


Transport and Economic Development: accessibility and implications for investment planning, evaluation and decision-making

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Agenda

- 1) **Definition:** Economic Development: Alternative Views
- 2) **Issue:** Metrics for Planning, Analysis + Decision Making
- 3) **Approach:** Transport-Economic Links in a 3-D World
- 4) **Moving Forward:**
 - Strategic + Tactical Actions
 - Linking Ex post and Ex ante Analyses
 - Implications for Investment + Planning

(1) Definition

Economic Development -- Alternative Views

World Bank goals:

- End extreme poverty
- Promote shared prosperity

The Basis for Economic Prosperity

Prosperity = economic well-being; achieved by having household income to purchase desired goods and services (standard of living).

Desired goods & services: housing, education, health care, recreation, retail – all enabled by inflow of income *into* a region, which requires producing & selling products & services to buyers *outside* the region.

That in turn requires **productive and competitive industries**. Transport plays a role insofar as:

- *Mobility improvements* reduce cost of labor, goods & services (for existing workers and business product/service deliveries).
- *Reliability improvements* enables more productive supply chain processes.
- *Accessibility improvements* expand the scale of labor, supplier & customer markets, and matching of specialized products + worker skills to business needs

→ ***Enabling business activities not already occurring.***

Outcomes of Regional Development

- **Growth of the economy of a region** -- associated with the upward economic well-being of its population, as indicated by rising income levels, increasing GRP and expanding job opportunities.
 - **Spreading of income and wealth of a region** – associated with decreasing incidence of poverty.
 - **Development of land and buildings** -- resulting from inward flow of money and its population + business expansion consequences
- All depend on the **inward flow of money**, from growth of net export income and/or inward investment, driven by gains in productivity + competitiveness

Enabling Economic Development

Economic development strategies focus on addressing:

Threshold Factors:

- *Cost competitiveness and productivity* vs. outside areas to enable export growth and inward investment (“market competitiveness”)

Cumulative Factors:

- *Path Dependence:* development of a region’s economy depends on sustained + resilient improvement over time, for its labor force, products/services and markets

Distribution Factors:

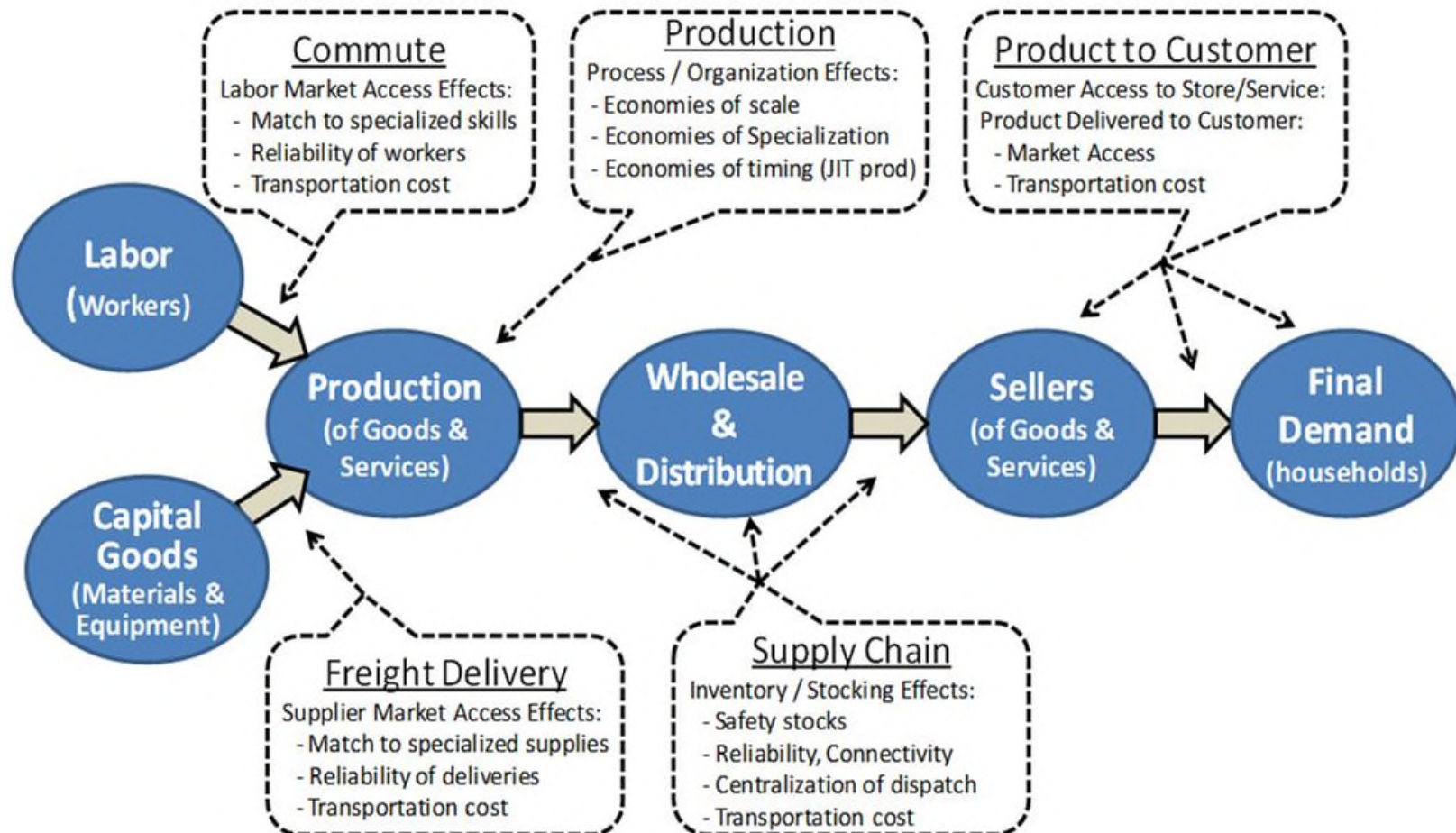
- *Specialization Clusters:* evolve to enhance productivity for resource extraction, R&D, production, supply chain distribution and sales. Conversely, pockets of poverty evolve where conditions do not support economic development.

Regional economies, as with land development and the environment, evolve over time.

Future patterns will depend on prior actions. Change is asymmetric, since it can be harder to undo what has already evolved.

Requirements for Economic Development

Minimum requirements for economic development: cost, effectiveness of labor and capital inputs, and processes for production + delivery



Transport Economic Development Factors

Generalised Cost Factors

(by mode and purpose)

- Travel Time
- Vehicle Operating Cost
- Fare/Fee/Toll
- Safety
- Reliability

Accessibility Factors Affecting Productivity

Local market scale

- for labor commute to work (car, transit)
- for health, education and social services (car, transit)
- for goods and services delivery (trucks)

Regional (same day) market scale

- for same day tourism + business trips (car, bus, rail)
- for same day freight delivery (trucks)

Longer distance market access:

