

BERLIN, SEPTEMBER 21<sup>ST</sup>

**INNOVATION ECOSYSTEMS AND PUBLIC-PRIVATE PARTNERSHIPS FOR  
SUSTAINABLE MOBILITY WORKSHOP**

RESEARCH PROJECTS OVERVIEW AND FOCUS ON MOBILITY RELATED PhDs

ECOLE POLYTECHNIQUE

CHEN BO  
MARCOCCHIA GIULIA



# INNOVATION MANAGEMENT RESEARCH TEAM



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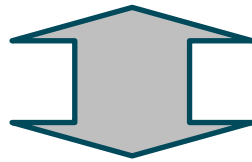
# MANAGEMENT SCIENCE KEYWORDS



## OUR RESEARCH APPROACH

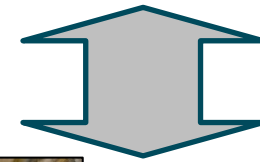
Our labs practice « action research » for decades, in close relationship with companies :

- **Specialized in the automotive industry**: eg. benchmark Advanced Engineering 9 global carmakers (incl. Nissan), disruptive project management (Logan Epic).
- **Experience in various industries** (digital, construction, luxury, etc), with similar issues: shift from product towards [product+service], enlarge to a wider « ecosystem ».



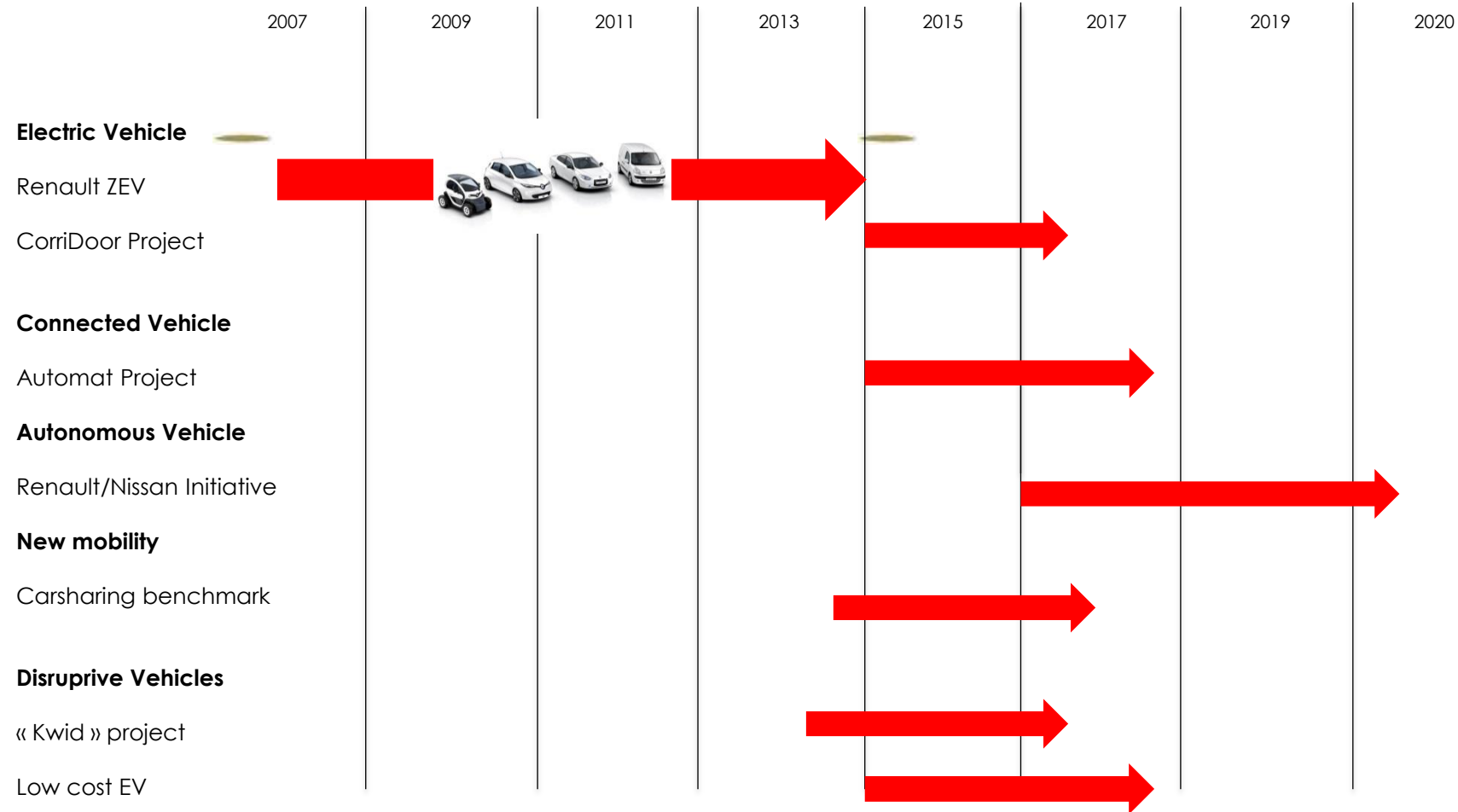
### Double output

- Scientific publications in leading journals, books.
- Close and « short-loop » feedback to counterparts within companies





# MOBILITY RESEARCH PROJECTS



# THE CONTEXT



## Empirical Context

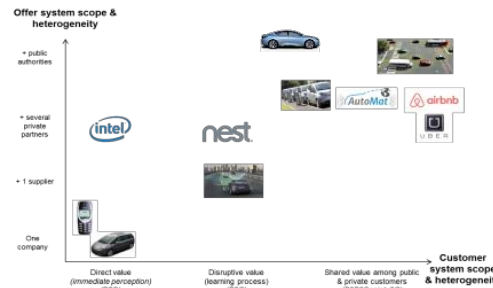
## Research question

Automotive markets shift in geography, opening avenues for disruptive products



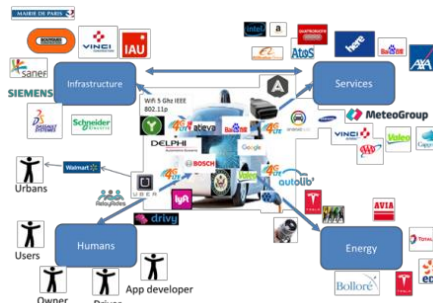
How systemic and disruptive innovation should be managed under globalization?

