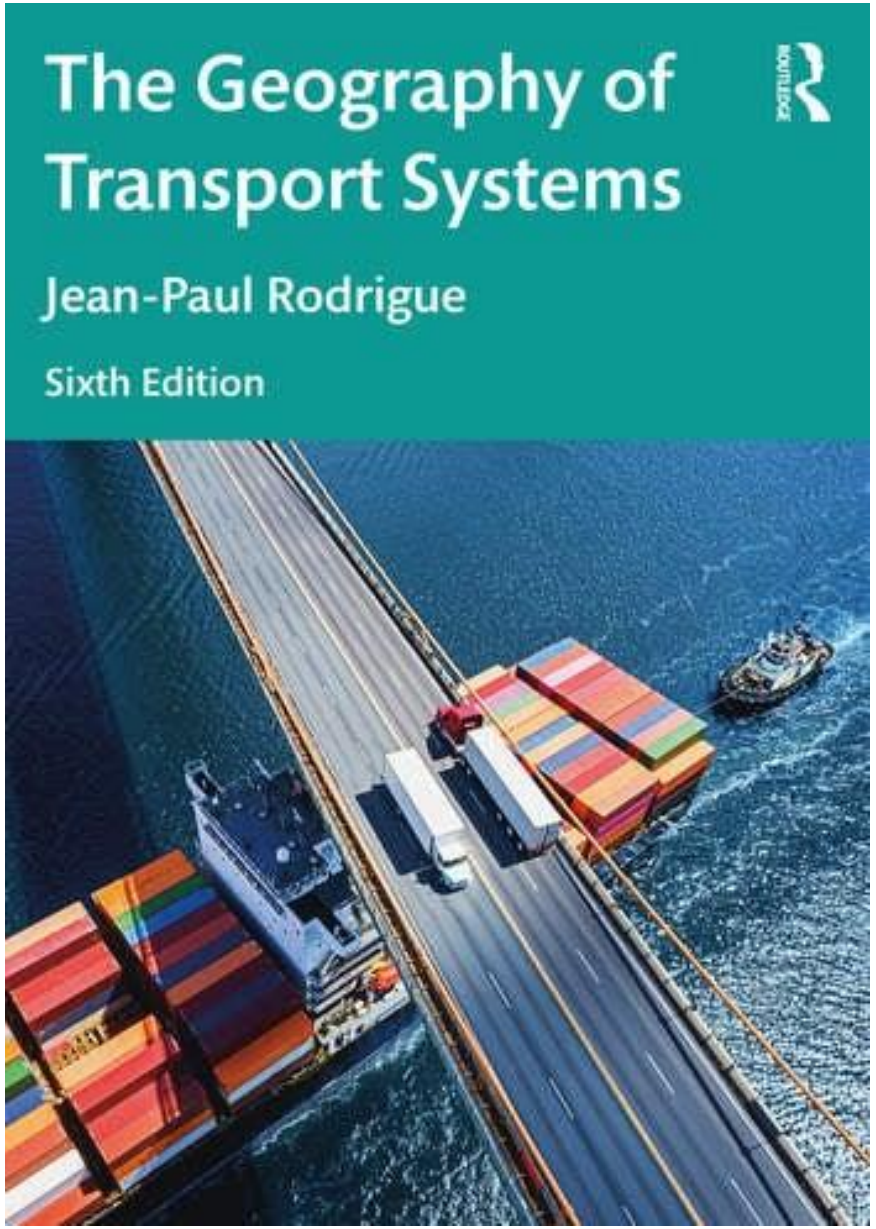

Challenges for Transport Geography

CHAPTER 10

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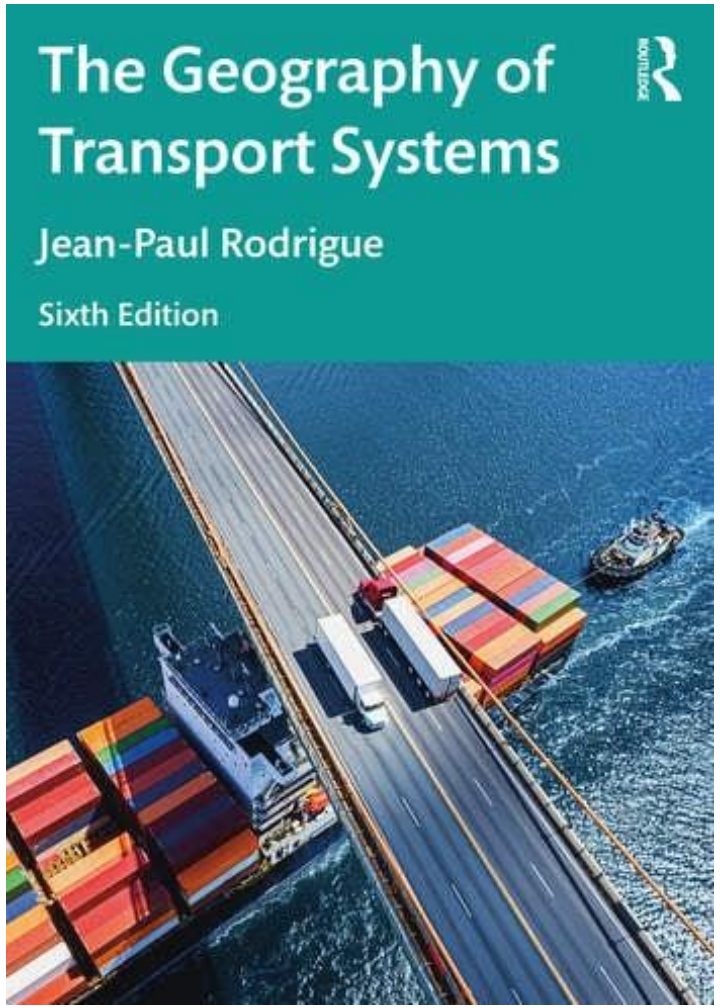
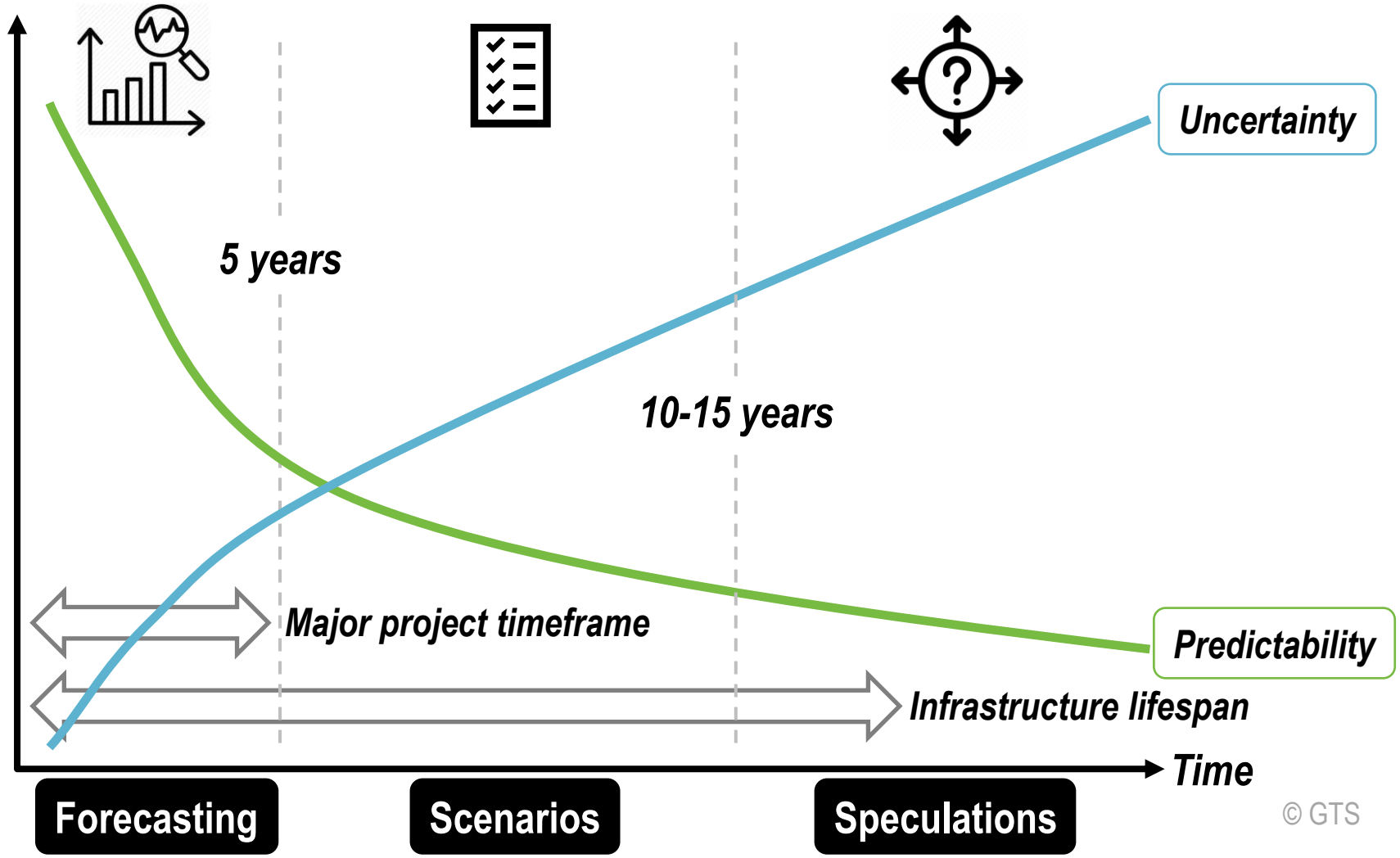