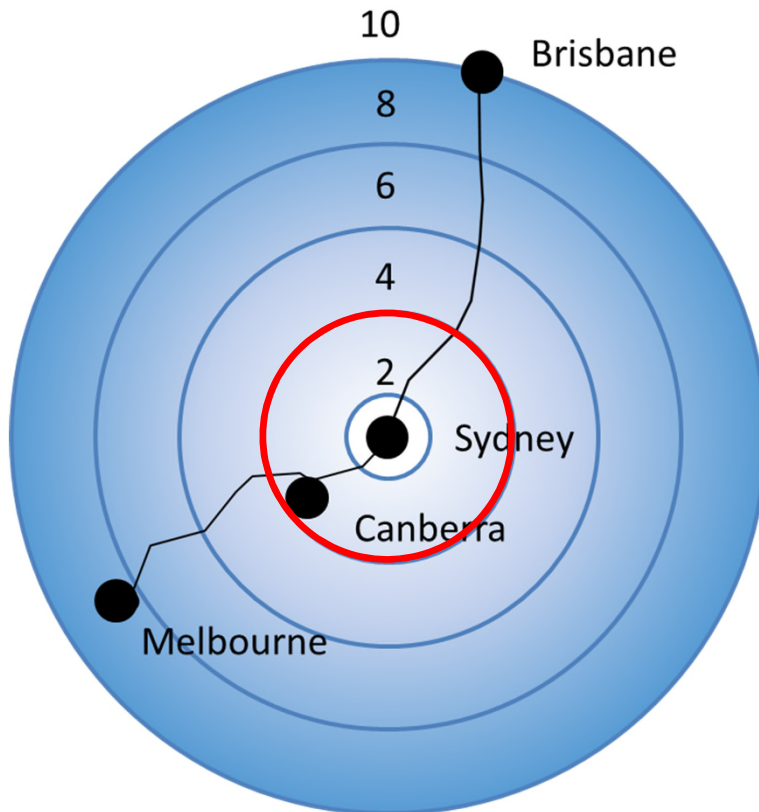
- via cargo airport (access by trucks)
- via air passenger terminal (access by car and transit)
- via rail freight terminal (access by trucks)
- via passenger train station (access by car, transit)
- via marine cargo port (access by truck, freight rail)

Transport factors affecting cost and productivity

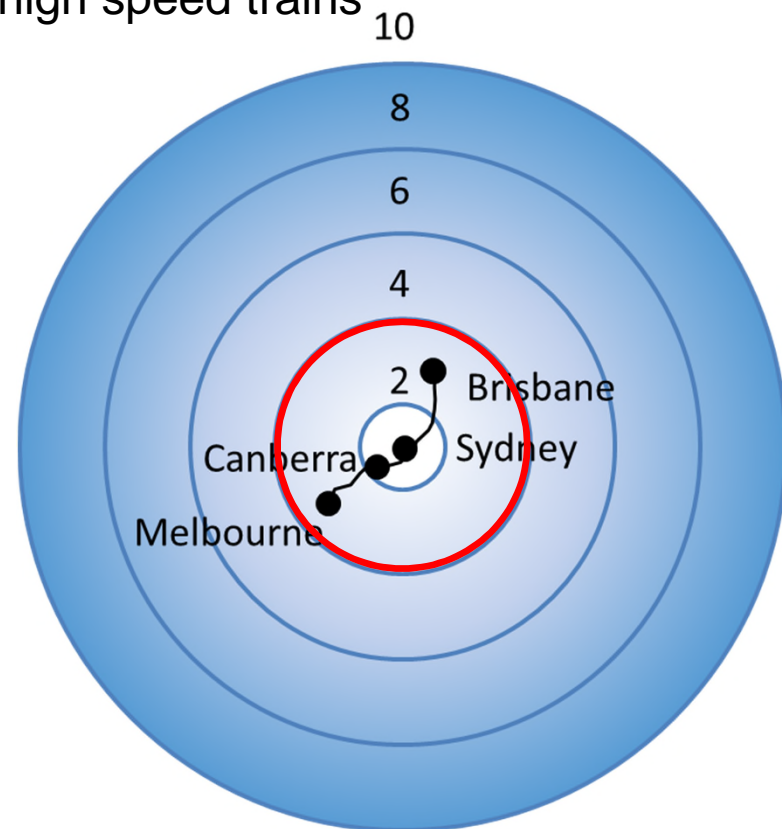
Access Effect: Shrinking Space-Time

Shrinking space-time = Expanding market size => Scale economies for same-day travel

with current roads

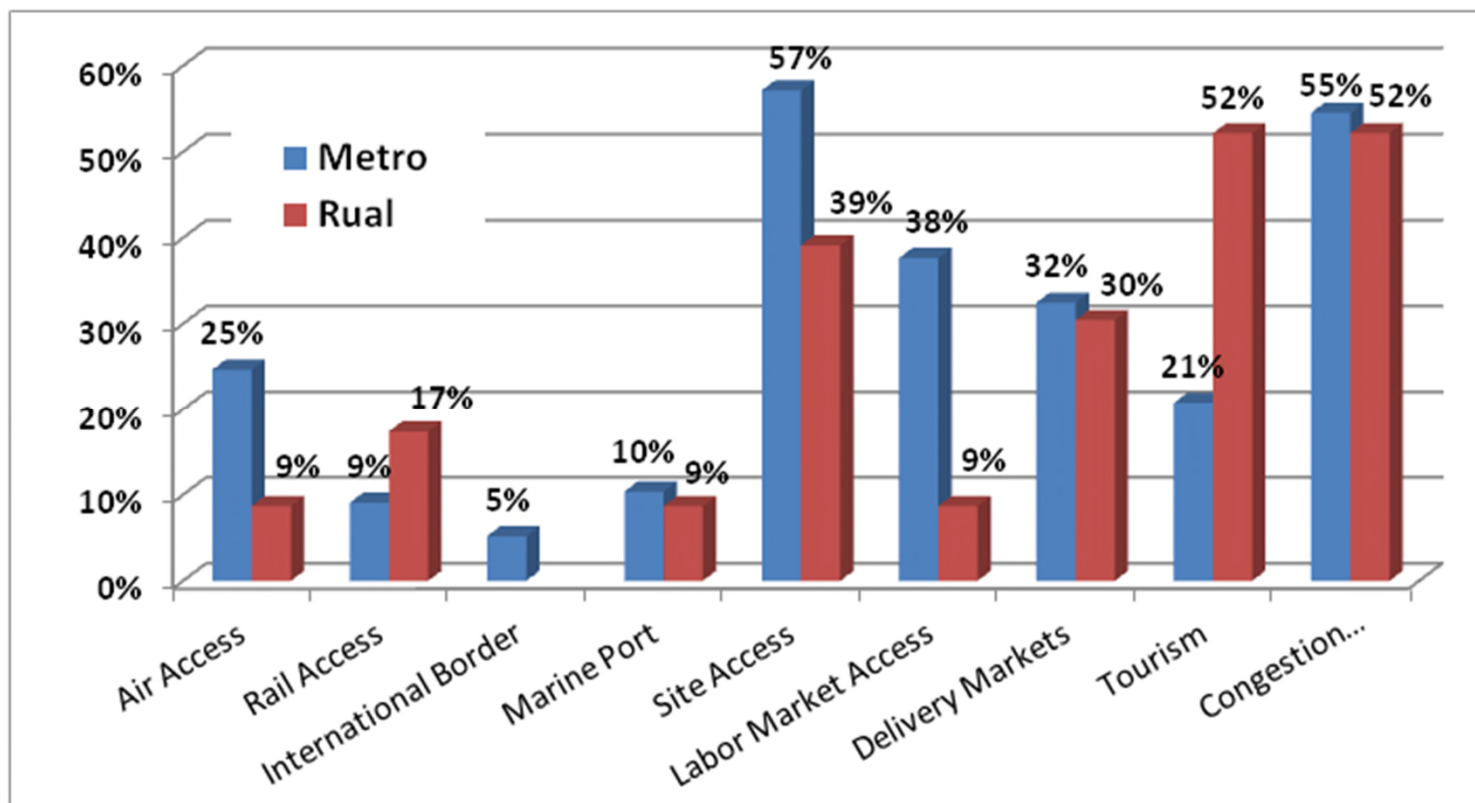


with high speed trains



Importance of Access

Projects are motivated by need for access and connectivity improvement. Economic development follows if other required factors are in place.



