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A Framework for Determining Highway Truck-Freight Benefits and Economic Impacts

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A Framework for Determining Highway Truck-Freight Benefits and Economic Impacts

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Background

- Quantitative analysis of freight investments prioritization is required.
- Few existing freight specific project impact analysis frameworks.
- Unable to capture full-range of freight related impacts stemming from freight investments.
  - Direct benefits: e.g. travel time savings
  - Indirect benefits: e.g. increasing in regional employment and income

Background

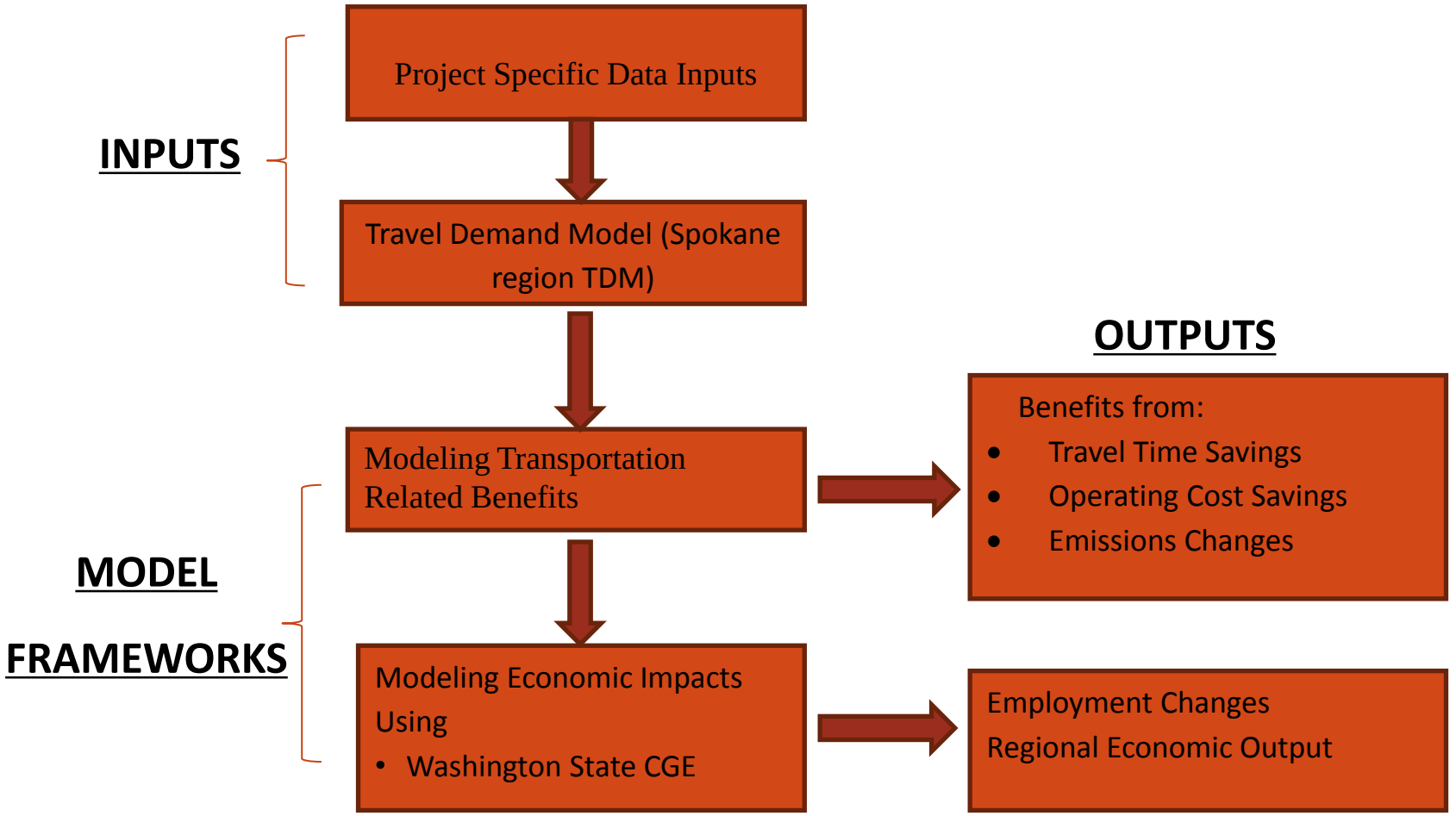
- Research objectives
  - Propose a transparent framework for calculating both the direct freight benefits and the larger economic impacts of freight projects.
  - Apply the framework for project evaluation and prioritization.