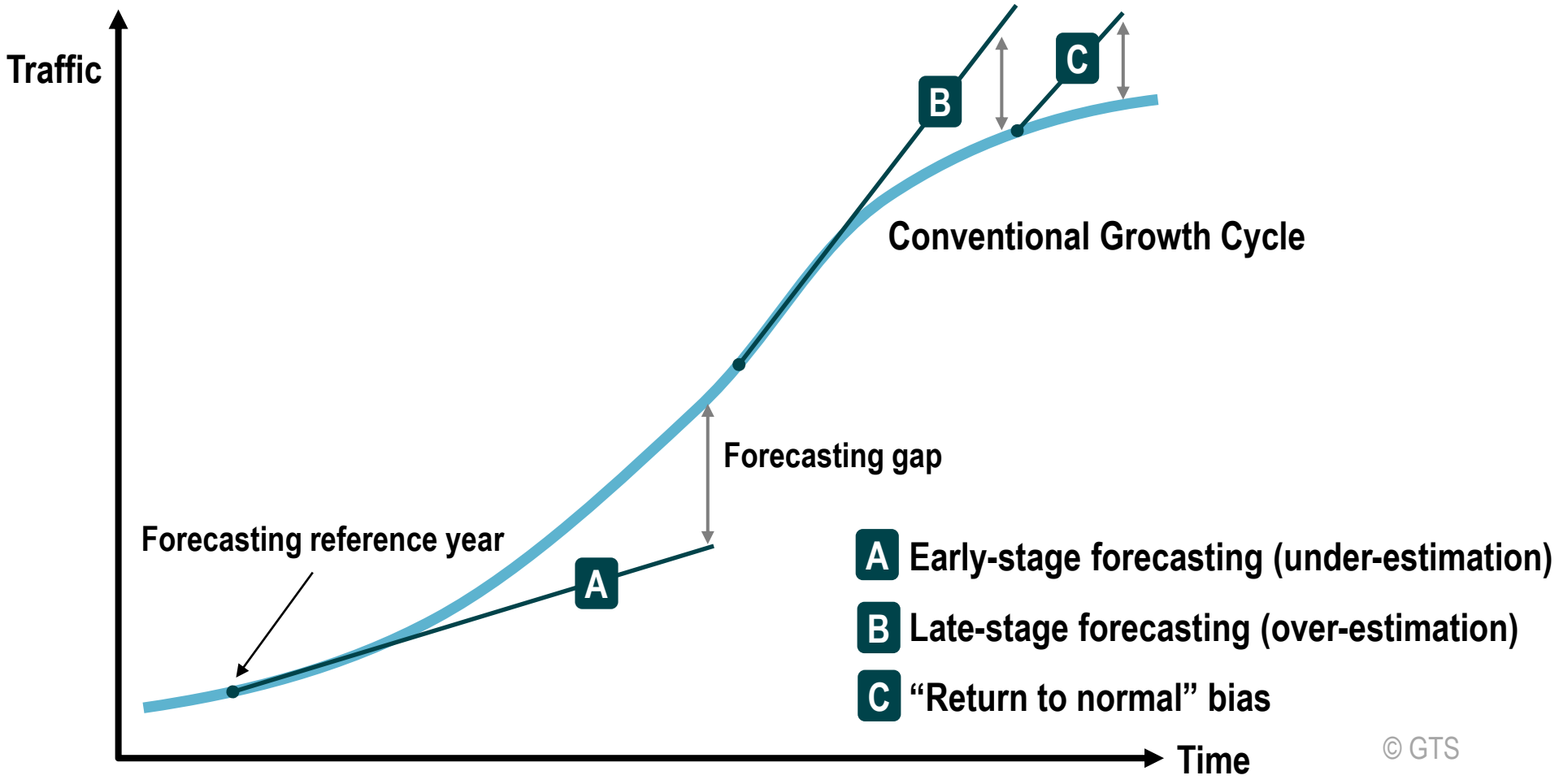
Future Transportation Systems

Chapter 10.4

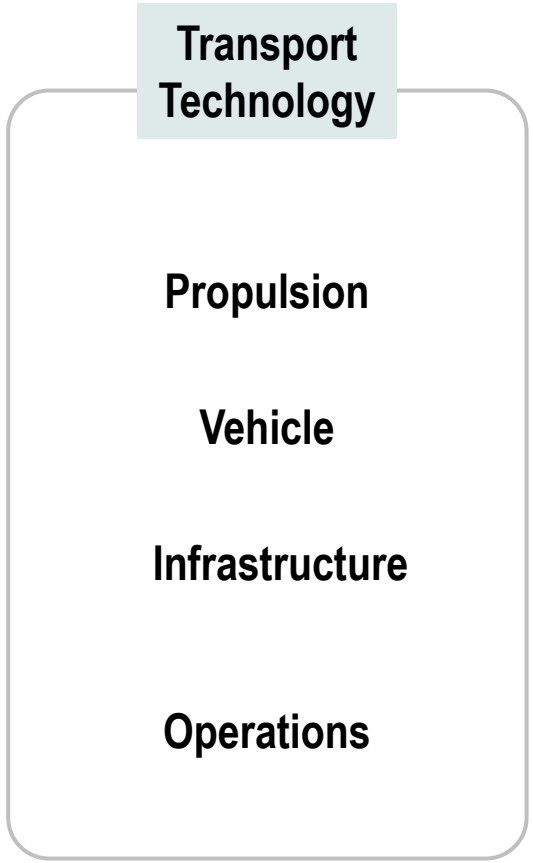
The Prediction of Future Outcomes



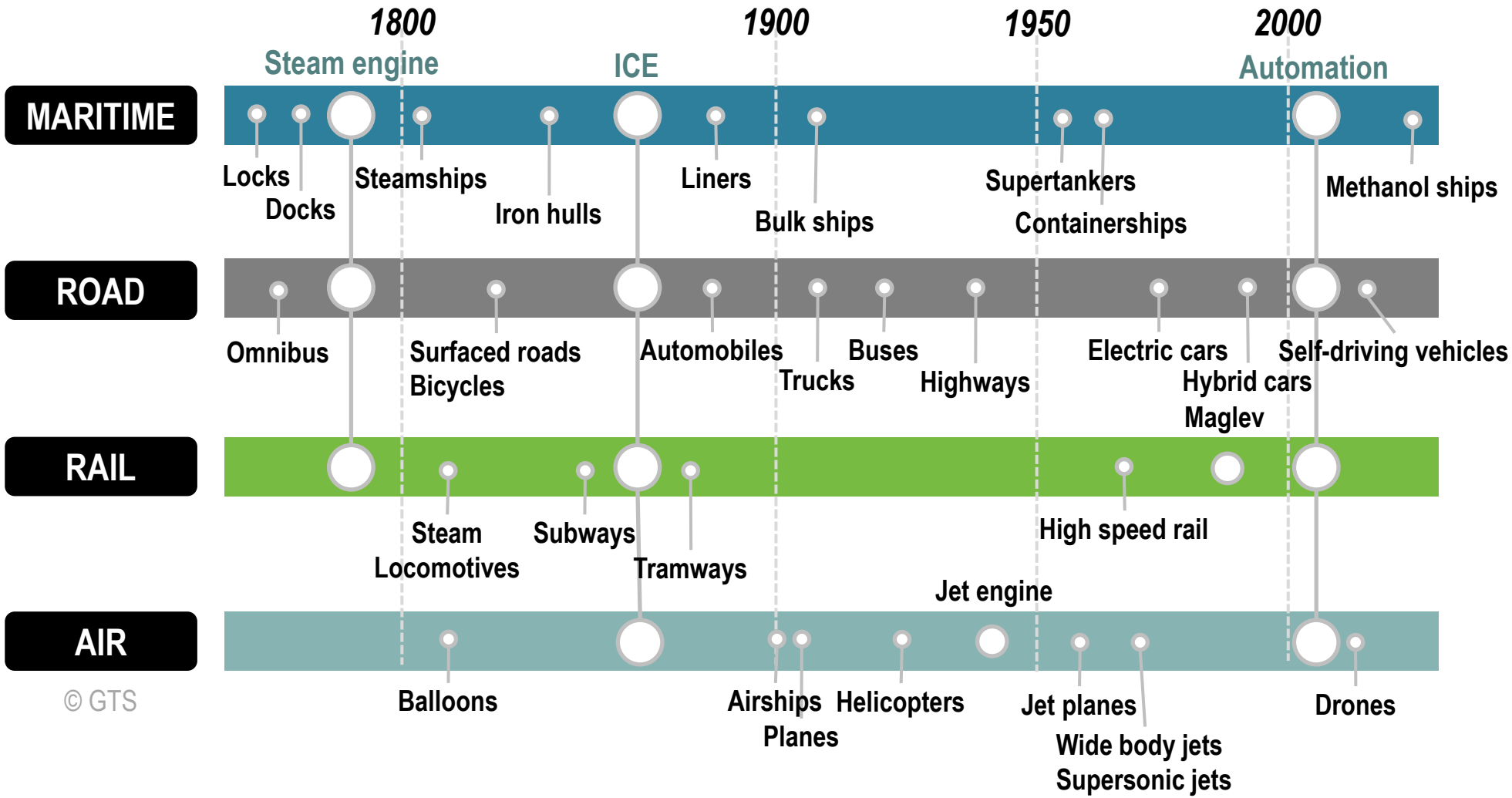
Common Flaws in Forecasting



Elements of Transport Technology (Under construction)