Automotive-based mobility solutions become increasingly systemic / public-private



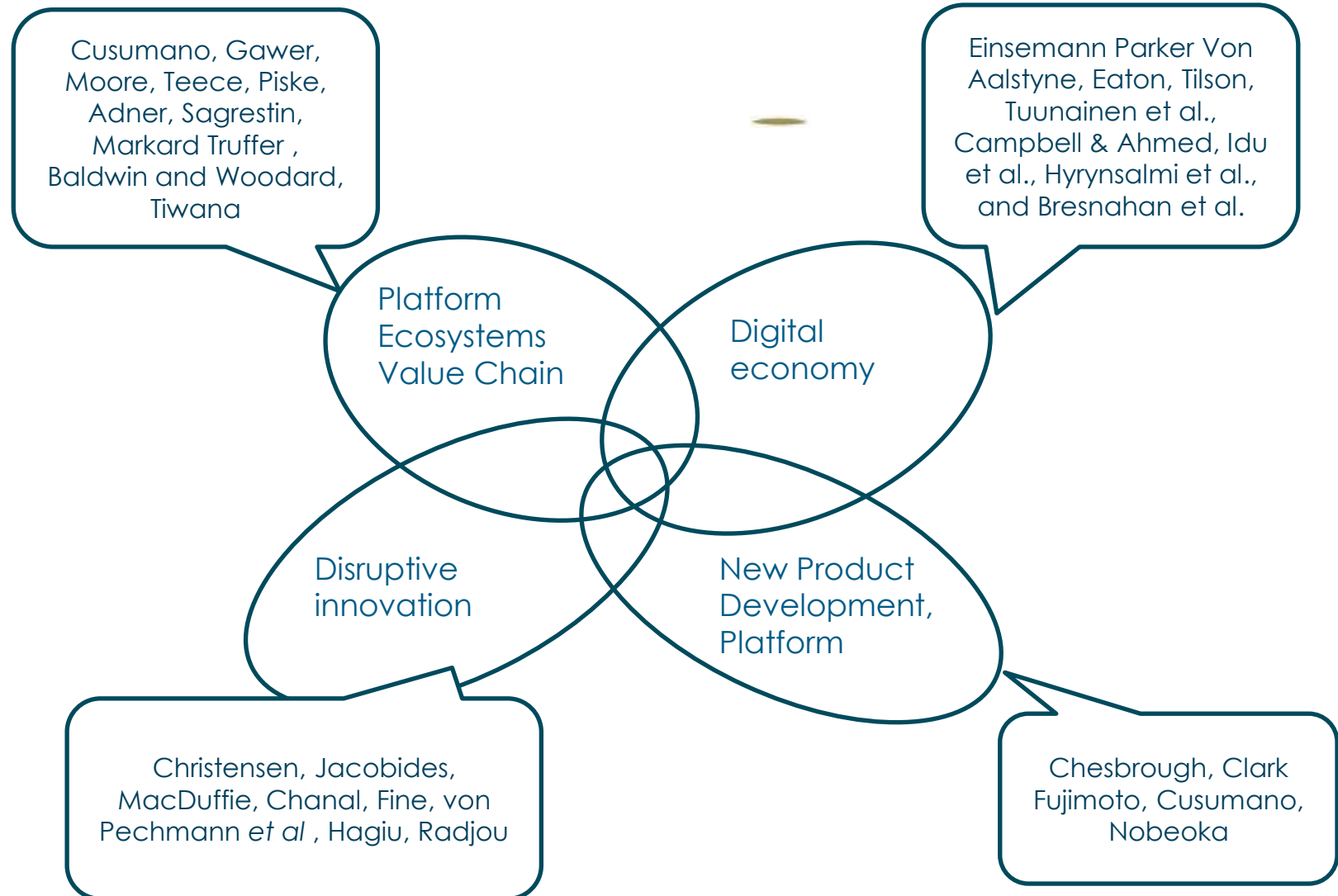
How systemic and disruptive innovation should be managed in this new arena of competition?

The automotive product becomes part of the « Internet of Robots », discovering the digital-specific market rules.



How an efficient ecosystem should be structured? Which consequences in partnership strategies?

# LITERATURE REVIEW





# Designing Strategy for the Globalization of Innovation

## The Case of Western Electric Vehicle Manufacturers in China

**Bo Chen**  
Sep. 21th 2016





## What electric vehicle strategies for foreign OEMs in China?

### Academic literature

- Strategy in emerging countries
- Innovation management
- Chinese electric vehicles market, industry and policies
- Institutional and sustainability transitions

### On going PhD research

- Joint PhD research between CRG and Renault EV Product (2013 - 2016)
- Director : Christophe Midler

### Field Research in China

- 5 field missions in China between April 2013 and January 2016
- 2 years of research collaboration with the Center for Automotive Industry (CAI), School of Automotive Studies, Tongji University in Shanghai, China

- 1. Market Status**
2. Strategy Design
3. Low Speed EVs
4. The Low End Approach













# MARKET STATUS

## EV MARKET TYPOLOGY



Vehicle Group	Cumulated Sales 2009 to Q1 2015	Vehicle Examples	Main Charging Mode	Deployment Territories
Mainstream PHEV	27 000		<b>220 V</b>  <b>Dedicated Charging</b> 	<b>TIER 1/2 CITY CENTERS</b> <ul style="list-style-type: none"> <li>EV is pushed by <b>constrains on ICE</b> (e.g. Beijing, Shanghai)</li> <li><b>Saturated</b> environment</li> <li><b>Great</b> existing mobility offer</li> <li><b>Parking</b> spaces are rare</li> <li><b>Massive</b> buildings and underground parking</li> <li><b>Difficulty</b> to install charging stations</li> </ul>
Premium BEV	4 000			
Mainstream BEV	25 000			
Official Low-End BEV	50 000		<b>220 V</b> 	<b>TIER 3/4 CITIES +SUBURBS</b> <ul style="list-style-type: none"> <li><b>Fast</b> urban development</li> <li><b>Weak</b> public transportation and gasoline stations networks</li> <li><b>More</b> individual homes and parking spaces</li> <li><b>Great</b> mobility needsx</li> </ul>
Unofficial Low-End BEV (Micro EV)	820 000			