Methodology

- Identify benefits
  - Literature review
  - Three Technical groups (urban goods movement, global gateway, rural economies)

- Travel time savings
- Truck operating cost savings
- Emission changes
- Economic impacts

Methodology



CGE: computable general equilibrium model

Methodology--Economic Impacts Analysis (EIA) -- Data

- Utilizes Social Accounting Matrices (SAM) from the 2010 IMPLAN data.
- Aggregate into 20 industrial Sectors:

Aggregation Code	Freight Dependent Industries	Aggregation Code	Other Industries
AGFOR	Agriculture and Forestry	INFO	Information Services
MIN	Mining	FININS	Financial and Insurance
UTIL	Utilities	REAL	Real Estate
CONST	Construction	PROTEC	Professional and Technical
MANUF	Manufacturing	MANAG	Management
WTRAD	Wholesale Trade	ADMIN	Administration
RTRAD	Retail Trade	SOCSER	Social Services
TRAWAR	Transportation and Warehousing	ARTS	Arts and Entertainment
TRUCK	Transport by Truck	FOOD	Food Services
WMAN	Waste Management	OTHR	Other (Including Government)

Methodology--Economic Impacts Analysis (EIA) -- Model

- Create four regional CGE models.
  - 2 Geographic scales
  - Long-Run (LR) and Short-Run (SR) scenarios
- Model the infrastructure investment as an improvement in technology.
  - Improves the productivity of the transportation system
  - Initiate the CGE through a counterfactual that shifts the industry supply curve: (Cobb-Douglas shown for simplicity)

$$Q=S(K^{\alpha}L^{1-\alpha})$$

    - Value of the shift is dependent upon the percent change in operating costs to the trucking industry

Case Study

- Interstate-highway widening project
  - 10 mile, 2 lanes each direction.
  - A critical connector for the region and serves approximately 9,000 trucks daily.
  - Freight demand is projected to increase by 30% over the next 10 years.
  - Adding one lane each direction.
  - 2035 build and no build scenarios were modeled by regional TDM.

Case Study -- Transportation Benefits

- 2016-2035, Thousands of 2010 Dollars

Benefit Category	
VHT reduction	295 hours
Truck travel time savings	$ 8,704
Truck operating cost savings	$14,613
Emission impacts	-$5,370
Total	$17,947

Case Study -- Economic Impacts

Travel Demand Model Benefit Output	$	4,533,563
Spokane County Intermediate Expenditures (TRUCK)	$	139,875,763
Statewide Intermediate Expenditures (TRUCK)	$	1,760,368,000
Change in Truck Transport Productivity -Spokane County		3.24%
Change in Truck Transport Productivity -State		0.26%

Case Study -- Economic Impacts

Region	Initial Employment Level	Change in Employment		Change in Activity Quantity (%)	
		SR	LR	SR	LR
County	264,128	25.5	77.9	2.31	3.06
State	5,647,012	22.4	47.2	0.20	0.21

- **Price for truck services and regional output sales change:**
  - County
    - SR: 1.94% decrease in price and $9.8 million increase in sales
    - LR: 1.67% decrease in price and $28.7 million increase in sales
  - State
    - SR: 0.18% decrease in price and $10.5 million increase in sales
    - LR: 0.14% decrease in price and $22.2 million increase in sales

Limitations and Future Work

- Limitation of using TDMs
  - Not all model users are experts
  - Rely upon user defined parameters
  - Demand is fixed
  - Challenging to evaluate some benefits, e.g. travel time reliability
- Limited feedback loops between TDM and Impact Models
- Future work
  - Freight performance data
  - Enhancing dynamic nature of models

Conclusion

- A quantitative and transparent framework capturing full-range of freight related impacts can be used for freight project impacts assessment and project prioritization.
- Industrial base of a geographical region significantly impacts model outputs.