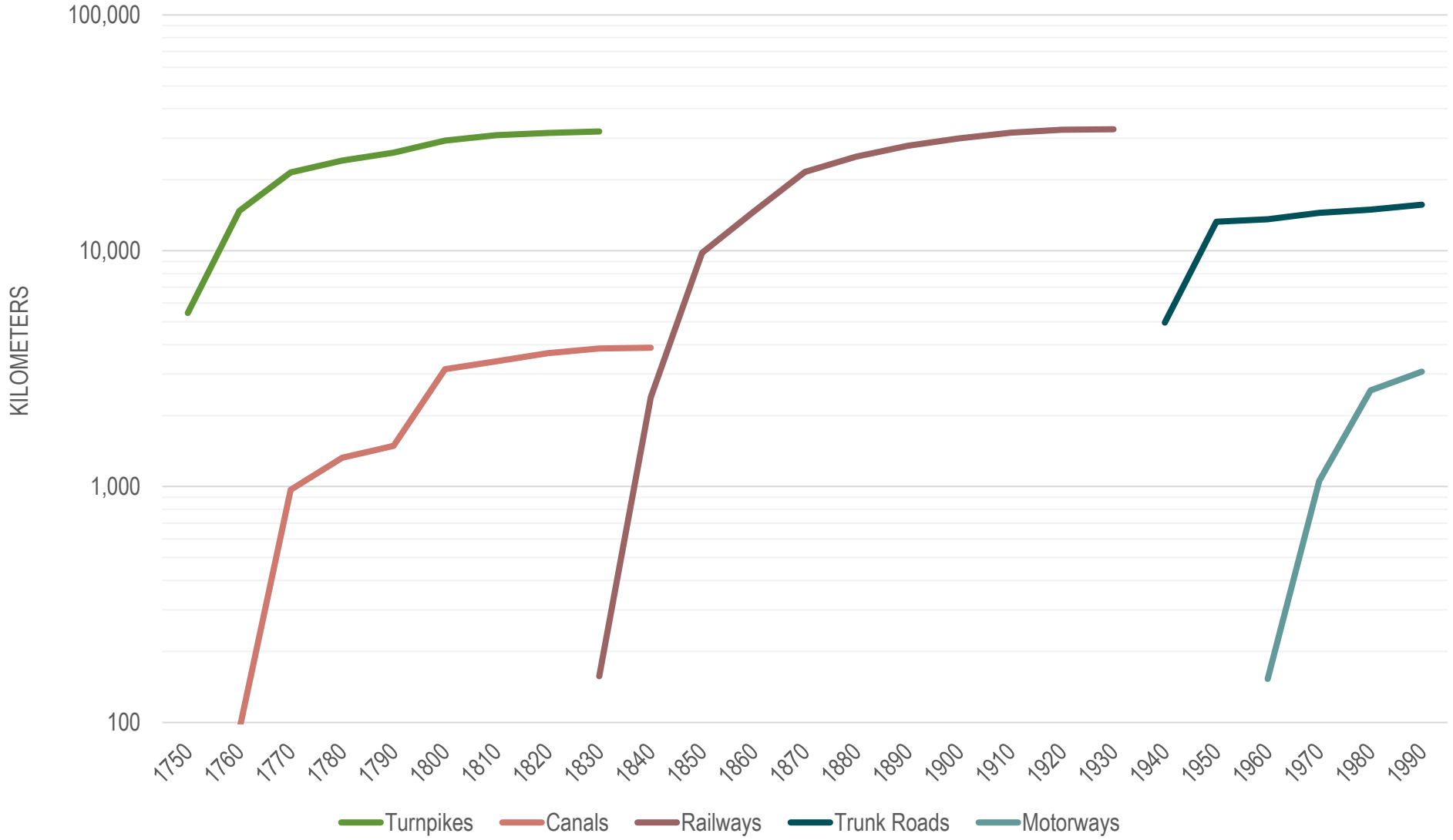
Evolution of Transport Technology since the 18th Century



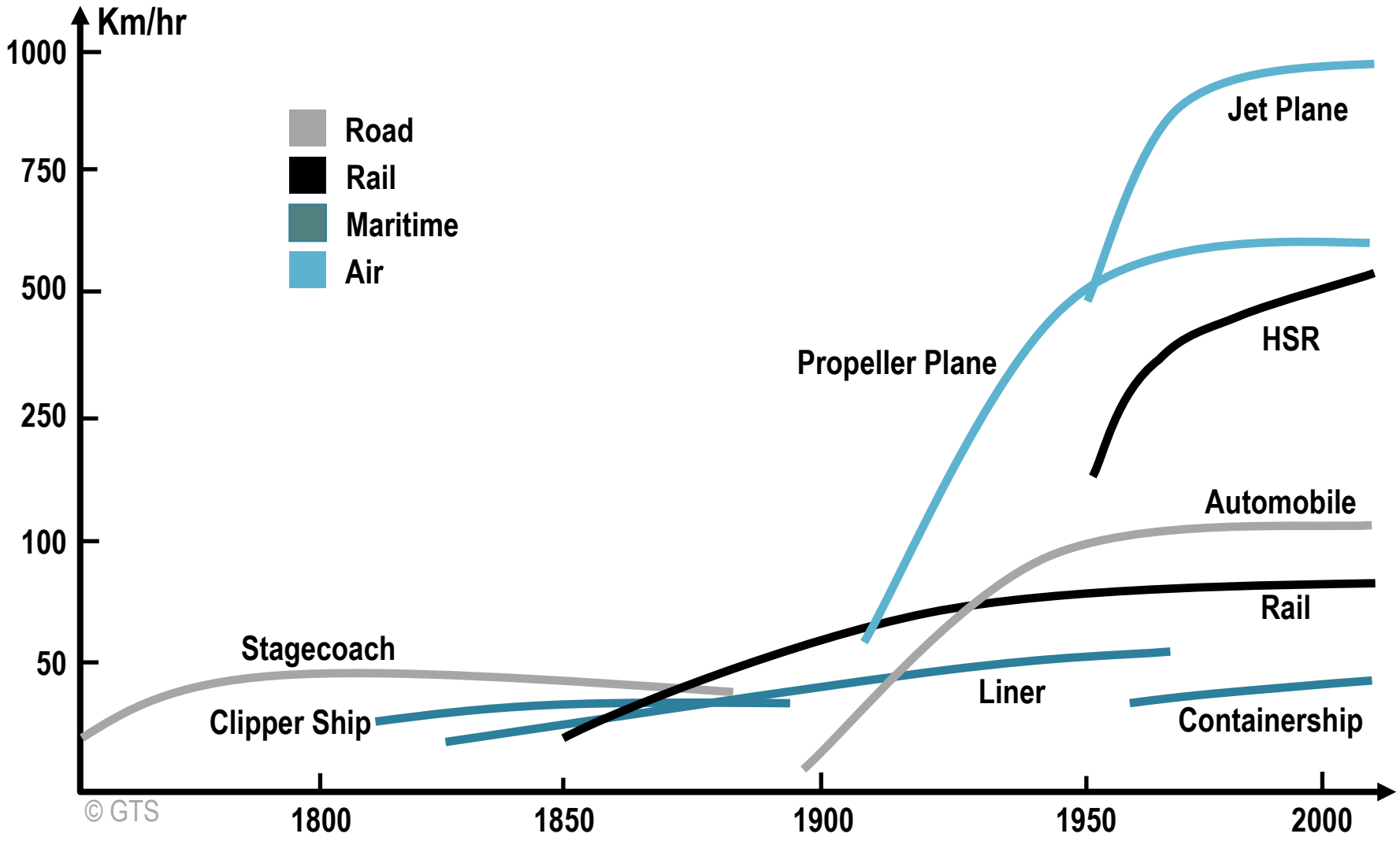
Major Technological Improvements in Transportation, Second Half of the 20th Century

Innovation	Characteristics	Role
Superships (1960-)	Bulk and tank vessels with a mass up to half a million deadweight tons.	Reduce transport costs through massive economies of scale.
Container vessels (1968-)	Vessel specifically designed to carry containers.	Carry primarily manufactured goods with the capacity to interface with major land transport systems.
Jet aircraft (1958-)	Fast an non-stop services between major urban centers.	Linked with the development of service activities such as banking, finance and tourism.
Fuel-efficient vehicles (1970-)	Reduction in fuel consumption due to lower weight and more efficient engines.	Enabled highway transport to increase its share of urban an intercity transport.
High-speed trains (1964-)	Trains capable of moving at speed higher than 200 km/hr.	Effective competition between intercity air and road transport in high density areas.