Chinese parties	Foreign parties	New JV Brand	Brand Launch	Model Name	Cumulative Sales until Q1 2015	Platform
BYD	Daimler	Denza	2010.05	Denza EV	399	Mercedes B-class
DFM	Nissan	Venucia	2010.09	E30	1031	Nissan Leaf
SAIC	VW	Tianyue (Tantus)	2011.03	Tantus EV	Not significant	VW Lavida BlueMotion
FAW	VW	Kaili	2011.05	Carely E88 EV	Not significant	VW Bora
BAIC	Hyundai	Shouwang	2011.11	500e EV	Not significant	Hyundai Elantra
DFM + Yueda	Kia	Dianyue	2012.02	N30	Not significant	Kia Cerato
Changan	Ford	Jiayue	2012.10	Jiayue EV	Not significant	Ford Focus EV
SAIC	GM	Springo	2012.11	Springo EV	213	Chevrolet Sail Hatchback
Brilliance	BMW	Zinoro	2013.04	1E	307	BMW X1
FAW	Toyota	Ranz	2013.03	E50	Not significant	Toyota Corolla EX
GAC	Toyota	Leahead	2014.10	i1 EV Concept	Not launched yet	Toyota Yaris
DFM	Renault	Fengnuo	?	?	Not launched yet	Renault Fluence Z.E.

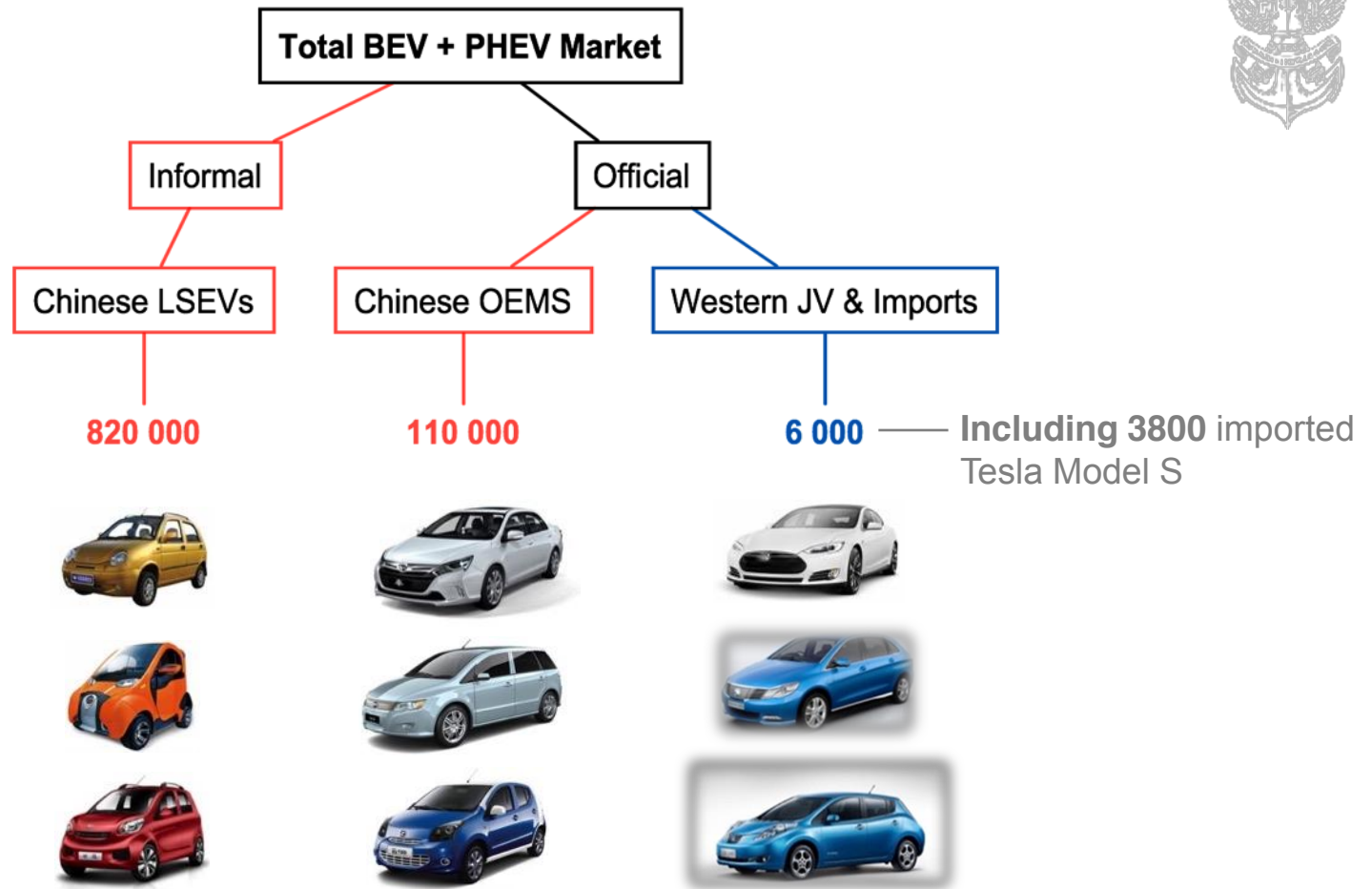
*New joint venture brands producing NEVs derived from existing ICEV platforms*

*Various sources, 2015*

Imported Tesla Model S : 3828 Units

# MARKET STATUS

## TOTAL MARKET TYPOLOGY



**Cumulative sales from 2009 to Q1 2015**  
 (LSEVs : Low Speed EVs or Micro EVs, JV : Sino-foreign Joint Ventures)

# MARKET STATUS

## BARRIERS AND WEAKNESSES

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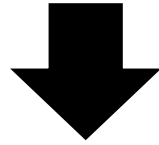
- **China's strategy, policies (JVs, technology transfers) and competitors**
- ***"Compliance electric vehicles"*, lack of engagement**
- **Unadapted products and pricing, weak brands**
- **Charging infrastructures**

1. Market Status
- 2. Strategy Design**
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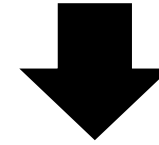