Economic Growth Paths

Local Conditions: Resources, Constraints, Opportunities

Decision Criteria on Most Appropriate Growth Path(s) to Pursue



Performance Evaluation – gauging progress on a growth path

Goal – Improved Economic Development

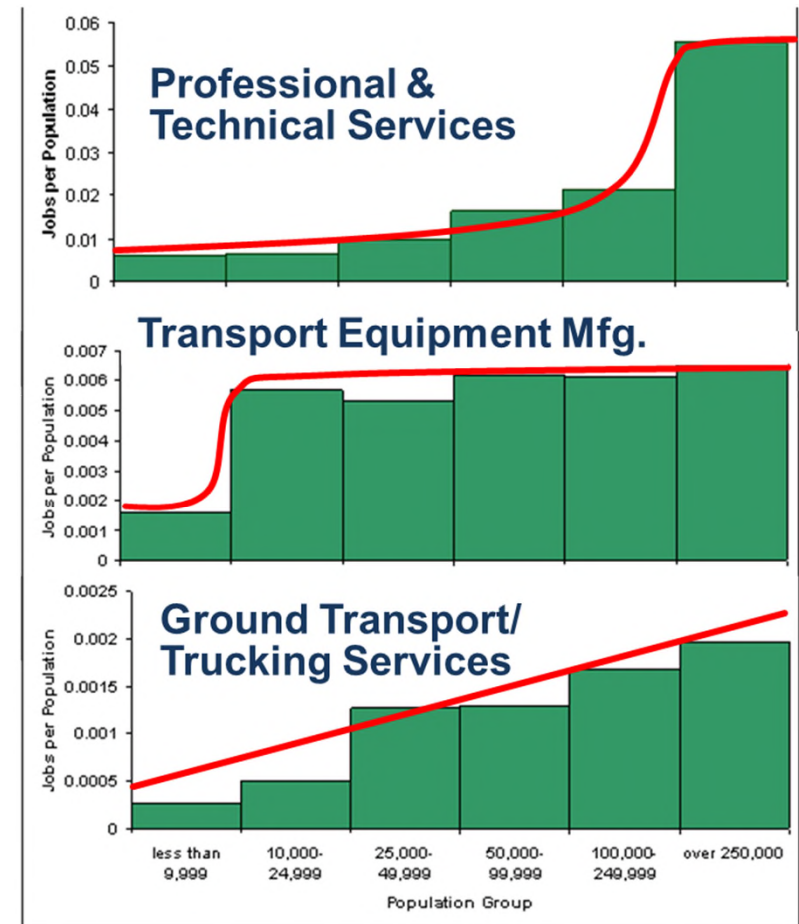
All Spatial Clusters Depend on Access

- 1) **Traditional resource development + tourism activity clusters**
enabled technologies: resource use and extraction
productivity from: outgoing product delivery and incoming customer access
- 2) **Market center clusters**
enabled technologies: inventory stocking, retail center development
productivity from: scale economies in business operations + customer access
- 3) **Production + supply chain clusters**
enabled technologies: production and logistics
productivity from: freight reliability + scale economies in operations, delivery
- 4) **Regional specialty technology clusters**
enabled technologies: technology transfer from R&D centers
productivity from: workforce access (skill matching), connectivity to R&D sites
- 5) **Business headquarters centers**
enabled technologies: corporate HQ functions, conference + visitor services
productivity from: workforce access, connectivity to convention, rail, airport
(as portals to wider markets)

Importance of Market Size Thresholds

Effective market expansion caused by transport can enable scale economies which occur differently depending on the industry sector

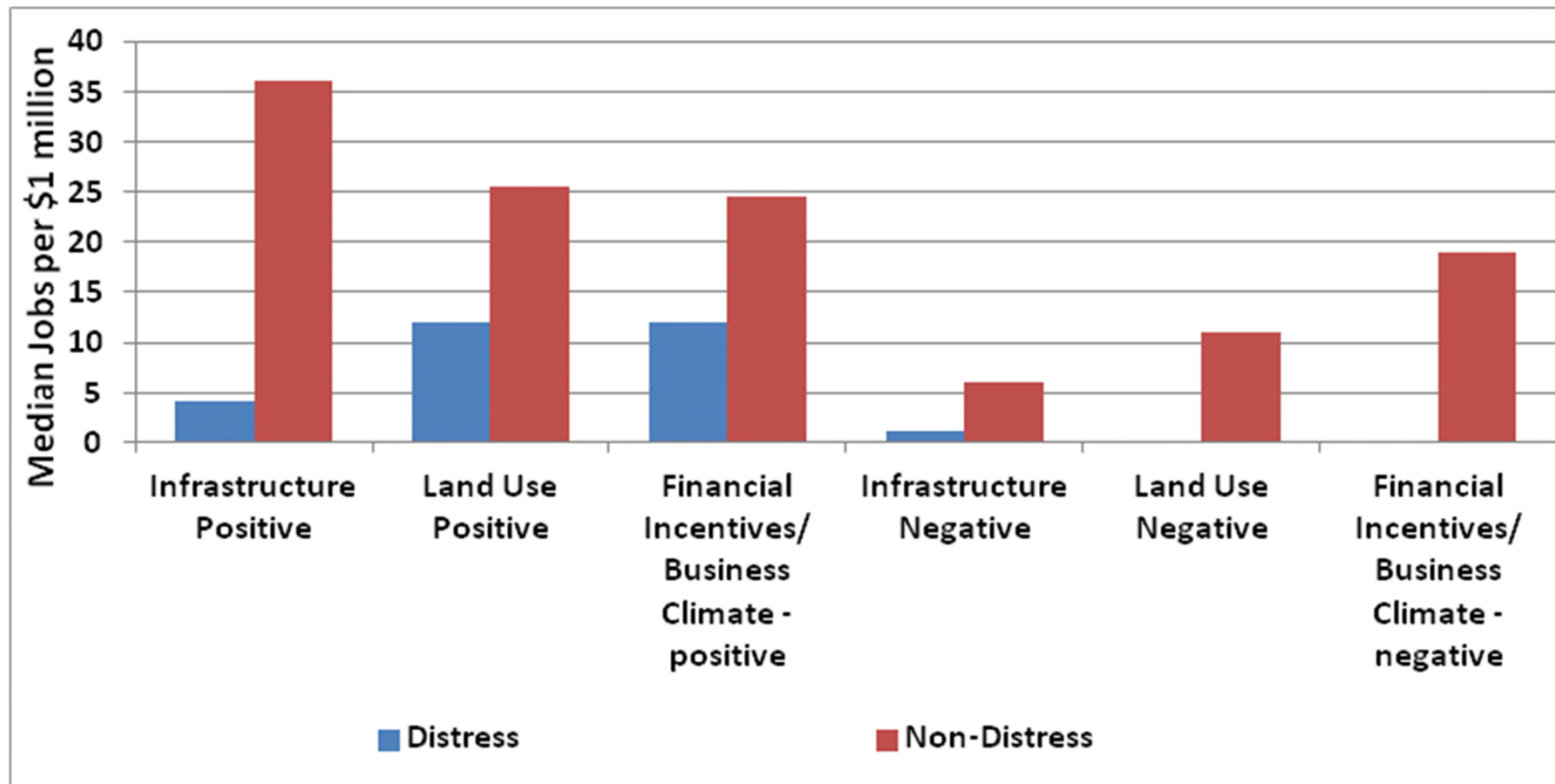
- Appalachian Region
– reducing isolation
- Industry concentration (location + growth) differs by market size
- Transport effect: expanding labor + delivery markets enable activities that were previously not feasible