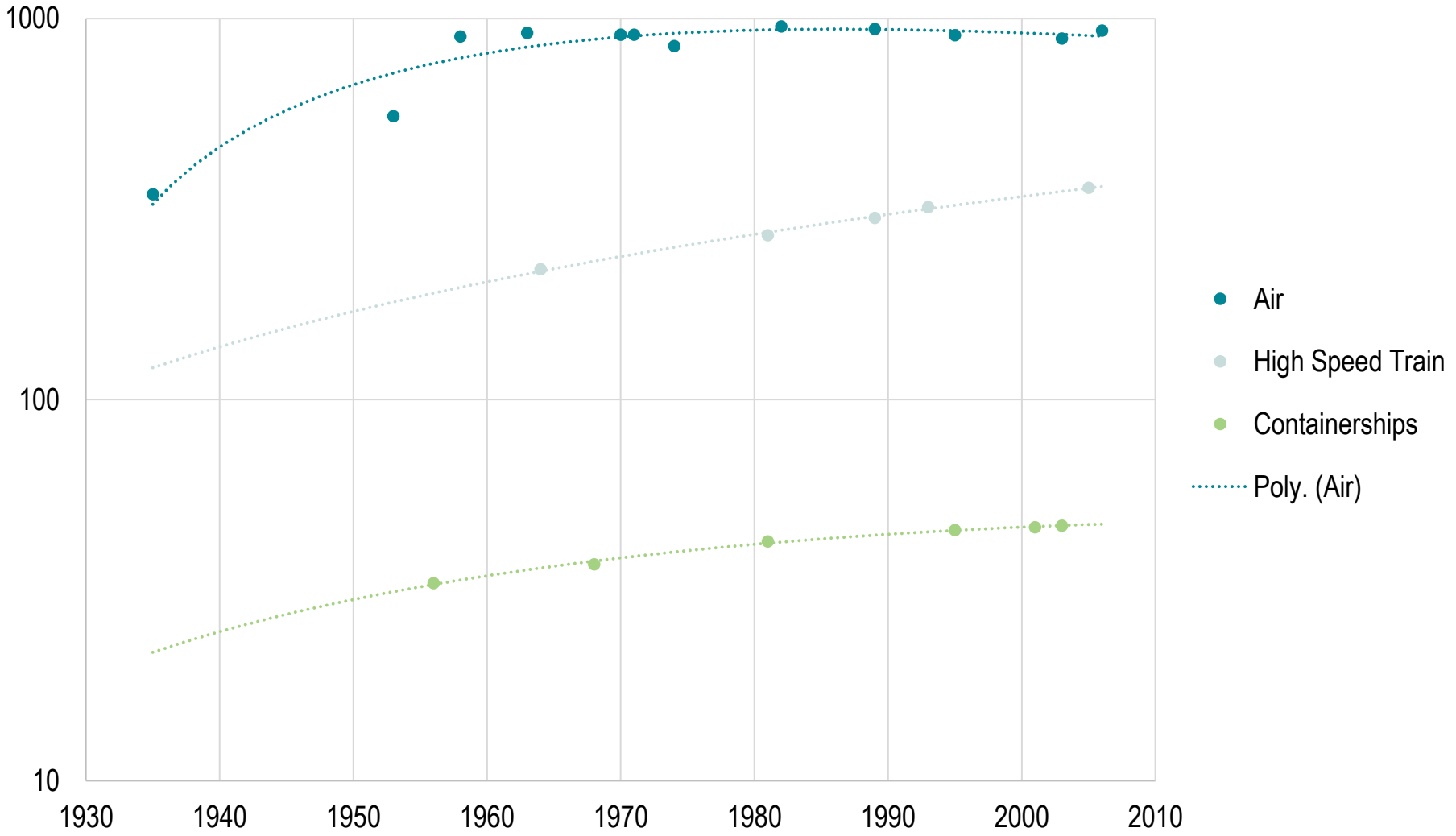
Development of the UK Transport System, 1750-1990



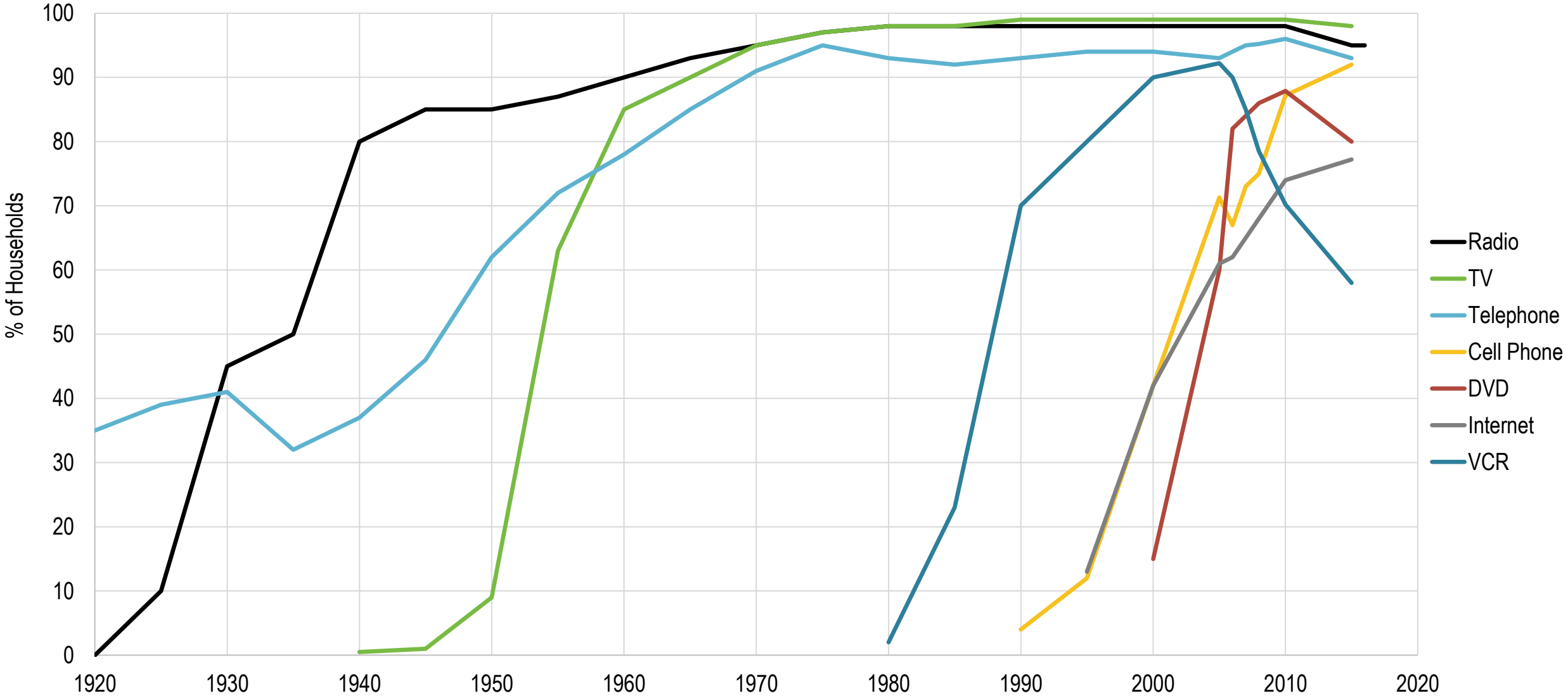
Development of Operational Speed for Major Transport Modes, 1750-2020



