

#### The New Mobility: The Long View, the Big View & The Big Research Questions

**Charles Fine** 

Former IMVP Co-Director & Chrysler LGO Professor, MIT; Founding President, Asia School of Business; Author of *Clockspeed* and *Faster, Smarter, Greener* 

#### **Jim Womack**

Former Research Director of the International Motor Vehicle Program & Co-Author of *The Future of the Automobile* and *The Machine That Changed the World* 



#### **Initial Conditions**

- The New Mobility (without a standard name, then or now!) emerged in 2009 with the Google Self-Driving Car Project, the launch of Uber service, and the announcement of the Tesla Model S.
- Coincident with a new competitive equilibration in the global motor vehicle industry, as the lessons of the Japanese disrupter companies were fully absorbed over the period 1984-2009.
- Solution driven with a fair measure of techno-determinism. "Cool new things are possible so they will happen quickly on a wide scale and disrupt a massive industry – automobility becomes mobility."
- Venture capital driven with tremendous optimism about the time needed to deploy the system.
- Problem driven with the perception that many big problems for society CO2, pollution, safety, congestion, even economic stagnation – could be addressed with connectivity, autonomy, sharing and electrification.



#### **Initial Conditions**

- The new disrupters were profoundly influenced by their origins in the Silicon Valley/Seattle world of network economics and winner-take-all rapid disruption: Microsoft in the office, Google in search, Amazon in shopping, Apple in smart phones, etc.
- Thus the widely held initial expectation was that the New Mobility would emerge and diffuse rapidly (think iPhones) and that a few players would dominate the new competitive landscape (think Google in autonomy, Uber in shared vehicles, Tesla in electric vehicles.)
- Not my expectation in 2010 when I began to think about successor research programs to the IMVP. "This will be hard. It will take a long time. Is it even possible? Is it even desirable in all respects? What can independent thinkers do to improve the outcome?"



#### The Current State, 9 Years In

- Adoption has been much slower than widely expected in the first decade of deployment:
- ✓No one has to date ridden as a paying passenger in an autonomous vehicle without an accompanying safety officer/test engineer;
- ✓ The number of electric vehicles in the world fleet is less than .2% and many are very energy intensive due to size and battery weight,
- ✓ The trip share of ride-hailing vehicles in their most mature market (San Francisco) is about 15%;
- ✓The connectivity concept with its many dimensions, including how the New Mobility can be profitable and the rules of data use, is still being developed.
- In consequence there are limited data available on customer reactions/acceptance.
- The impacts on incumbents have hardly been felt (except in the market caps of some legacy car companies!)
- Public reactions to safety, data security/use, and subsidy issues are still unknown.



#### The Current State

- The expectation of rapid winner-take-all dominance in autonomy, electricity, sharing, and connectivity has dramatically receded (but with duopolies in ride hailing?)
- The prudence/necessity of disrupter/incumbent partnering has been widely accepted (but in what configurations and on whose terms is still in doubt.)
- The focus of discussion among players and academic investigators has largely been on narrow technical issues and business dynamics rather than customer acceptance and socio-technical-political implications.
- Is a 25-year time frame (from 2018) for a new mobility equilibrium more realistic? (Sum-up: This will be very hard and take a long time!)
- But climate and safety challenges need a much quicker response!
- Point for discussion in a moment: How can PVMI help speed diffusion and countermeasure inevitable problems?



# The Big View of the IMVP

- We started in 1979 to understand the disruption of the automotive system by Japanese new entrants and new geo-political conditions.
- We sought consciously to create a dialogue among all players (companies, countries/governments, unions, etc.) involving large amounts of data sharing and analysis in order to reach a common understanding about the root causes of disruption and constructive paths toward a new and better equilibrium.
- Work had some effect. (Indeed, was the IMVP a winner-take-all which dominated the global discussion of the problem and its resolution?!)



# A Big View for the PVMI?

- To date the PVMI has focused on bounded problems that can be studied with limited resources: mostly technical analysis and mind experiments on various elements of the New Mobility.
- Mindful of the complexity of the situation and the disinclination of the many players to talk about system design and to share data rather than focusing on maximizing their own position in whatever system emerges.
- Are additional steps possible and attractive to create a big view of the challenges and potential of the New Mobility, as happened in the IMVP?

# What Are the Most Important Research Questions?

#### How about these five?

- What problem are we trying to solve?
- How should we usefully define the "New Mobility System"?
- What is the proper unit of analysis for designing the new mobility system?
- Who can be the chief engineer of the new mobility system?
- Who should/will own/control the data the new mobility system needs and creates?



# What problem are we trying to solve?

- Greater customer convenience?
  - sleep while you drive?
- More breathable air in urban areas? (Pollution)
- Reduced congestion and travel times? (Congestion)
- Save the planet from a watery, fiery future? (Carbon)



# **Delhi 2017**

#### **Congestion is Universal**































#### How should we usefully define the "New Mobility System"?



- Does vehicle Electrification, Autonomy, Sharing, Connectivity do it?
- What about planes, trains, buses, scooters, bicycles, walking, & flying cars?
- Focus on urban transportation? Freight interactions?
- Role of
  - Connectivity
  - Heterogeneity
  - Intelligence
  - Personalization



# **Proper Unit of Analysis for Research?**

- In "Machine ..." auto assembly plants worked well.
- In "Product Development Performance" car projects worked well.
- For Mobility Systems?
- City/region, nation, world?
- Congestion is a regional concern, but a global phenomenon
- Air pollution is a regional concern, but a global phenomenon
  CO2 is a global issue.
- How can the right problem(s) be addressed at the right level?

# **The Chief Engineer?**

- ASB
- The New Mobility innovations require the creation of complex mobility networks with many collaborators and local focus but global reach-- over the next 25 years at least.
- They will profoundly disrupt a substantial fraction of global economic activity.
- Yet, there is:
- No chief engineer for the new networks. (Nor will there likely be.)
- No working model of the system to be engineered
- No concept paper, describing the opportunities and problems.
- No hoshin plan for the most important implementation challenges and problems to countermeasure at what point in time.
- Can a collaborative process be devised to create a surrogate chief engineer to speed implementation and optimize the results? How about PVMI?!



#### **Control of Data?**

- Key point of conflict between users, providers, and regulators.
- The key to profitability through analytics and sell-on of data?
- Perhaps resolvable by assigning different rights to different players:
- $\checkmark$  Opt-out rights to users.
- ✓ Aggregated travel data to governments and the general public.
- ✓ Personal travel patterns to providers.



#### **Other research questions?**

#### **Backup Slides**



# Software

- Toyota Research Institute-Advanced Development
- James Kuffner (ex-Google Self Driving Car Program), president
- "Fully-Integrated Production-Quality Software"
- Gill Pratt: "Toyota is known for the quality and efficiency of the Toyota Production System. I have no doubt that we can translate the fundamental ideas of TPS from the production of hardware to the production of software and dramatically enhance Toyota's software capabilities."
- Carrying on from agile and scrum.
- A focus for PVMI? (A link to the original IMVP.)



#### **Contact with the Customer**

- Everyone wants it.
- Key point of conflict between disrupters and legacy players.
- Candidate for the role: Legacy OEMs, new entrant ridehailing/software disrupters, financial entities owning the vehicles, organizations currently servicing and managing fleets – car dealers, rental car companies, franchise repair centers?