Sources of growth in non-metro Appalachia, Volume 3, statistical studies of spatial economic relationships, Appalachian Regional Commission.
www.arc.gov/research/researchreportdetails.asp?REPORT_ID=84

Importance of Context Factors

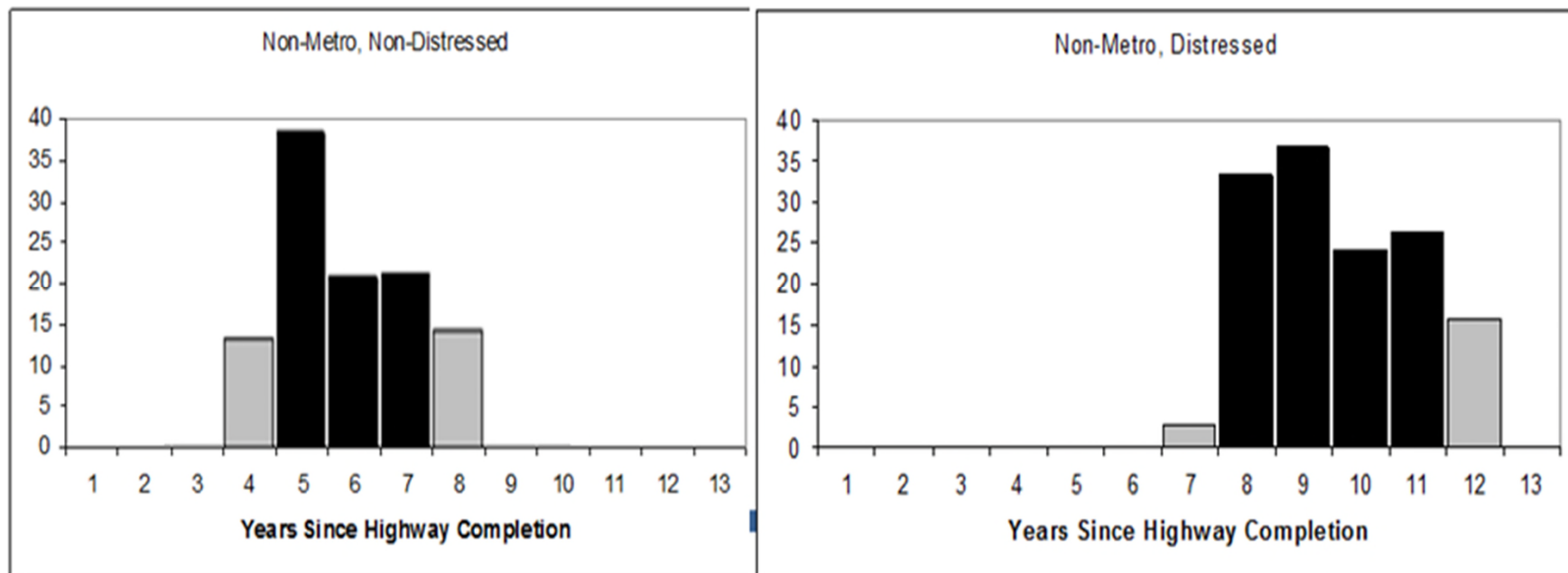
Transport investment effects can be extended or muted by local context factors.



Highway projects only; source: http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_S2-C03-RR-1.pdf

Importance of Time Factors

Transport investment effects can be accelerated or delayed (lag effect) by local context factors. This affects cumulative growth over time.



Sources of growth in non-metro Appalachia, Volume 3, statistical studies of spatial economic relationships, Appalachian Regional Commission. www.arc.gov/research/researchreportdetails.asp?REPORT_ID=84

Gap Analysis: Rating Barrier Factors

Barriers Factors by Industry (1=Critical, 2=Important)

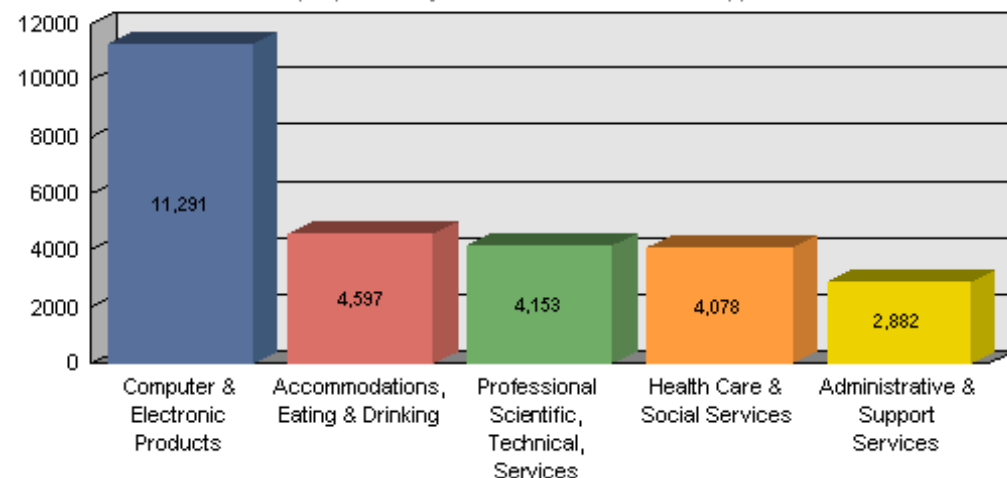
Performance Measurement = Employment
Actual Number of Jobs



NAICS	Sector	Potential Attraction	Prod Cost	Labor Cost	Land Cost	Energy Cost	Tax Cost	Work Force	Labor Skill	Hwy Trans	Rail Trans	Air Trans	Water Trans	Broad Band
221	Utilities	14	-	-	-	-	-	-	1	-	2	-	-	-
230	Construction	374	-	-	-	-	-	-	-	-	-	-	-	-
334	Computer & Electronic Products	15	-	-	-	-	-	-	2	-	-	2	-	-
335	Electric Equipment, Appliances, etc.	19	-	-	-	-	-	-	2	-	-	1	-	-
420	Wholesale Trade	100	-	-	-	-	-	2	2	-	-	2	-	2
481-487	Transportation	206	-	-	-	-	-	-	-	-	-	2	-	-
491-493	Mail, package delivery & warehousing	86	-	-	-	-	-	2	-	-	-	1	-	2
511	Publishing Industries (except Internet)													
513	Broadcasting													
521-523	Monetary, Financial, & Credit Activity													
524	Insurance Carriers & Related Activities													
532	Rental & Leasing Services													
541-551	Professional Scientific, Technical, Services													
561	Administrative & Support Services													
621-624	Health Care & Social Services													
721-722	Accommodations, Eating & Drinking													
TOTAL														

Sectors With Largest Performance Gap

(Reported by Size of Performance Gap)



Typical Economic Development Process

Role of transport investment in economic development follows from spatial + sectoral effects of transport on economic growth, which evolve over time.

Spatial Dimension	<p>Target areas of poverty and unemployment (Stakeholder policy objective)</p> <p style="text-align: right;"><i>Distributional effect</i></p>
Time Dimension	<p>Strategy to enhance LT stability + sustained growth over time (cumulative outcome)</p> <p style="text-align: right;"><i>Cumulative effect</i></p>
Sectoral Dimension	<p>SWOT/gap analysis to target key industries (job + income growth), With strategy to achieve cluster development (competitiveness), with diversification + value chain expansion (resilience, sustainability)</p> <p style="text-align: right;"><i>Threshold effect</i></p>
Enabling Results	<p>Intermediate outcomes + achievement of long term objectives</p>

Takeaway Points...