**Empirical Data**



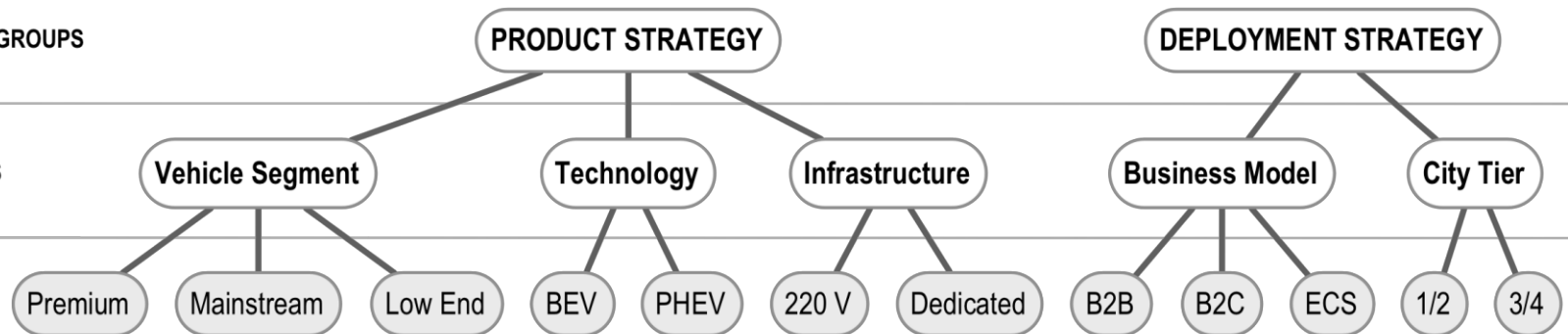
**Litterature**



2 VARIABLE GROUPS

5 VARIABLES

12 VALUES



***Five Strategic Variables of Electric Vehicles in China***  
*(Chen and Midler, 2016)*



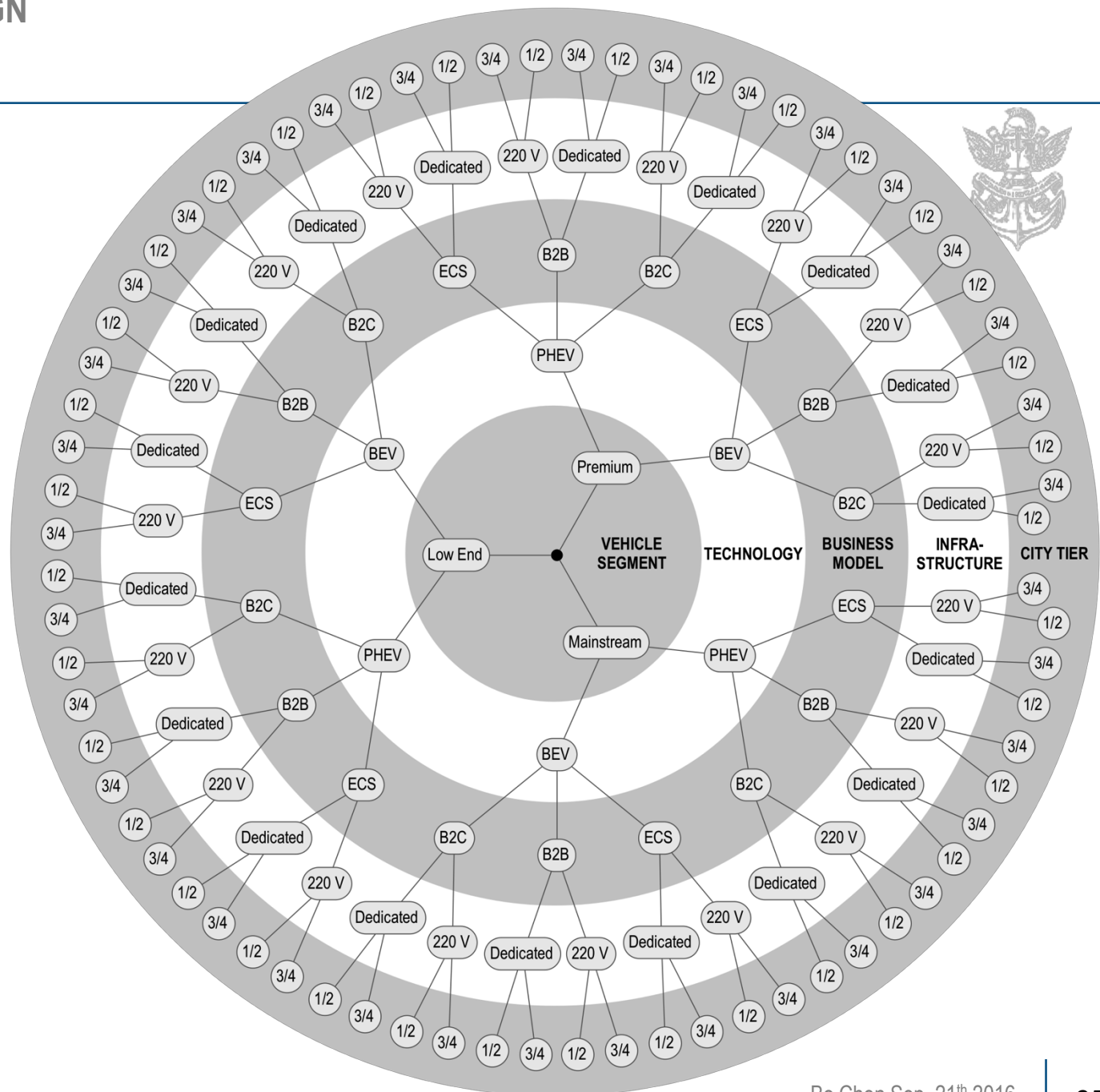
5 Variables  
12 Values



**STRATEGIC  
OPPORTUNITY  
SPACE**



72 Strategic  
Opportunity  
Paths

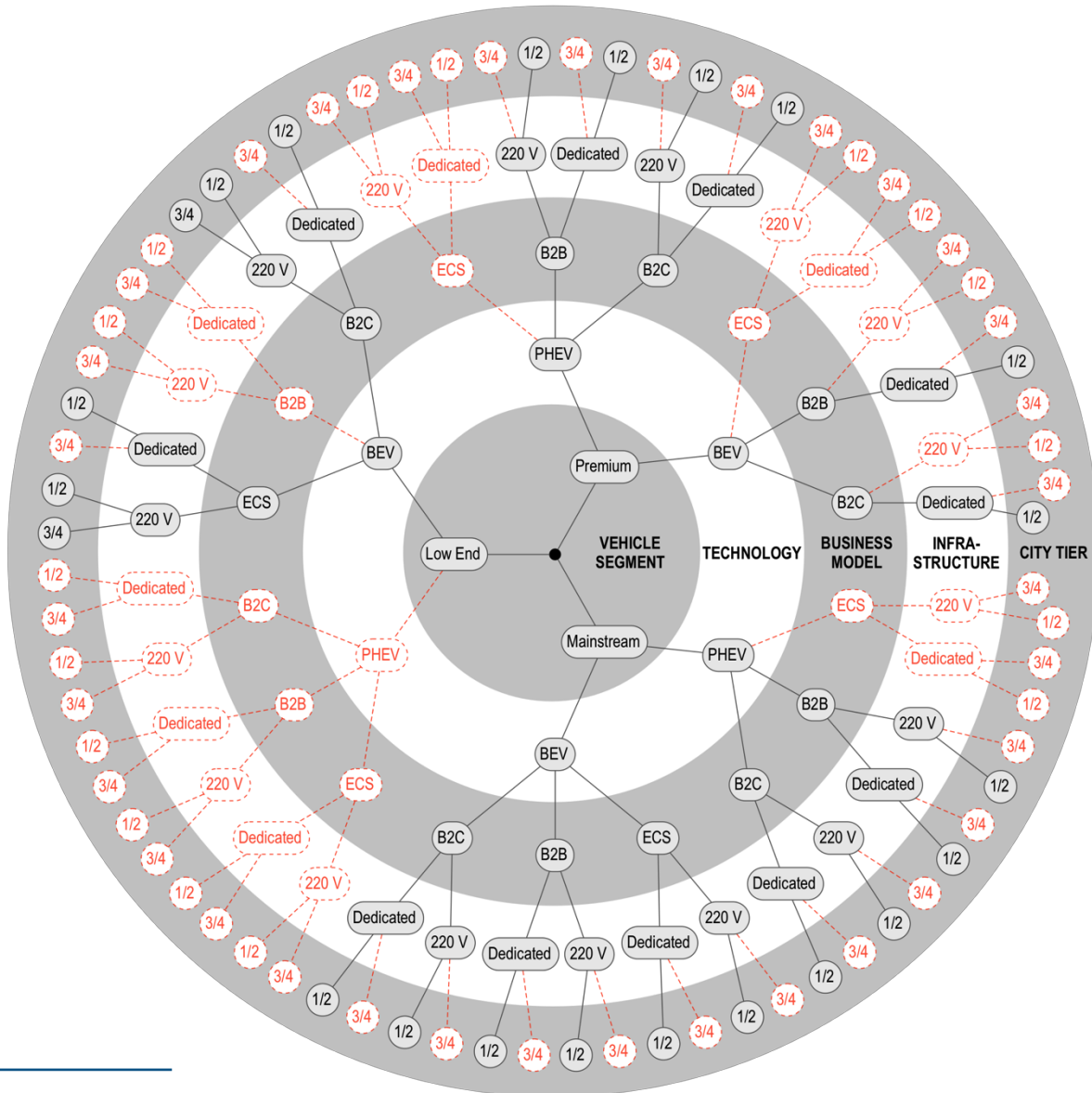




1. The Premium segment is **incompatible** with T3/4 cities: *T3/4 lack high-income population.*
2. The Premium segment is **incompatible** with ECS: *Carsharing is cost-sensitive and require low vehicle up-front costs, low replacement parts' costs and low maintenance costs.*
3. Premium BEVs are **incompatible** with 220 V: *Premium BEVs generally coming with large batteries, they need very long charging durations for full charges (around 30 hours for a Tesla Model S at 16 A/220 V).*
4. The Mainstream segment is **incompatible** with T3/4 cities: *These territories lack middle-income buyers. The limited number of potential buyers does not fit with the mainstream segment's objectives.*
5. The Low-End segment is **incompatible** with dedicated charging in T3/4 cities: *The cost of a dedicated charger is too high for low-income consumers.*
6. Low-End BEVs are **incompatible** with B2B: *In case of demanding B2B applications like taxi or ride-hailing, dedicated charging and large batteries are required, which is not the case of Low-End BEVs.*
7. PHEVs are **incompatible** with the Low-End segment: *The high cost of PHEVs' technology makes it incompatible with a low-end product.*
8. PHEVs are **incompatible** with ECS: *PHEVs are costly. ECS requires low vehicle up-front cost, low replacement parts cost and low maintenance costs. PHEVs are more expensive and technically more complex than BEVs or ICE vehicles.*

