Private-Sector Applications of Big Data for the Public Sector

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Paul Bingham, Economic Development Research Group

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Activities enhanced or newly possible due to availability of big data and the tools to analyze it.

The applications of big data follow the critical activities of acquiring, storing and processing large volumes of a variety of data quickly, often continuously.

Focus here is on the analysis and applications of the big data for freight in the private sector for public sector purposes.

Source: Adapted with reference to U.S.DOT OCIO
Categories of private sector big data applications:

- Data warehouse modernization
- Operations and asset management
- Security, safety, intelligence
- 360-degree views of customers / suppliers
- Big data exploration

Source: adapted from IBM
Enterprise-level big data, across dimensions of the business:

- **Financial data** – internal asset / inventory valuation, item-to-subcomponent level detail, customer / supplier financial conditions and performance, dynamic financial modeling, capital management, financial regulatory reporting compliance and audit cost reduction

- **Legal and regulatory** - Compliance-driven data streams for risk management, liability or insurability reasons, damage claims, contract terms fulfillment monitoring, reporting

- **Human Resources** – Workforce management, health & safety, recruiting, performance evaluation, benefits, training and education

- **Environmental data** – regulatory compliance, reporting, performance

- All potentially with public sector uses, but not the focus for freight now
Key categories of private sector big data applications for freight in the public sector:

- Operations
- Asset Management
- Supply Chain Management

Data for these categories are interrelated.
Operations data are at the core of freight transportation services businesses

- The most advanced freight services providers can be described as information technology companies who sell goods movement services

- Competitive pressure to make continuous improvements in operations depends on advances in data applications, increasingly big data applications to find additional improvement

- Reduce cost, time, unreliability and emissions
Freight operations big data applications include:

- Deployment / dispatch and schedule planning
- Real-time dynamic route optimization
- Operational capacity planning
- Risk management and resiliency planning
- Network planning
Big data application made possible revolution in routing optimization.

- Streamed vehicle data, combined with real time traffic data and network topology and stop points.
- Replaced proxies such as distance, travel-time

UPS reduced fuel consumption, emissions and time by avoiding left turns & stopping at lights

Source: Adapted from James Pol, US DOT ITS JPO, 2012
GPS Data Uses:

- Tracking, tracing, security
- Supply chain visibility
- Adapt to operator preference
- “Eco-routing” – emissions / fuel

Can optimize for time, distance, fuel use or emissions

Schneider National reduced safety incidents applying predictive analytics to big data streams

Motor carrier Schneider National created a big data application for improvements in operational safety of their truck driver workforce.

Using data streamed from onboard sensors, driver behavior is monitored and managed to maintain safe operations and meet safety metrics.

Schneider piloted a process where sensor data, along with other factors, is used in a model predicting which drivers may be at greater risk of safety incidents.

This use of predictive analytics is used in coaching drivers in advance of incidents to pre-empt and lead to less safety-related incidents.
Freight asset management is using big data applications to reduce cost and increase asset life and reliability.

These applications are advancing rapidly using on-asset sensors combined with predictive modeling.

Applications are used to monitor conditions and optimize maintenance and replacement.

Sensor data stream potentially useful to public sector for network asset condition monitoring.
Global supply chain management is using big data applications for in-transit visibility. These applications have progressed rapidly yet are in their infancy when likely viewed from perspective of 5-10 years from now. Third party firms such as Cargo Smart integrate data from 1000s of shippers and dozens of carriers to offer global shipment tracking data and associated performance metrics.
Go beyond UPS-style one firm fleet optimization to the rest of the commercial vehicle universe.

Current application is a big data silo within UPS.

No V2V exchange of data, or fleet-to-fleet that could allow optimization of interactions between other vehicles to more efficiently allocate network capacity (though timing, routing, etc.)

Big data from ubiquitous sensors will eventually allow network-wide system optimization.

For public roads, a public sector application.
Inrix freight traffic data big data analysis example: Chicago freight trips

Study Area:
- Greater Chicagoland Area, and beyond
- 154 zones

Study Period:
- July – Sept 2013 (3 months)

Total Data Points Analyzed:
- ~1.5 billion

Freights Trips Identified:
- 4.8 million

Results provided as OD Matrix

Source: Inrix, 2015
Overcoming Barriers / Finding Value

Barriers to Public Sector Applications of Private Sector Big Data
- Trust in others’ data quality and security
- Ownership rights, use / reuse of the data
- Operator behavior sensitivity
- Gap between private and public sector time-frames

Finding Value in the Big Data Applications:
- Leveraging user-optimal choices to deliver system-optimal performance
- Promoting a more open public sector – shipper/carrier dialogue
- Demand management influence on dynamic freight routing
- Network operations management
- Road / congestion pricing
- Economies of scale to provide access to data at lower cost

Source: Adapted from James Pol, US DOT ITS JPO, 2012
The pace of evolution in the big data field is fast, driven by Moore’s law, Silicon Valley innovation and substantial private sector financial investment in big data R & D.

The pace of public sector big data policy and program development is slower, limited by procurement and rulemaking processes and funding availability.

The gap between public and private sector temporal perspectives and abilities to act impedes progress in applying private sector big data for the public sector.

Government facing this problem openly can help minimize its impact and help set expectations more realistically.

Source: Adapted from FHWA-JPO-14-157, Dec. 2014
For the public sector

• Identify candidate high-priority applications judged by data availability to the government with greatest potential for improvement in operations and asset management

• Push towards use of predictive analytics for traffic, demand management, infrastructure maintenance, based on weather, demand, and incident patterns.

• Redeploy resources in the public transportation agencies to build capacity and technical capabilities to use big data for freight.

• Expedite public sector R & D to reduce the gap between the private sector adoption and public sector

For the private sector

• Engage with the public sector to profit from potential collaboration

Source: Adapted from FHWA-JPO-14-157, Dec. 2014
Need institutional framework, policies and business models for public sector to use private sector big data applications

• Lessons learned from existing programs (e.g. Freight Performance Measures)

• Consideration of impacts of applications for state and local agencies

• Develop a roadmap of research and related activities to close gaps and advance adoption of applications

Source: Adapted from FHWA-JPO-14-157, Dec. 2014
Thank you!

Paul Bingham
pbingham@edrgroup.com
(617) 338-6775 x260