- If the agency goal is to reduce poverty + increase prosperity by enabling new investment and development
... then project planning and analysis should also focus on economic development metrics (as well as other secondary benefit categories)
- To do that right, attention must be given to the key elements of economic development, which include:
- Achievement of targets to:
 - reach competitiveness thresholds (filling market-related deficiency gaps),
 - support cumulative economic growth (“on the right evolution path”) and
 - Focus on distributional targets (right locations, industry/population groups).

(2) Core Issue

Metrics for Planning, Analysis + Decision Making

Goal Achievement Effectiveness

Governments (and supporting investment banking institutions) are in the *business* of serving people to make their lives better. But to do this, we need to evaluate proposed plans and projects in the following terms

- **The Strategic Case** – *Does it address strategic public goals regarding intended benefits and their distribution (incl. economic development, equity and sustainability)?*
- **The Economic Efficiency Case** – *Is it an efficient use of funds? (Does it provide overall value for money?)*
- **The Financial Case** – *Is it economically viable? (Can it be funded and maintained?)*
- **The Commercial and Management Case** – *Is it organizationally achievable?*

Economic analysis methods (tools)

... each tool has a different intended use

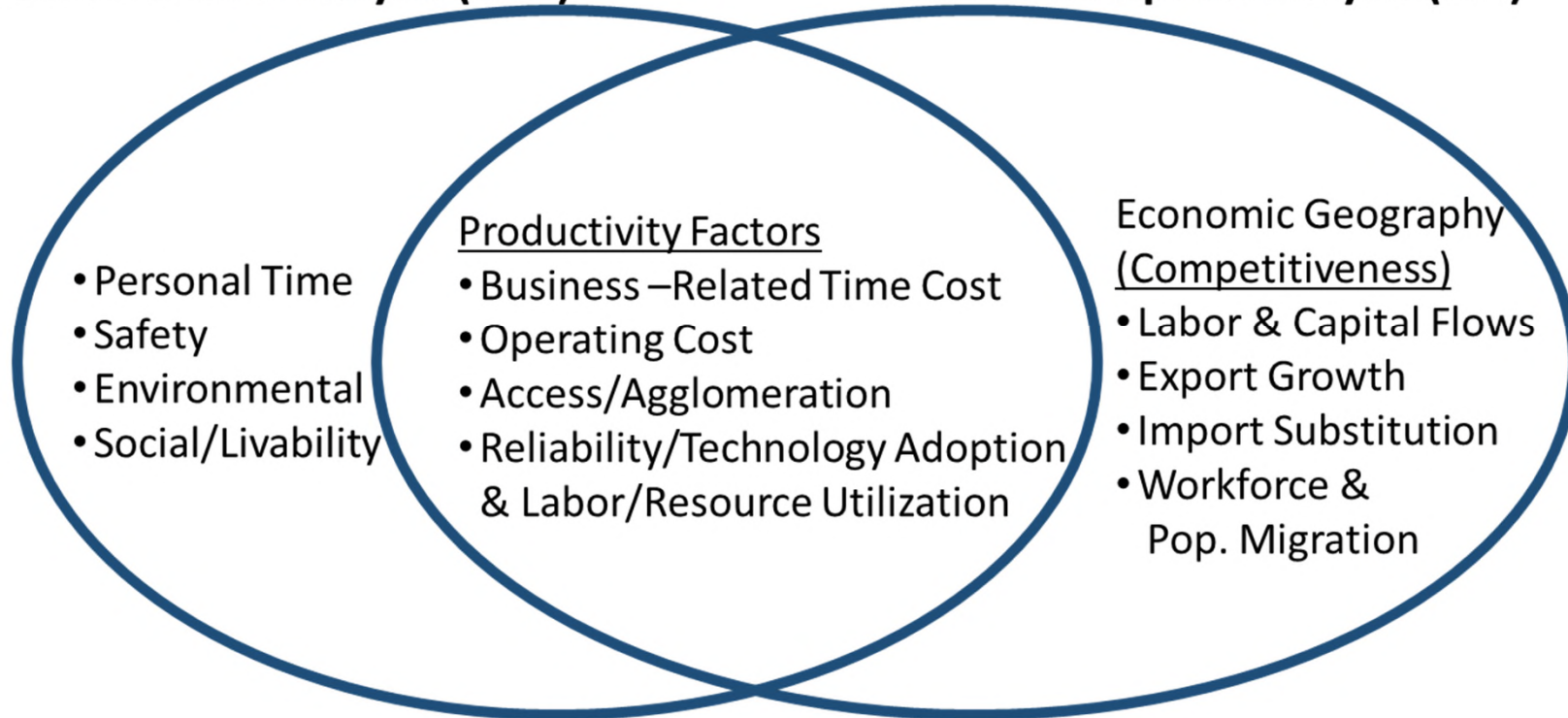
CBA	Discounted \$ <i>(future year values are diminished by the time value of money)</i>	Present Value for Net Benefit (B-C) or Benefit Cost Ratio (B/C) <i>(sum of stream over time)</i>	Efficiency of Investment <i>(reflecting roll-up of all benefits and costs over time, space, elements of economy)</i>
EIA	Constant \$ <i>(reflects today's \$)</i>	Change in GVA or GDP (and assoc. jobs, wages) <i>in specific target years</i>	Strategic Goal Achievement <i>(in terms of economic growth for specified areas, times and elements of the economy)</i>
FIA	Nominal \$ <i>(future year values are increased by inflation growth over time)</i>	Annual Cash Flow and Return on Investment <i>by year over facility life</i>	Feasibility of Financing <i>(in terms of expenditures required and revenues achieved over time)</i>