# STRATEGY DESIGN

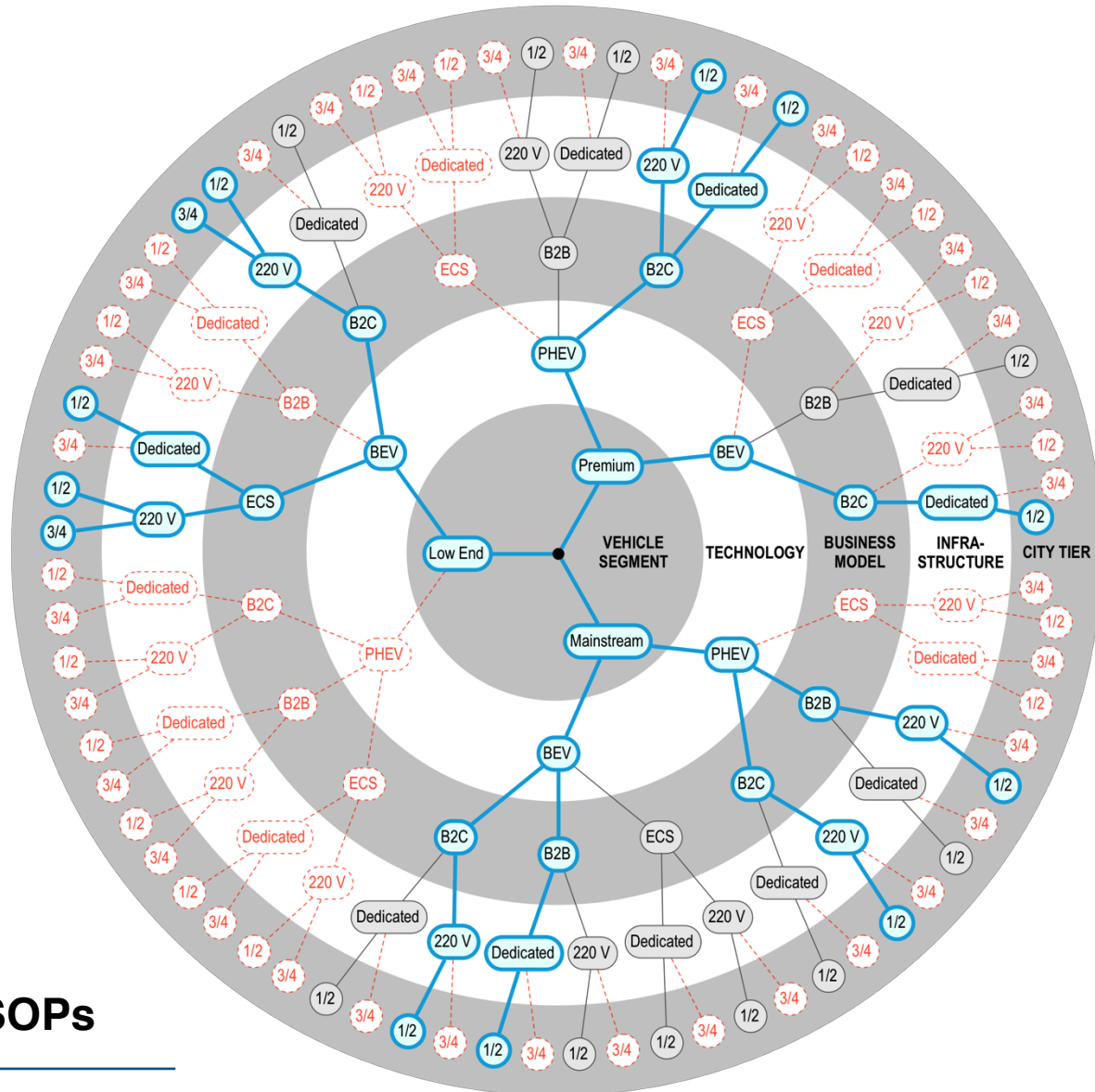
## PHASE 3: IDENTIFY “FIT STRATEGIC OPPORTUNITY PATHS”



22 Fit SOPs



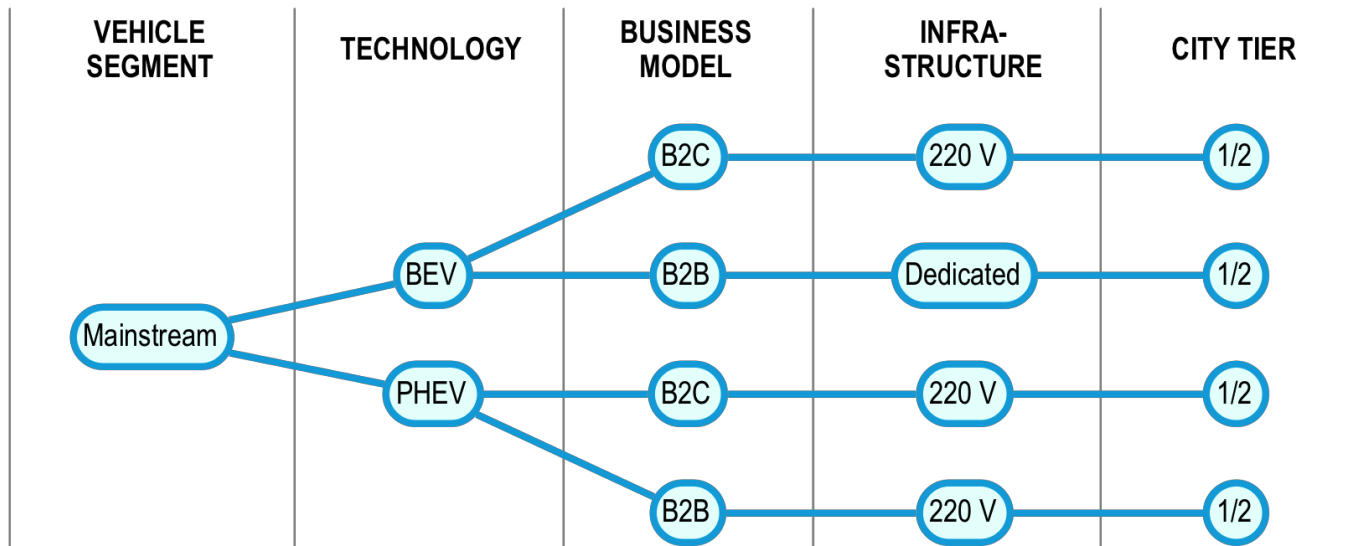
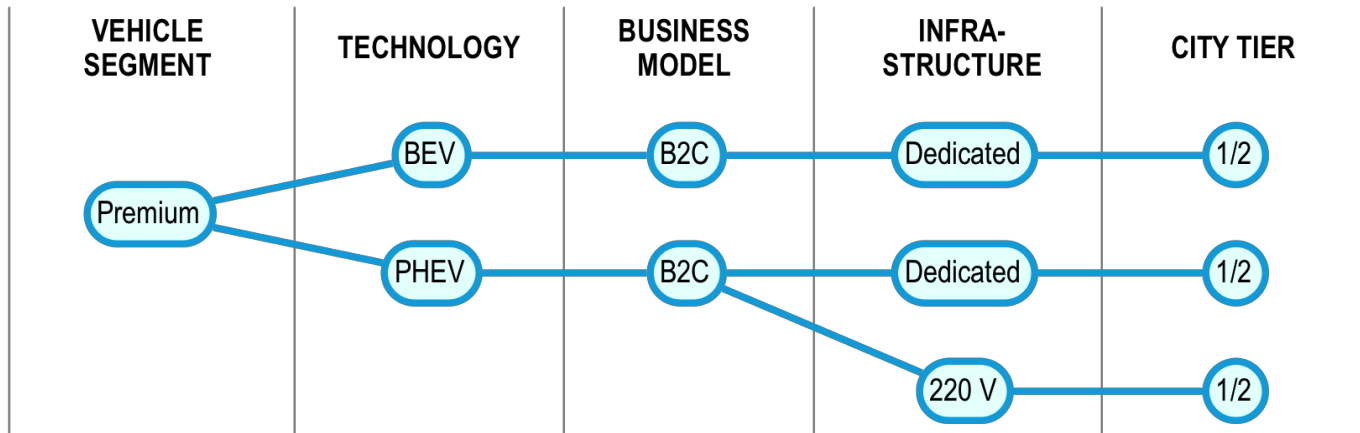
1. **The Low-End segment better fits ECS than the Mainstream segment does:** *Electric carsharing systems require vehicles with the lowest purchase and repair costs as possible. Although several carsharing systems...*
2. **The Mainstream segment better fits B2B than the Premium segment does:** *B2B applications such as taxi, ride hailing and chauffeur services require an optimum ratio between cost and comfort. Premium vehicles are...*
3. **220 V charging better fits B2C Mainstream and B2C Low-End than Dedicated charging does:** *Premium segment vehicles have the right business model to enable installation of residential dedicated charging...*
4. **220 V charging better fits B2B PHEVs than Dedicated charging does:** *Dedicated chargers' installation is costly. Thanks to their ability to drive in ICE mode only, PHEVs do not necessarily need to be charged to run...*
5. **Dedicated charging better fits B2B BEVs than 220 V charging does:** *Demanding B2B applications require Dedicated charging. BYD e6 taxis in Shenzhen are operated around the clock with multiple drivers' shifts...*