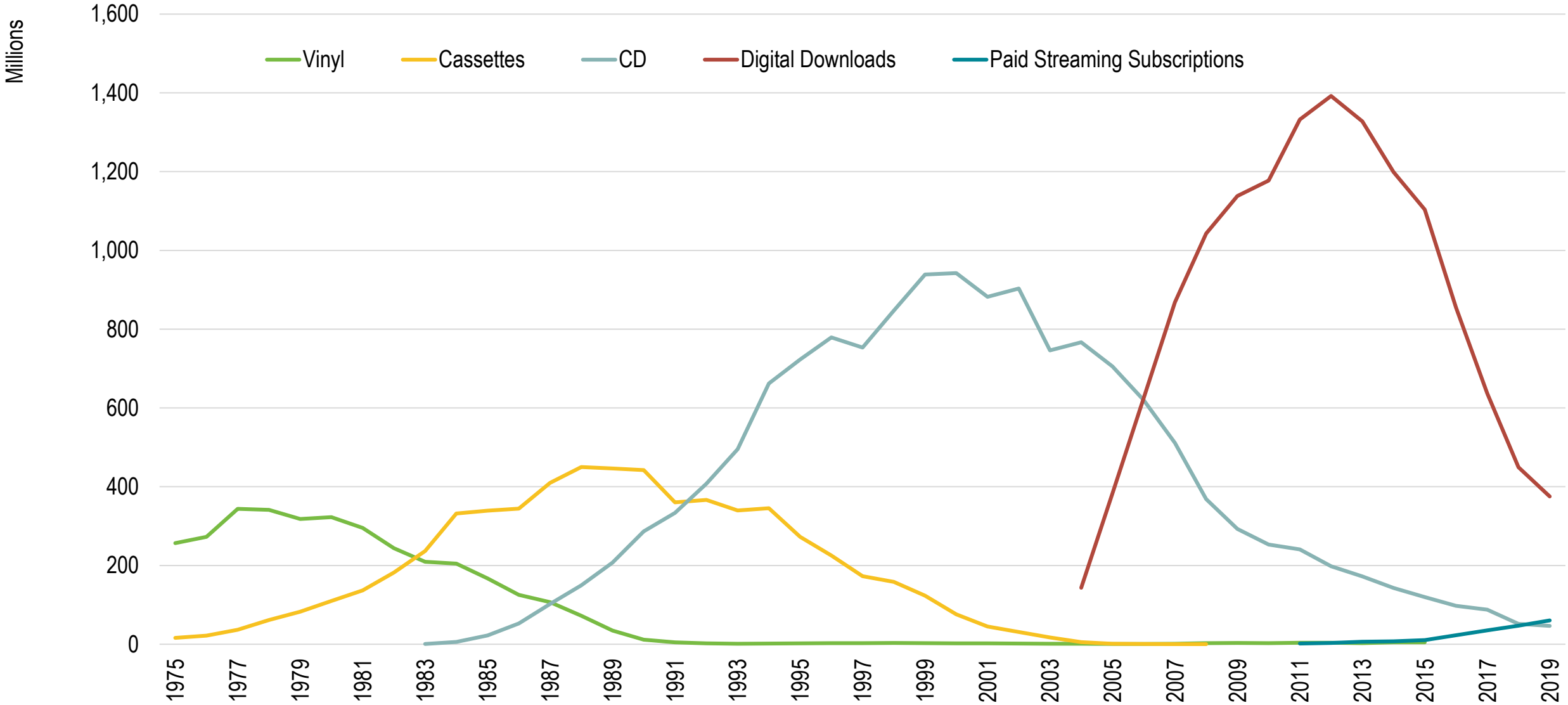
Operational Speed of Contemporary Transport Modes



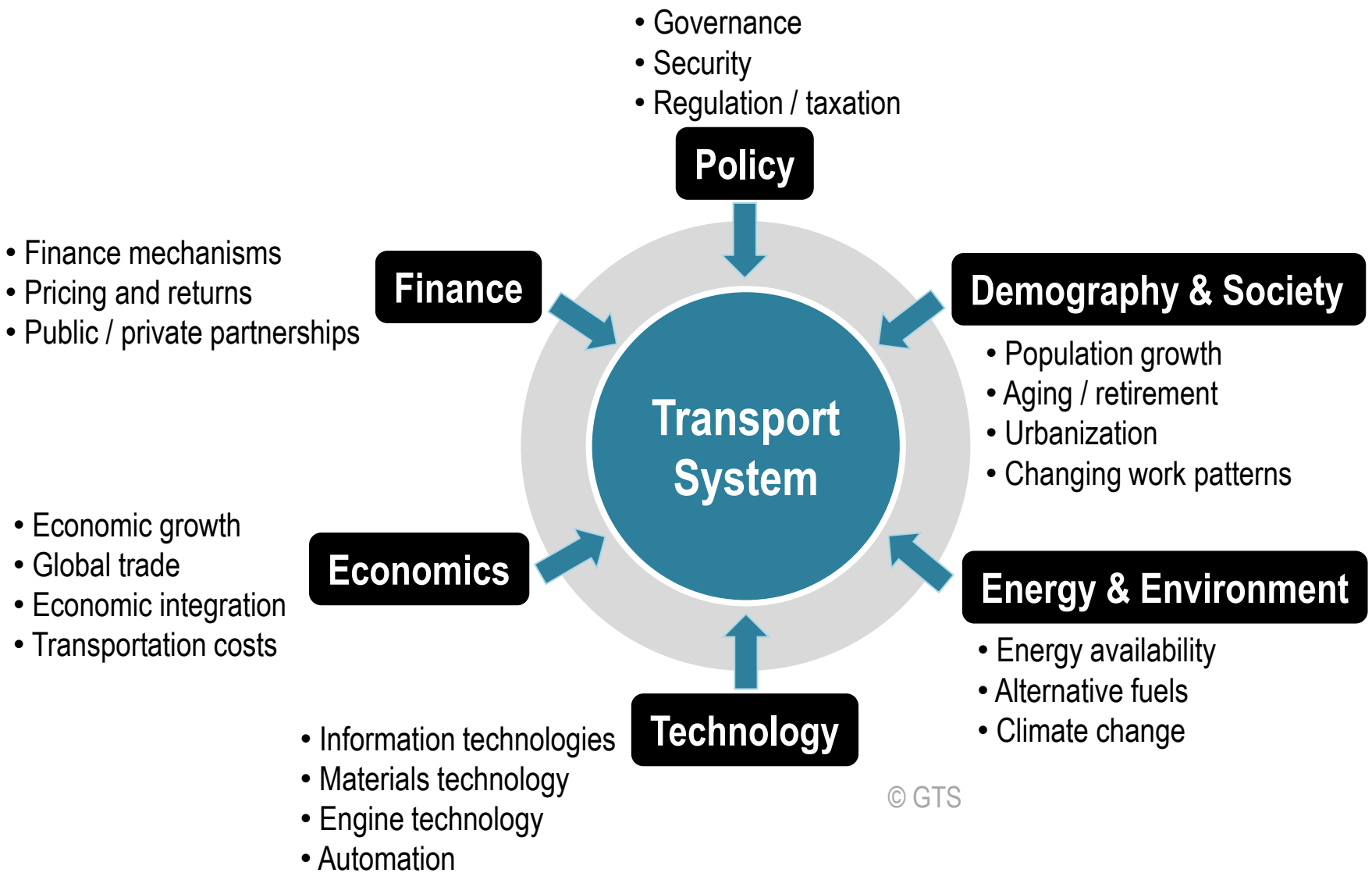
US Household Penetration of Telecommunications, 1920-2020



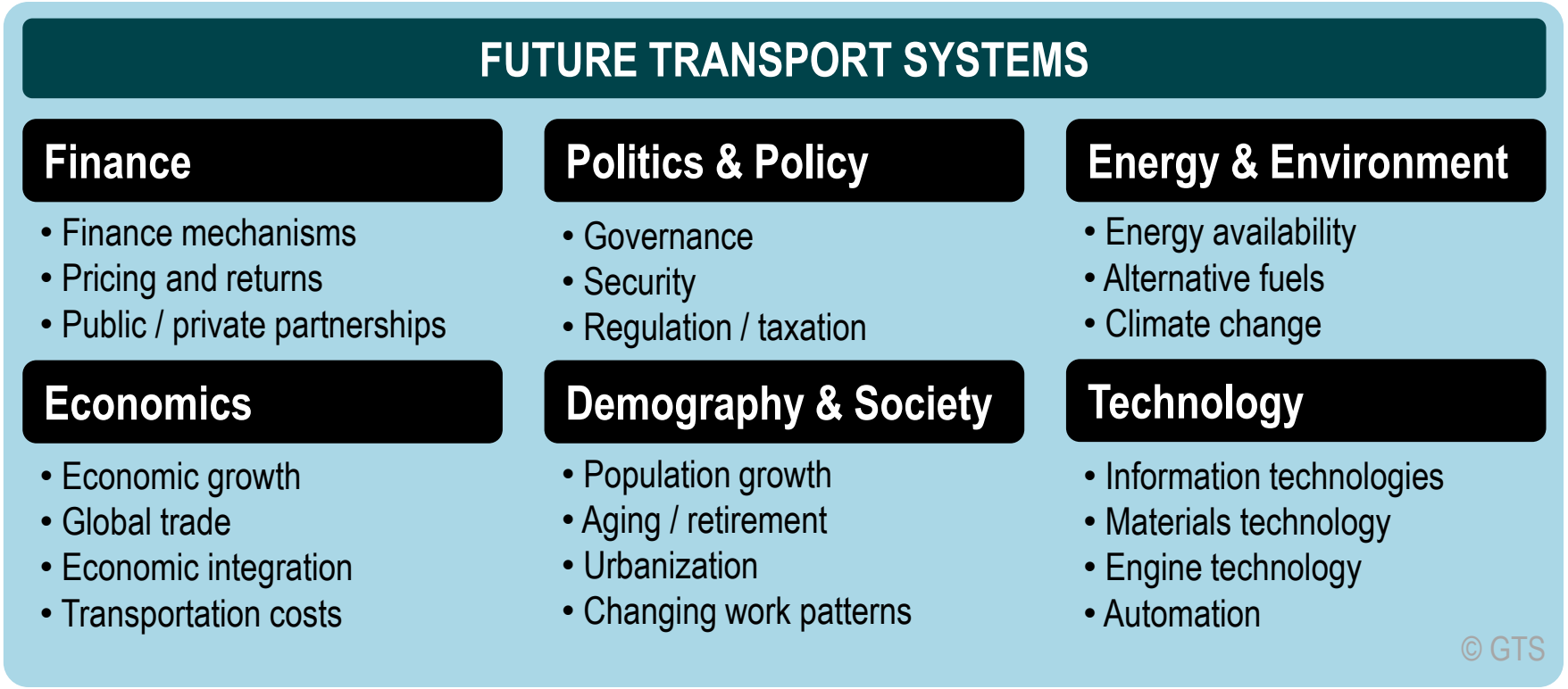
Music Sales in the United States, 1975-2019