Relationship of CBA and EIA

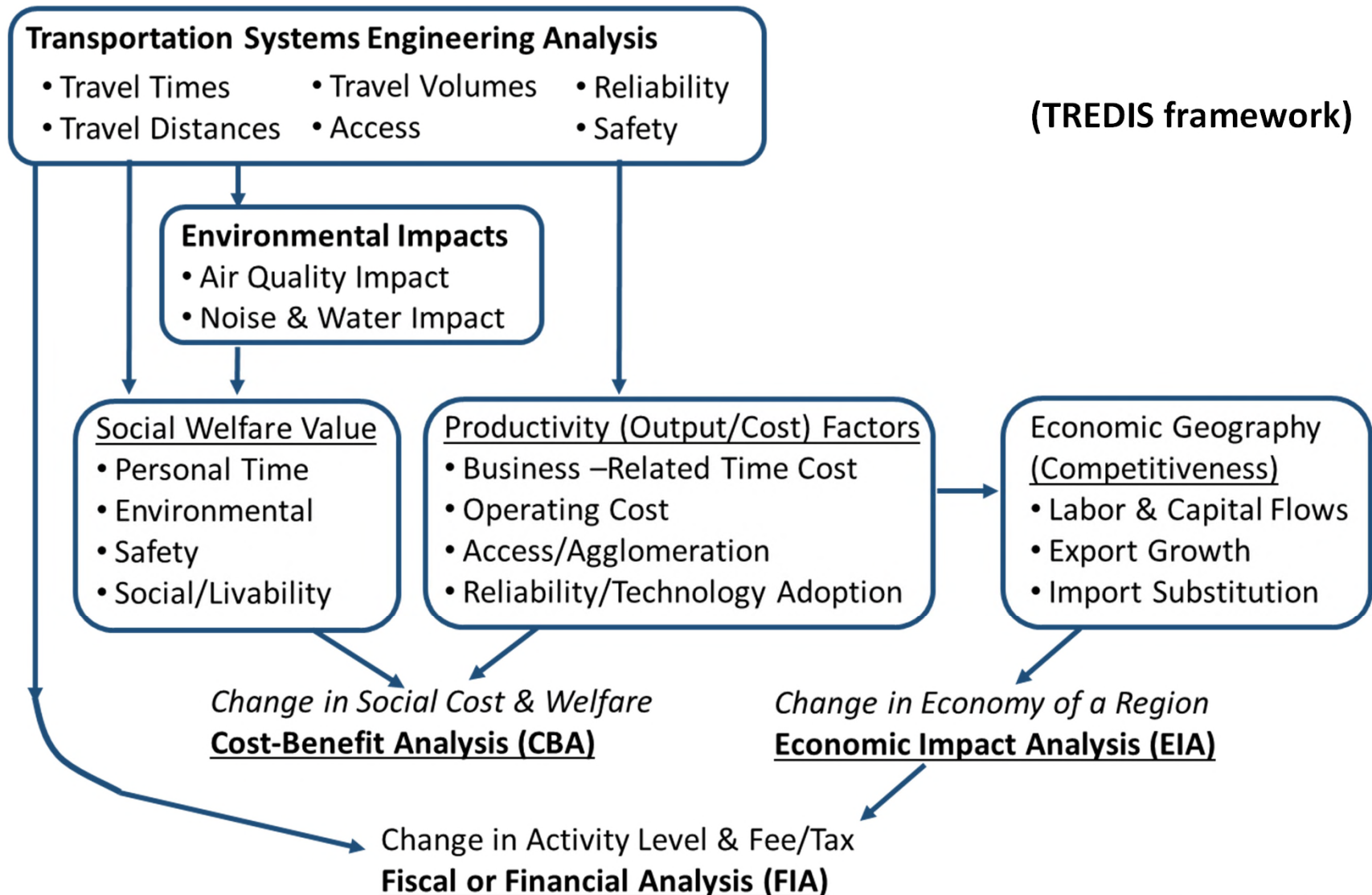
Besides differences in treatment of spatial and temporal distributions, CBA and EIA also differ in coverage of effects.

Cost-Benefit Analysis (CBA)

Economic Impact Analysis (EIA)



Elements Covered in CBA and EIA



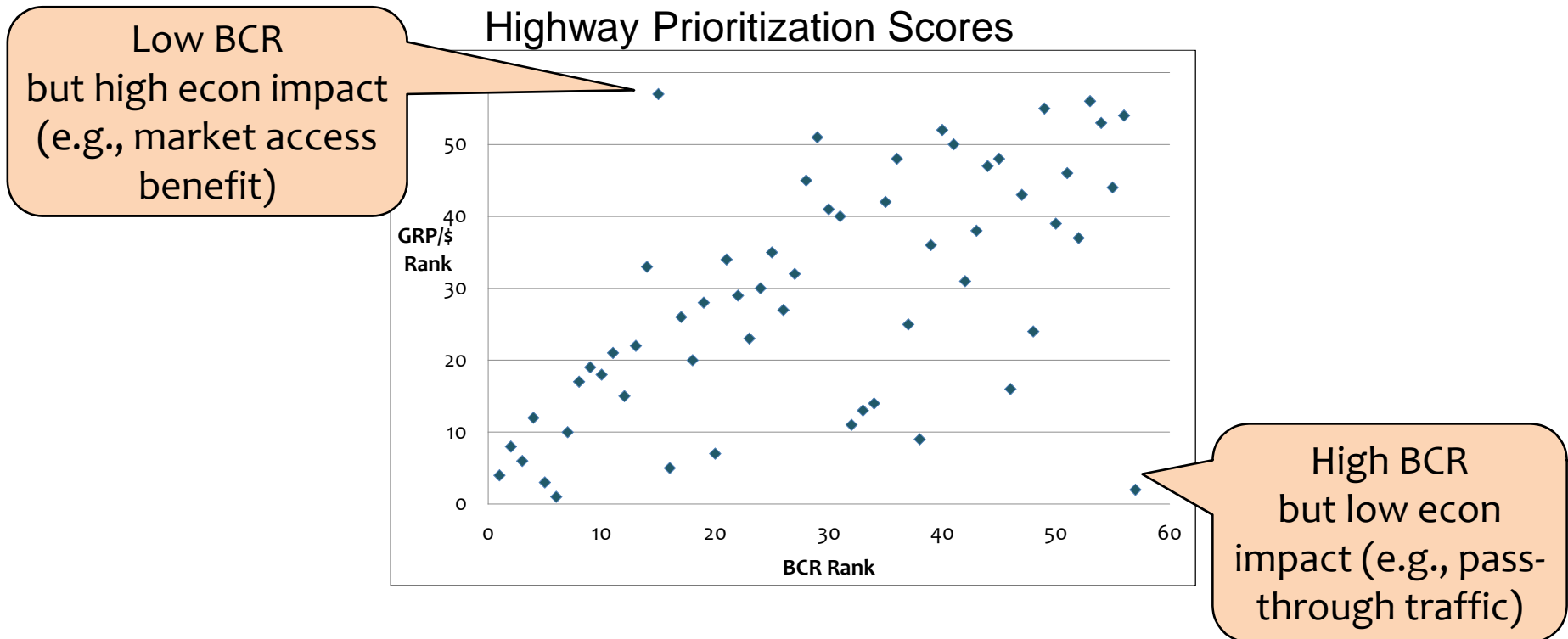
Evolution of infrastructure appraisal

- US 1936 Flood Control Act and 1939 Navigation Act require analysis of full benefits and costs, allows primary & secondary benefits.
<focus on induced regional economic development>
- 1960s: US and UK Guidance documents codify social welfare analysis for federal and state highway investments (building on earlier works of Dupuit, Marshall, Eckstein).
<focus turned to valuation of user benefit>
- 1990s environmental impact valuation added to standard CBA, initial efforts to include wider economic <GDP> benefits or consider economic development impacts separately.
- 2005+ growth of multi-criteria analysis (MCA) to supplement consideration of CBA with social, economic and environmental considerations.

HDM-4: standard CBA for highways

Infrastructure Prioritization Framework (IPF): form of MCA.

CBA and EIA Lead to Different Rankings



Correlation = .54 (Kansas study)

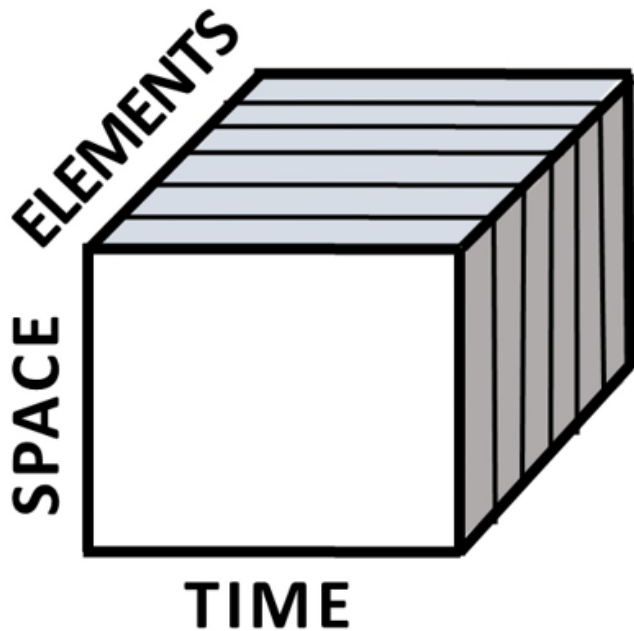
Source: Yvonne Keinembabazi (2015). *A comparative study of transport investment appraisal tools and their implications on project selection*, dissertation, ITS, Univ. of Leeds, 2015