12 Best-Fit SOPs

# STRATEGY DESIGN

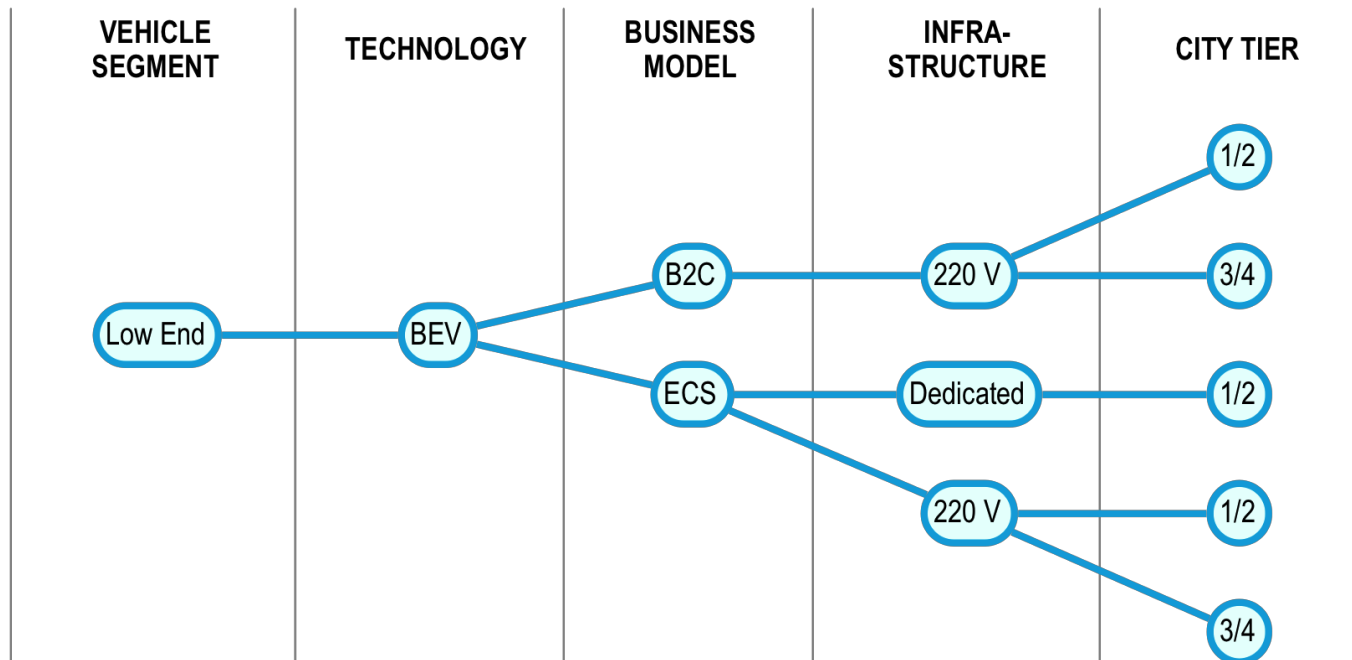
## PREMIUM & MAINSTREAM SEGMENTS





# STRATEGY DESIGN

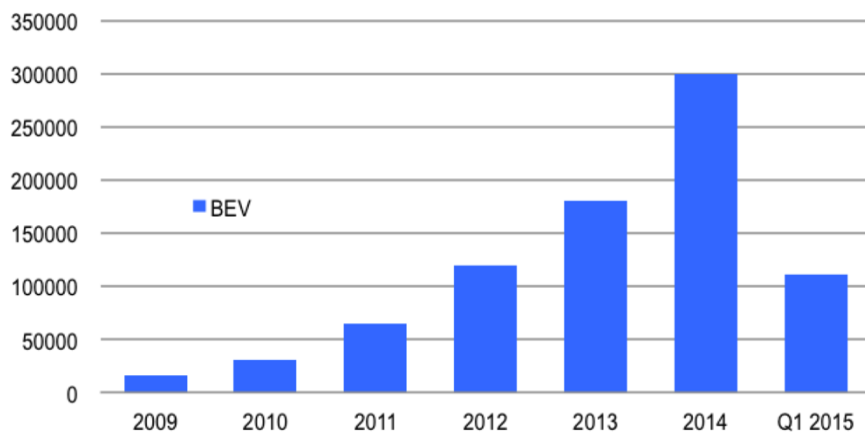
## THE LOW END SEGMENT



1. Market Status
2. Strategy Design
- 3. Low Speed EVs**
4. The Low End EV Approach



- Bottom-up, market driven, developed in low tier cities
- Local regulations but no central support yet
- National regulation being discussed
- Frugal design, poor safety and quality