Drivers of Change for Future Transportation



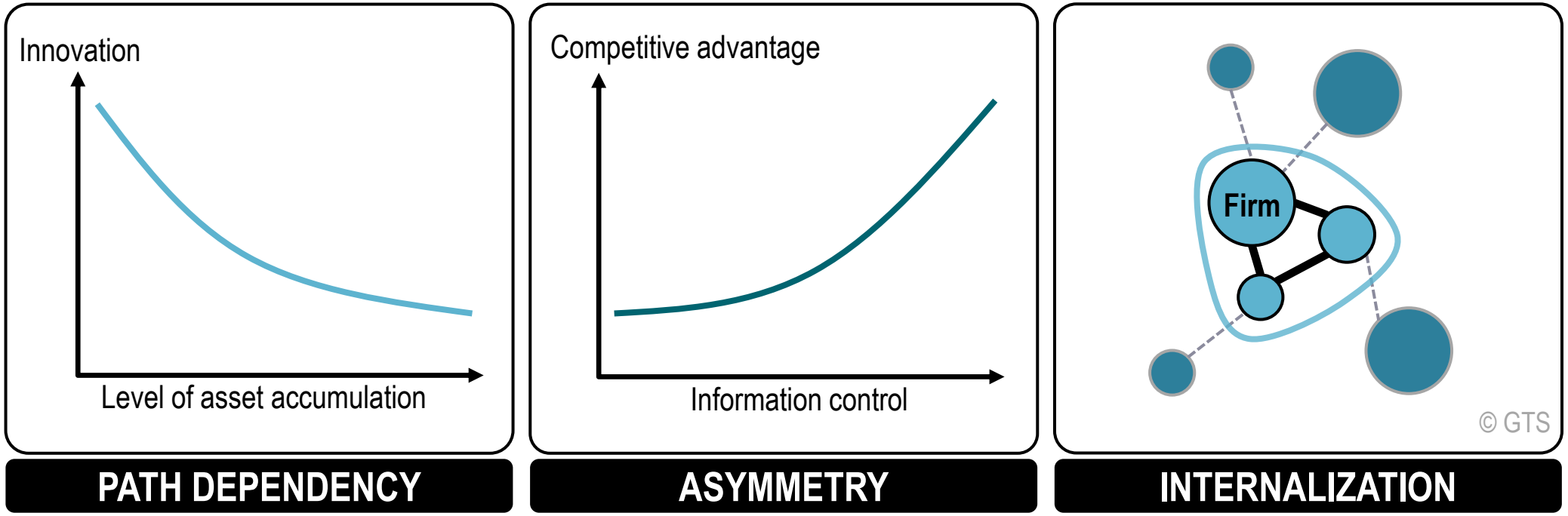
Drivers of Change for Future Transportation



General Impacts of Transport Innovations

Field	Outcome
Travel time	Lower time and higher reliability
Trip planning	Easier to book and monitor
Environment	Less environmental impacts and noise
Energy	Lower energy consumption pet unit carried
Assets	Higher level of utilization of modes and infrastructure
Safety	Reduced number of accidents, fatalities and injuries
Accessibility	Improved accessibility; reduced friction of distance
Cross-border	Improved throughput and security
Infrastructure	Longer life cycle, improved maintenance and reliability
Materials	New and recycled materials
Intermodal	Improved connections between modes

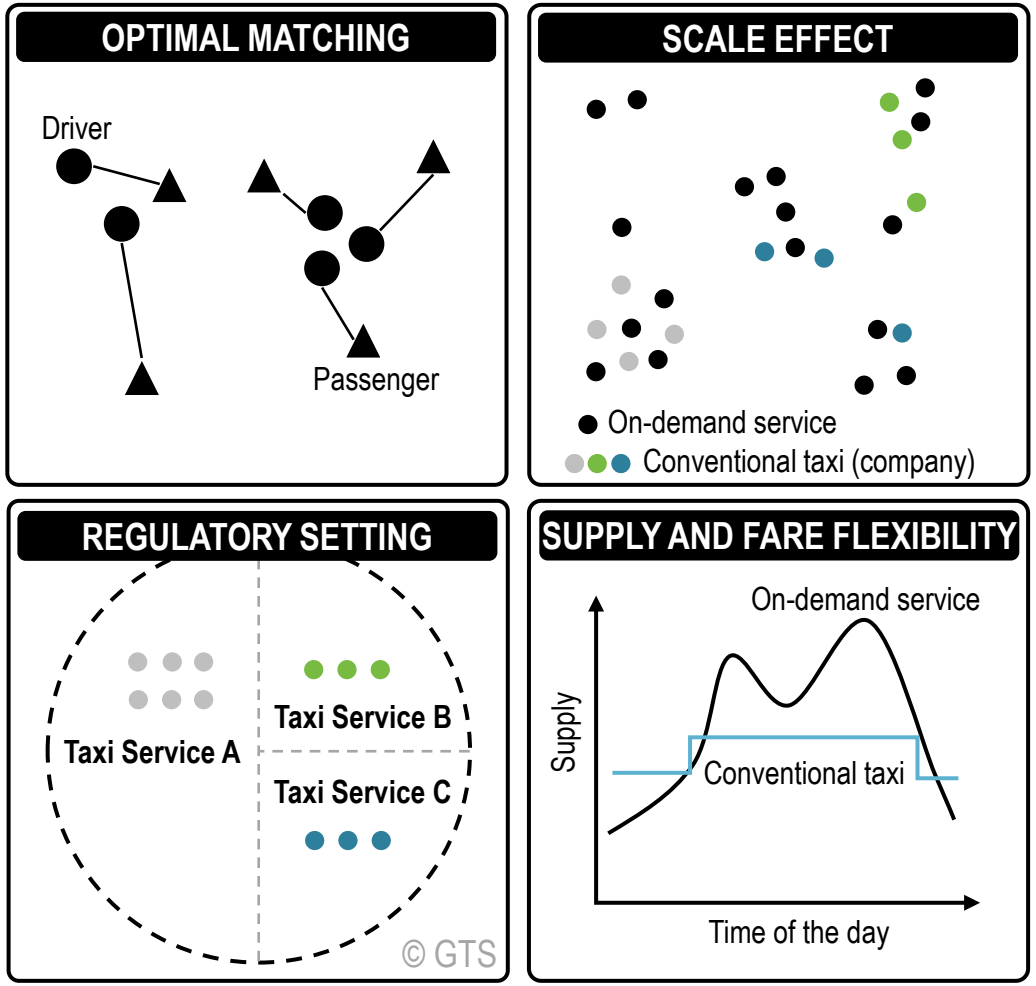
Forces Shaping the Diffusion of Information and Communication Technologies in Transportation