(3) Needed Approach

Transport-Economic Links in a 3-D World

Multi-faceted Economic Evaluation:

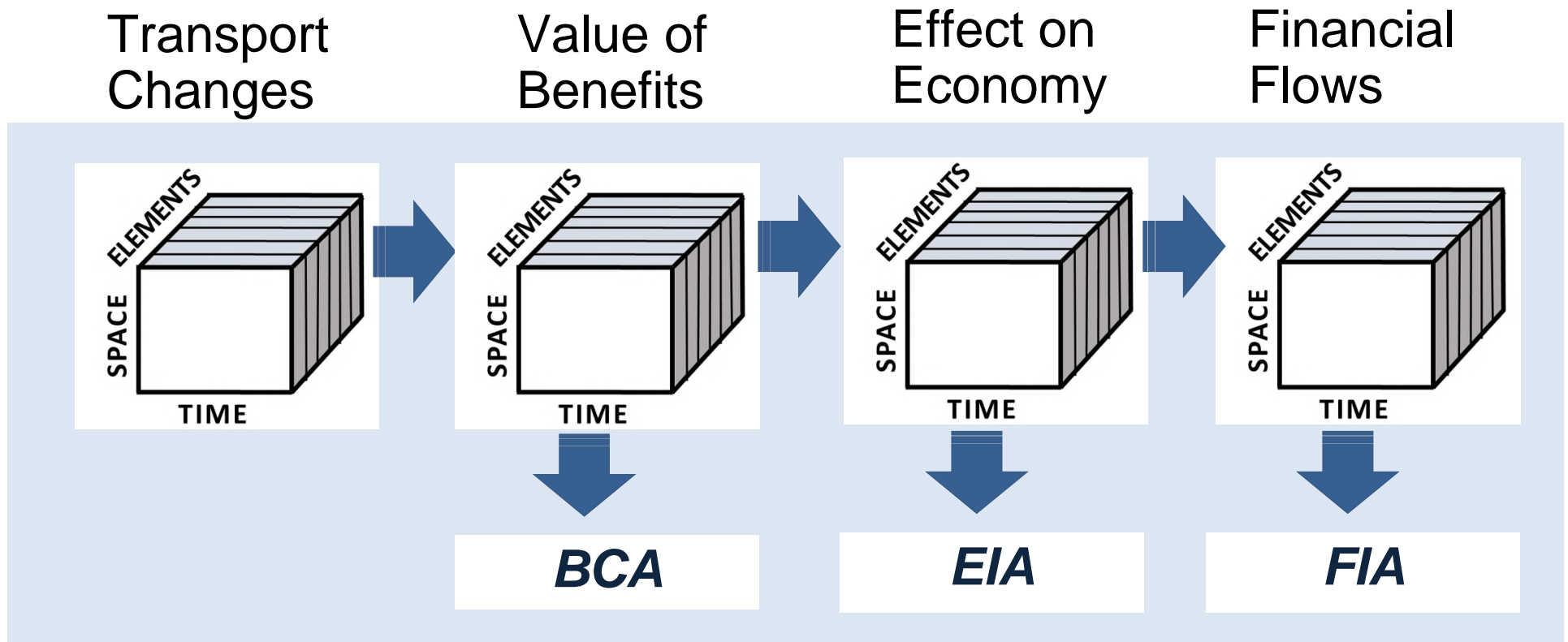
The Three Dimensions of Analysis



Each form of economic analysis covers these dimensions differently

- Cost-Benefit Analysis (CBA)
- Economic Impact Analysis (EIA)
- Financial Impact Analysis (FIA)

Approach: *A Consistent Framework*



TREDIS: Tracking impacts across the same three dimensions

Compare CBA and EIA Perspectives

Dimension	CBA Definition	EIA
Spatial Dimension	Sum across all locations (spatial transfers are ignored)	Focus on target area(s) (incl. distributional effects)
Time Dimension	Sum across all years in a time stream, with discount rate adjustment (ST and LT futures are aggregated)	Focus on future date, outcome undiscounted (cumulative effect)
Sectoral Dimension	Sum across all pop + industry groups (transfers among groups are ignored)	Show sector-specific results (threshold effect)
Enabling Results	Constant marginal value of \$ benefits, Maximize utility via trade-off among cost and benefit categories	Show impact on various job, income, investment outcomes

Example: Varying Dimensions of Impact

1. Travel Benefits	National	Regional	Local	Owner/ Operator
Travel Time	XX	X	X	-
Travel Cost	XX	X	X	-
Reliability	XX	X	X	-
Consumer Surplus from Induced Travel	XX	-	-	-
2. Broader Societal Benefits	National	Regional	Local	Owner/ Operator
Safety Impact	XX	X	X	X
Noise impact	X	X	XX	-
Reduction in Greenhouse Gas (CO ₂)	XX	-	-	-
Emissions Reduction for Other Pollutants	XX	XX	XX	-
Energy Resources: Oil Import Reduction	XX	-	-	-
Accessibility (agglomeration economies)	-	XX	X	-
3. Local, Govt. and Operator Impacts	National	Regional	Local	Owner/ Operator
Station Area Land Development	-	-	XX	-
Community Economic Development (not station)	-	-	XX	-
Government Revenues from Taxes	-	X	XX	
Service Operator and Facility Owner Costs	-	-	-	XX
Service Operator and Facility Owner Revenues	-	-	-	XX

Alternative “Hybrid” Formats

Multiple Account Evaluation

- Show multiple outcome metrics which may differ in their time, space, sectoral perspectives
 - Can include cost savings, income, wealth, environment, safety, social inclusion, etc. -- benefits that society values, even if they are correlated
 - No summation of totals

Social ROI Presentation

- Avoid outcomes that overlap (double counting), but allow both efficiency + transfer benefits to be counted
 - efficiency benefits from aggregate perspective
 - transfer benefits in terms of benefitting party – for relevant space, time, group (and impact on others, if measurable compared to today)
 - Effective zero discounting to enable desired temporal transfers to be seen
 - Sum results to reflect what society values as beneficial outcomes

