national markets and customers. A major threat to world stability is unsynchronized business cycles and investment strategies, a symptom of the lack of global unity. Nationalistic attitudes obstruct emigration, even though there is a high demand for younger migrant workers in many countries. In the Alien Nations world charity begins - and ends - at home.

Scenario 2: Spin City

Trust and national security issues dominate political and corporate agendas. Globalization remains a powerful force, but hamstrung by a complex web of conflicting regulations. Governments are intervening more and more to strengthen security and paying less attention to their markets in an increasingly complex trading environment. As a result, markets are not as efficient as they could be, and managing change is a major challenge since the ground rules for trade are in a constant state of flux. Trust is a distinct competitive advantage. To compete globally, companies have to build solid reputations for being trustworthy. Highly innovative enterprises that can exploit the new, but fleeting, business opportunities around the globe that are a feature of this fast-changing world are also in a strong competitive position. The conflict at the heart of this world is: should regulation or market forces champion trust and physical security?

Scenario 3: Synchronicity

Democratic ideals have taken hold across the globe, and intrinsic to these ideals is the notion that all parties - whether they be individuals, companies or governments - must trust each other. In this world, trust does not impede business or societal relationships - it promotes them. As a result, untrammelled global commerce flourishes in Synchronicity world, to such an extent, that a major challenge for companies is keeping up with constantly shifting market demands and technological breakthroughs. Qualities such as trustworthiness and integrity are essential to business success. Life is rich but frenetic, and people like to sample as much of it as they can. They change jobs frequently, another challenge for companies that increasingly rely on "knowledge workers" to create the customized products and services that are in demand. Environmental protection has become universal aspiration.