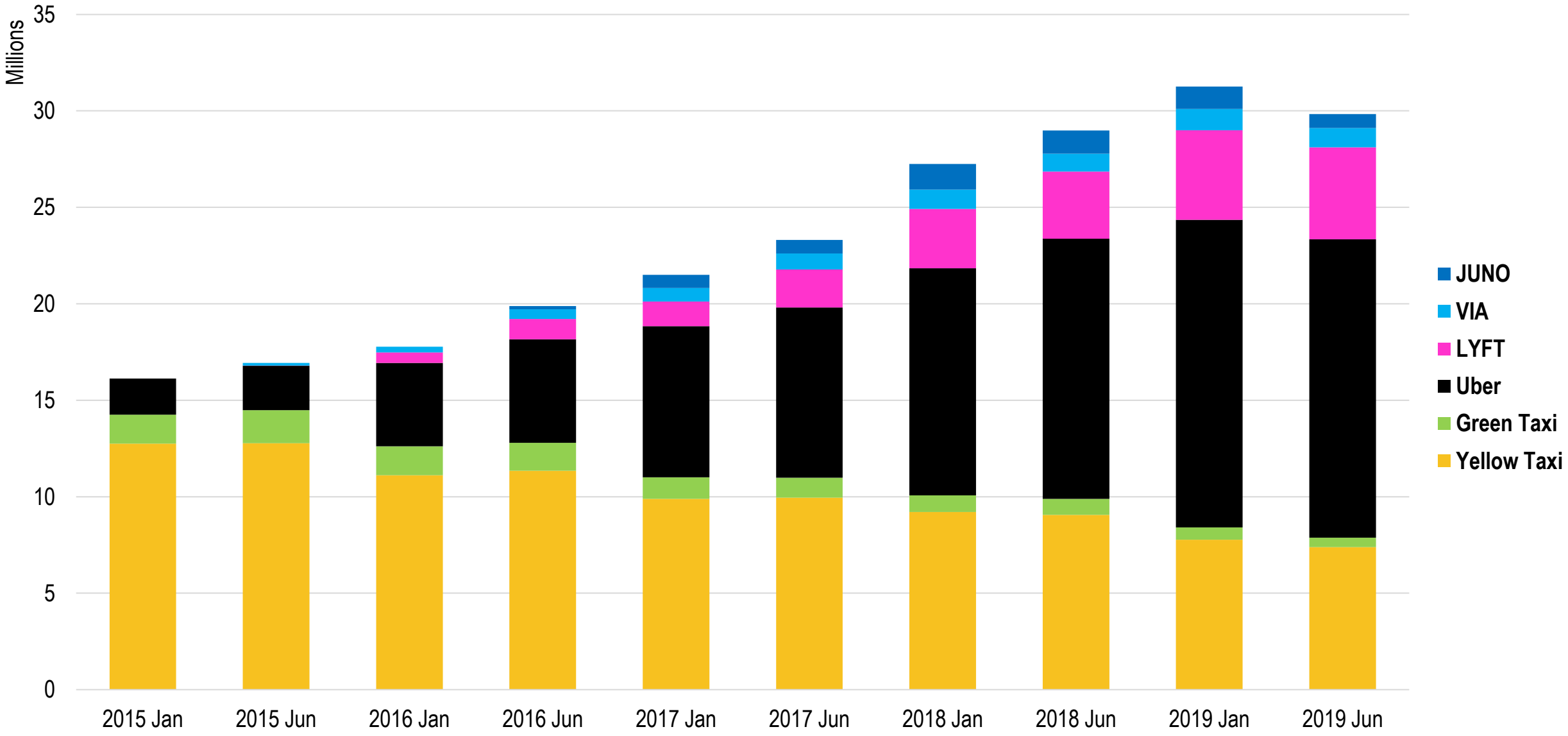
Potential of Some Transport Innovations

Innovation	Perceived Benefits	Potential Beneficiaries	Cost Burden	Potential Supporters
Light Rail	Accessibility to CBD; Reduced emissions and energy used per pass. – km; Safety	New users; Developers; Landed interests along paths	Tax payers; Nearby residents	Transit industry; Drivers; Environmental groups; Passengers
Road Pricing	Reduced congestion and emissions	Drivers with high time value	Drivers	Environmental groups; Collecting institutions
Telecommuting	Reduced congestion and emissions; Time savings	Telecommuters; Commuters	Employers; Tax payers (if subsidized)	Environmental groups; IT industry; Commuters
Shared / on demand vehicles	Lower costs; Increased mobility, better usage of existing vehicle assets	Commuters; Users; People without vehicles	Taxi industry; Transit industry	Passengers; IT industry

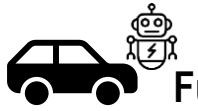
Potential Benefits of On Demand Vehicles Compared with Conventional Taxi Services



Number of Monthly Trips by for Hire Services, New York City, 2015-2019



Forms of Transport Automation

AUTOMATION LEVEL	MODES	TERMINALS
0  None	All driving functions assumed by user.	All functions assumed by manually operated equipment.
1  Basic	Driving assistance (e.g. adaptive cruise control), but user responsible for core driving functions.	Operation assistance (location of drop-off, storage and pick up), but manually operated equipment.
2  Partial	Some driving tasks (e.g. steering, acceleration, deceleration). User monitors environment and ready to take control.	Planning and managing the use of equipment and storage space (Warehouse and yard management systems).
3  Conditional	Perform most driving tasks and monitors driving environment. User must be ready to take control at request.	Semi-automatic equipment (cranes, gantries, storage stacks). Automated access to facilities (automated gates).
4  High	Performs all driving tasks and monitors controlled driving environment. User does not need to take control.	Integration between automated handling and storage systems (Fully automated terminal or warehouse). Automated pick-up and deliveries.
5  Full	Autonomous vehicle; Performs all driving functions under all environments. User provides destination but does not control vehicle.	Autonomous terminal; responds to demand (modal, intermodal, flows).