(4) Moving Forward

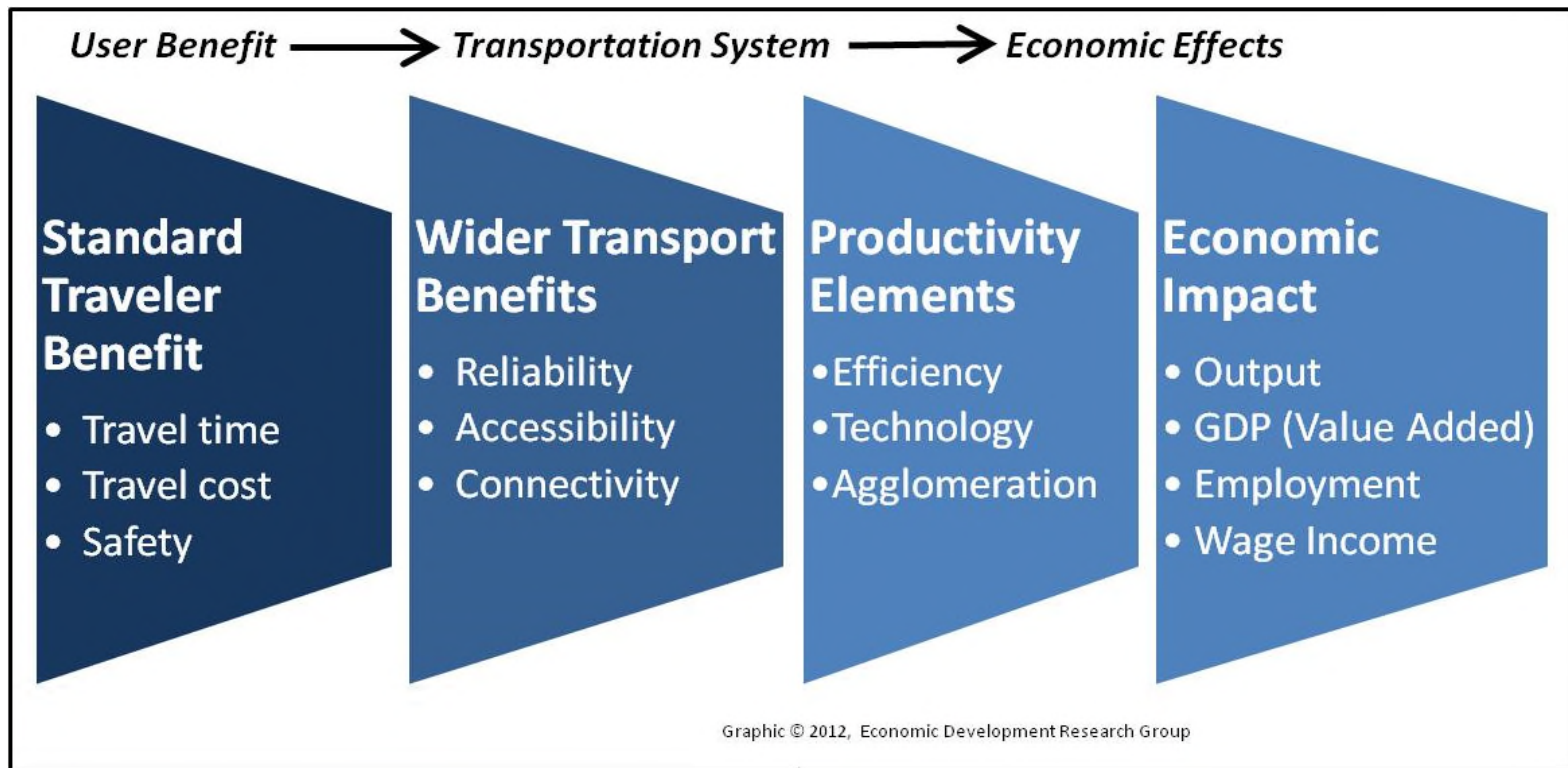
Strategic + Tactical Actions

Econ Metrics Matched to Strategic Goals

Dimension	Metric	Strategic Policy Effect Addressed
Overall State Economy	Jobs	Reduce overall region unemployment Increase career advancement opportunities
	Worker Income	Better paying jobs for residents
	GDP	More inward investment & tax revenues
Spatial Distribution	High unemp. and low income areas	Target job & income growth where most needed Address historic inequity in access to opportunities
	Urban and rural areas	Support agriculture & resource market access Address inequity in pop. access to opportunities
Econ Sector Distribution	High tech / growth industry clusters	Support sectors with greatest potential to provide sustainable jobs & income growth in future years
	Freight facility: access, connectivity, and reliability	Recognize freight user benefits Productivity for export industries and commerce that is the lifeblood of job and income growth
Temporal Distribution	Reinforce policy, leverage investment	Support LT sustainability for economic +spatial development over time

Intermediate (Tactical) Outcome Metrics

- Transport impacts drive broader economic effects, which vary widely depending on locations and their economic settings.
- A convincing economic impact metric will have accompanying metrics that traces prosperity effects to intermediate measures shown below.
- Localized property value effects, tax impact effects and quality of life effects are recognized as subsequent consequences of economic growth



Economic Development Metrics in MCA

Multi-Criteria Analysis involves: (1) rating of outcome achievement for listed goals, (2) calculation of overall score based on factor weights.

Many possible metrics for outcome achievement
Poverty Reduction
Unemployment Rate Reduction
Job Growth
Wages, Income Growth
Value Added, GRP, Output Growth
Well-paying Jobs (over min.) Growth
Skilled Worker Jobs Growth
Increased Inward Investment
Income Distribution Inequity Reduction
Spatial Disparity Reduction
Improvement in housing, building stock
Industry Diversification Increase
Support for Export Base Expansion

Mix of intermediate (tactical) and final outcome (strategic) metrics, as well as secondary benefits

MCA Systems in Use

Rating Criteria	CBA	MCA			Rating	Appraisal	
	USDOT	OH	WI	MO	KS	DfT	Scot
<i>Traveller Benefit and Environment</i>							
Efficiency: Travel time, cost, level of service	X	X	X	X	X	X	X
Safety (accident rate)	X	X	X	-	X	X	X
Pollution emissions/air quality/greenhouse gas	X	X	X	X	-	X	X
<i>Transportation Drivers of Business Productivity</i>							
Intermodal facilities, access & interchange	(x)	X	(a)	X	(a)	X	X
Reduce localized congestion bottlenecks	(x)	X	X	X	X	(b)	(b)
Connectivity to key corridors or global gateways	(x)	-	X	X	(a)	-	-
Labour market access	(x)	-	(a)	-	(a)	(a)	(a)
Reliability of travel times	(x)	-	(a)	-	(a)	X	(b)
Truck freight route, supply chain impact	(x)	X	(a)	X	X	-	-
<i>Localized Outcomes</i>							
Location: regeneration of distressed area	-	X	-	X	-	X	X
Land use: supports cluster or in-fill development	-	X	-	X	X	X	X
Econ Policy: support target industry growth	-	-	-	X	X	-	-
Local public support	-	-	X	-	X	-	-
Leveraging private investment	-	X	-	-	-	-	-
<i>Macroeconomic Outcomes</i>							
Productivity	X	-	-	-	-	X	X
Jobs(support job growth/reduce unemployment)	-	X	X	-	-	-	-
Gross Regional Product or Value Added	-	-	-	-	X	-	-

Conclusion 1: Match Metrics to Objectives

If the agency goal is to reduce poverty + increase prosperity by enabling new investment and development

... then project analysis should also focus on economic development metrics (as well as other secondary benefit categories)

... to do that right, attention must be given to the key elements of economic development, which include:

achievement of results which typically involve:

- intermediate + final outcomes (tactical + strategic elements)
- competitiveness thresholds (filling market-related deficiency gaps),
- cumulative growth paths (“on the right evolution path”) and
- distributional targets (right locations, industry/population groups).

Conclusion 2: Learn from Ex Post Studies

Build information and expertise regarding

- Spatial development evolution and shifts
- Economic sector evolution and shifts



Role of (1) intervention threshold factors and (2) external (constraint + interaction) factors

Build logic narratives about how strategic interventions can lead to intermediate and long term outcomes

- For strategy planning
- For impact monitoring



Avoid sweeping conclusions about response elasticity factors that obscure the strategic aspects of economic development

Expand ex post case databases

- US: National EconWorks Case Study Database
- France: Impact “Observatories”

Conclusion 3: Investment Narrative

Set investment strategy + outcome expectations in terms of a logic narrative:

- Gap analysis – how the investment will address econ devel gaps
- Market assessment – how the market is expected to respond
- Intermediate indicators reflecting gap and market factors
- Final outcome indicators dependent on intermediate outcomes
- Secondary factors – do they justify projects that otherwise fail?

Build expectation metrics and monitoring that reflect the logic narrative with perspectives of space, time and sectoral impacts

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