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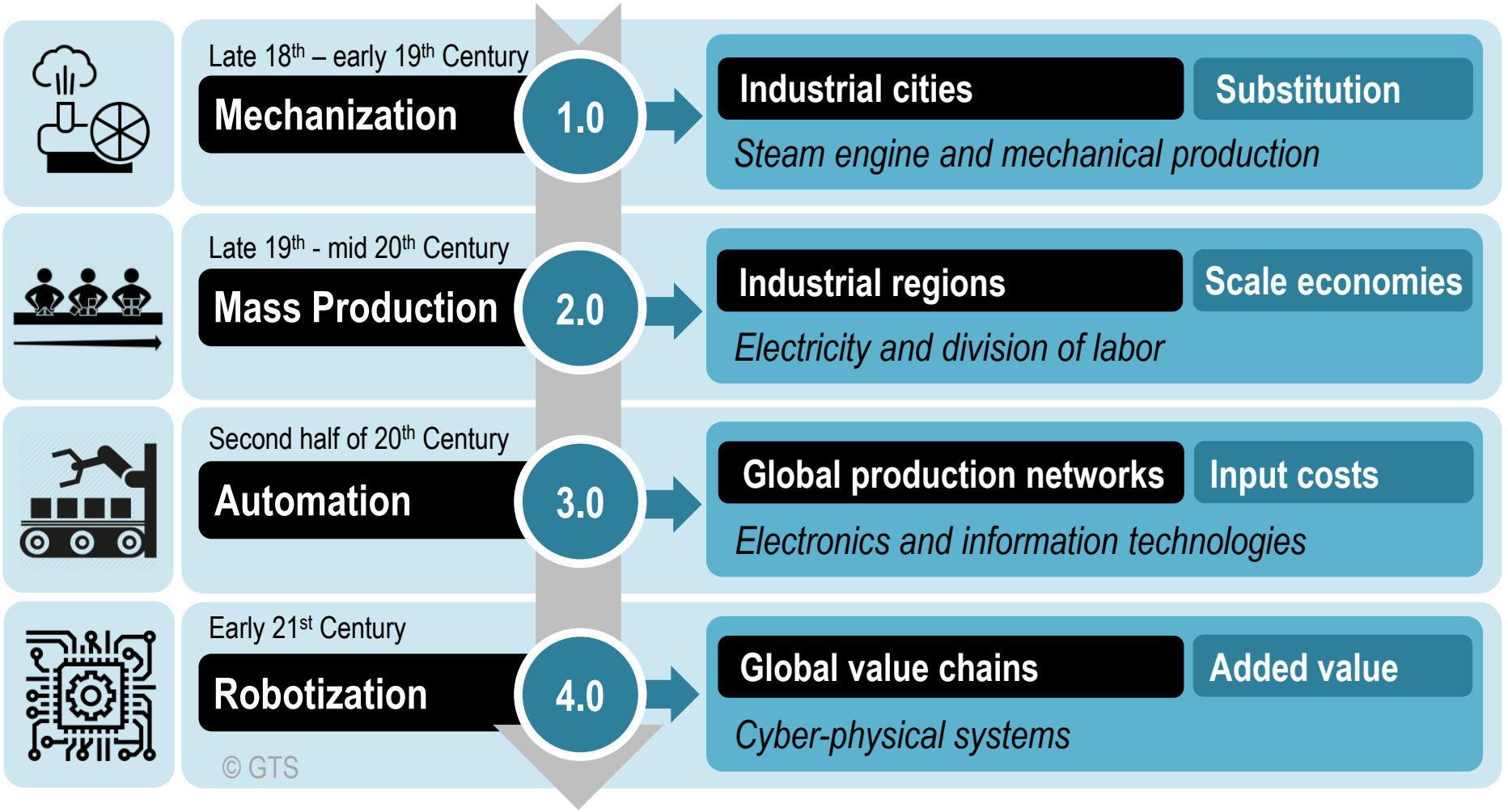
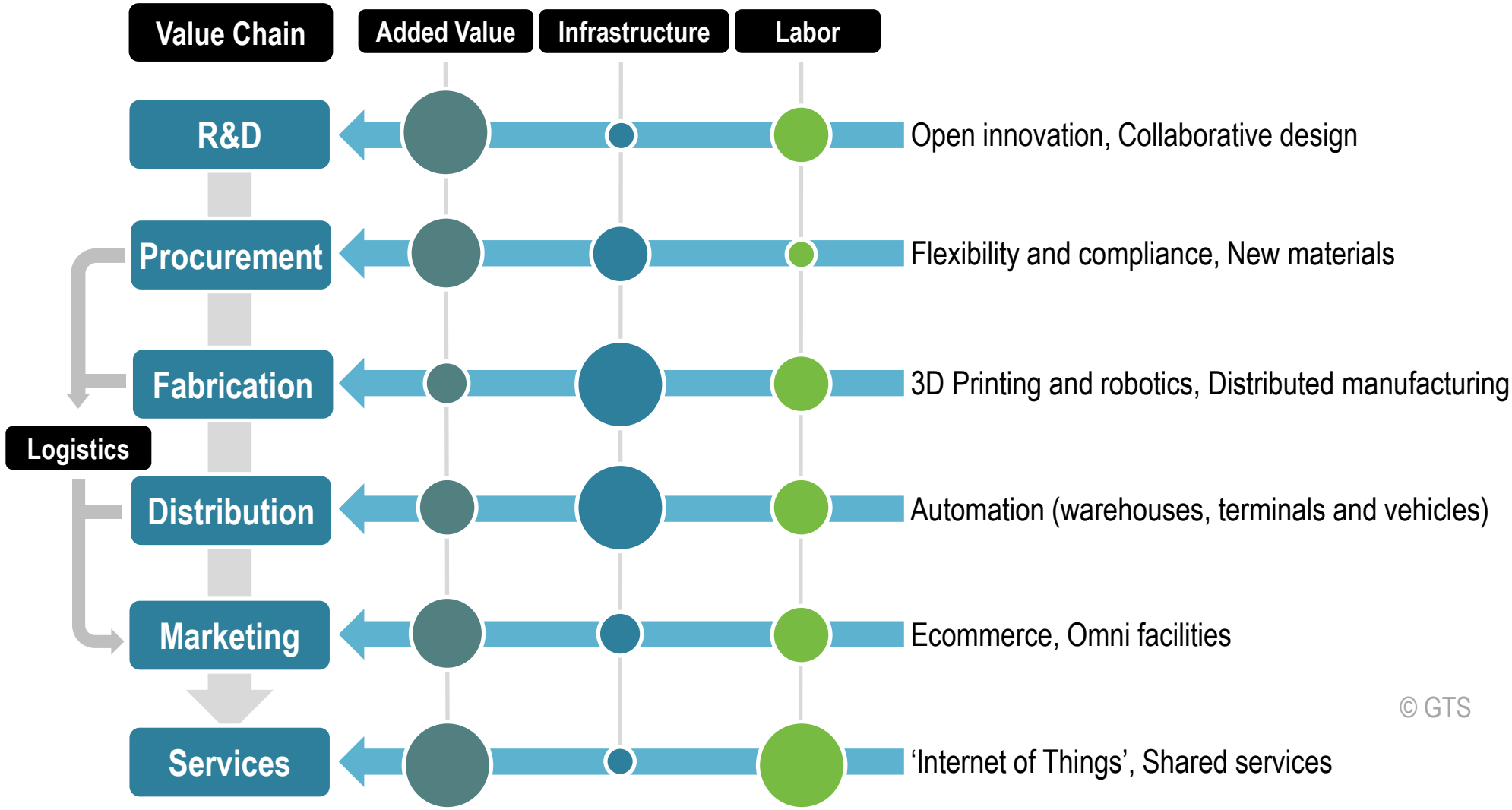
Emerging Transportation Technologies

- 1. Connected vehicle technologies;
- 2. Advanced aviation systems;
- 3. High-speed rail technologies;
- 4. Advanced propulsion, alternative fuels and related infrastructure;
- 5. The “Internet of Things”;
- 6. Advanced analytics and machine learning;
- 7. Automated vehicles;
- 8. Unmanned aircraft systems (UAS);
- 9. Maritime autonomous surface ships (MASS);
- 10. Infrastructure inspection robots;
- 11. On-demand ride services: Transportation network companies;
- 12. Innovative concepts for protecting pedestrians, bicyclists and motorcyclists;
- 13. Wireless power transfer;
- 14. Additive manufacturing (3D printing);
- 15. Materials science in infrastructure;
- 16. Hyperloop;
- 17. Big data and energy-efficient computing;
- 18. Satellites and commercial applications of space;
- 19. Robotics and autonomous systems;
- 20. Agri-science;
- 21. Blockchain;
- 22. Augmented/virtual reality;
- 23. Airline New Distribution Capability;
- 24. Sensors and screening technology;
- 25. Advanced materials and nanotechnology;
- 26. Modern airships;
- 27. Ice-phobic materials;
- 28. Intelligent transportation systems;
- 29. Wearable technology; and
- 30. Energy and its storage.

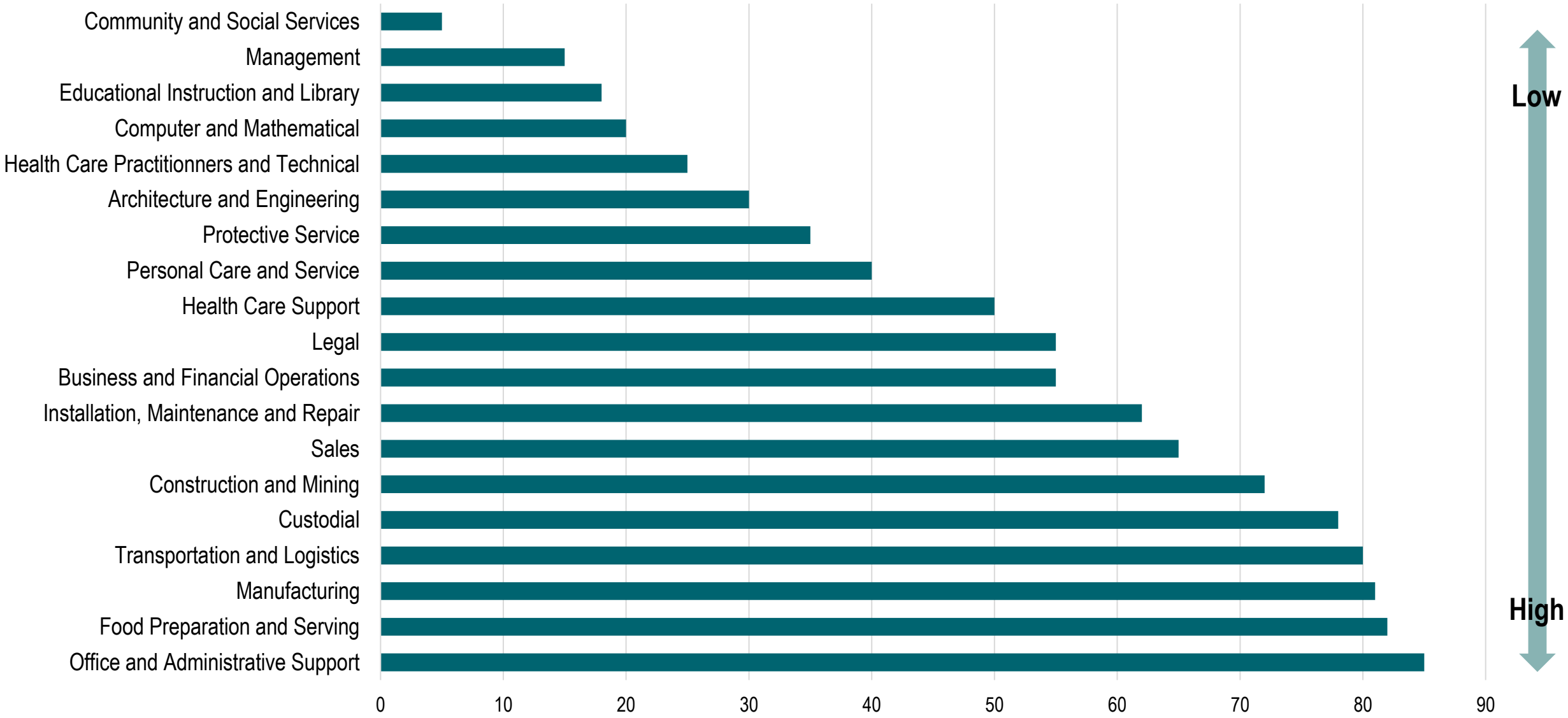
The Four Industrial Revolutions



Value Chain Drivers of the Fourth Industrial Revolution



Probability of Automation by Occupation Group, United States, 2018-2030



Phases of Development of the Global Economy