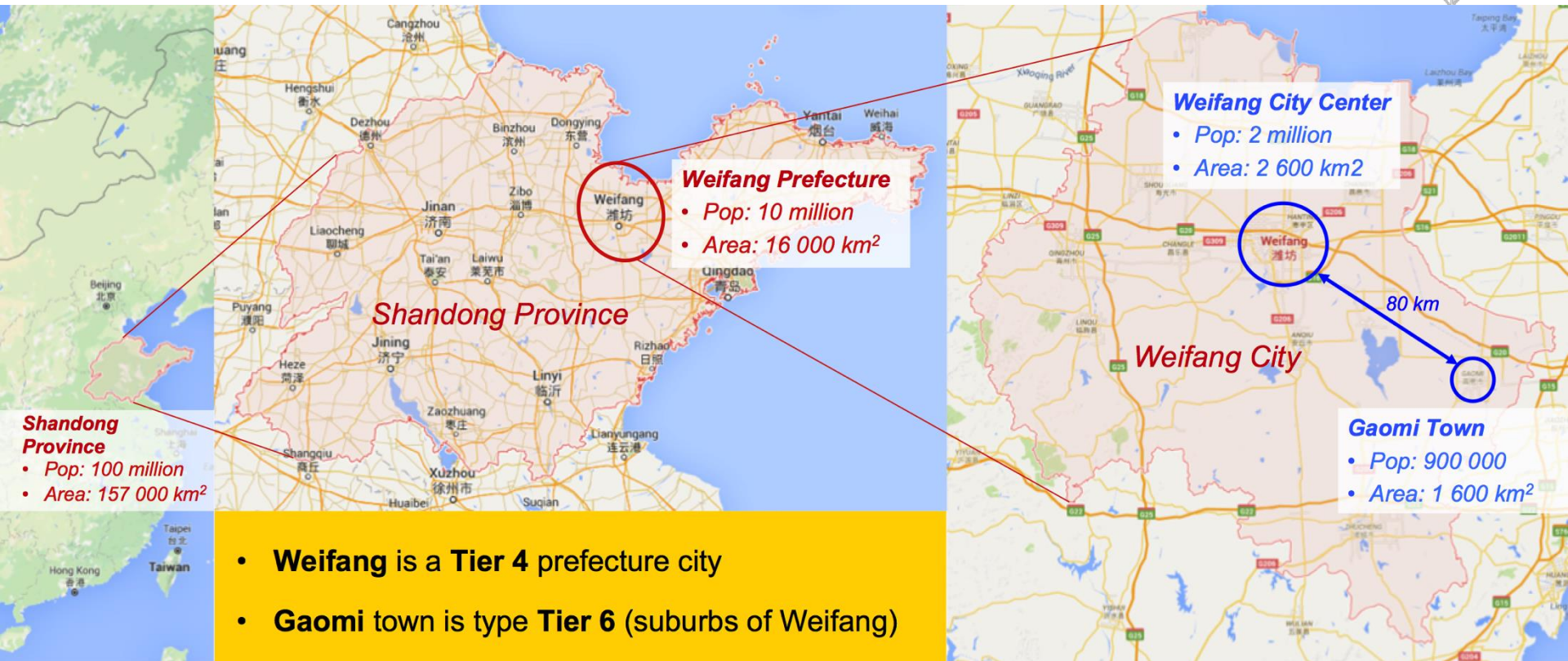
**Informal Passenger LSEV (BEV) sales in China from 2009 to Q1 2015**  
Chen and Midler, 2015

Top speed	40-80 kph, mostly 60 kph
Range	80-150 km
Battery type	Lead-acid batteries, Lithium batteries as an option on high end models
Battery capacity	100 Ah to 260 Ah, mostly 150 Ah
Motor power	4-10 kW
Charging time	8-10 hours on AC 220 V outlet

**Typical LSEV Specifications & Performance**  
d1ev.com, Shanghai Tongji University, 2013

# LOW SPEED EVs

## FIELD MISSION IN SHANDONG PROVINCE





# LOW SPEED EVs FIELD MISSION IN SHANDONG PROVINCE



## Weifang City Center



## Gaomi Town



# LOW SPEED EVs

## MICRO EV AND LOW END EV DEALERSHIPS



**Shifeng**



**DurableV + Lichi**



**Official EV Multi-Brand**



**JAC**



**Yogomo**



**LEVDEO**



**Geely**



**Chery**





## Framework

- Joint Research : Ecole polytechnique + Tongji University
- Official support :
  - National Development and Reform Commission
  - Ministry of Science and Technology

## Survey

- Dealership : 33 questions in 6 groups :
  - Dealership general information
  - Customer Profiles
  - Usages
  - Product
  - Services
  - Legal

## Results

- Dealership Survey : total 17 dealerships
- We interviewed **Top 4 MEV maker dealerships**
- We also found **Official EV makers dealerships**

	Dealership	Date / Time	Location
D1	Fulu ( <i>low quality</i> )	13.01.2016 / 10:14	Weifang 1
D2	<b>Shifeng</b>	13.01.2016 / 11:58	Weifang 1
D3	<b>Zotye</b>	13.01.2016 / 14:57	Weifang 1
D4	<b>LEVDEO</b>	14.01.2016 / 11:05	Weifang 2
D5	<b>NEV Center</b> (JAC iEV5, BAIC e160)	14.01.2016 / 12:34	Weifang 2
D6	<b>Dojo</b>	14.01.2016 / 13:06	Weifang 2
D7	<b>Shifeng</b>	14.01.2016 / 16:18	Weifang 2
D8	<b>Multi-Brand</b> (Chery QQ EV)	15.01.2016 / 10:41	Gaomi
D9	<b>LEVDEO</b>	15.01.2016 / 11:13	Gaomi
D10	<b>Geely</b> (EK2)	15.01.2016 / 11:57	Gaomi
D11	<b>Yogomo</b>	15.01.2016 / 14:59	Gaomi
D12	<b>Multi Brand</b> (JAC iEV4, Lifan 320e)	15.01.2016 / 10:41	Gaomi
D13	Multi Brand ( <i>medium quality</i> )	15.01.2016 / 16:29	Gaomi
D14	<b>Yogomo</b>	16.01.2016 / 10:00	Weifang 2
D15	<b>Multi Brand</b> (Changan)	16.01.2016 / 10:28	Weifang 2
D16	<b>Chery</b> (QQ EV, eQ)	16.01.2016 / 13:33	Weifang 2
D17	<b>JAC</b> (iEV4, iEV5)	16.01.2016 / 15:05	Weifang 2

# LOW SPEED EVs CUSTOMERS & USAGES



User Group	Age 30 – 45 Male		Age 30 – 45 Female		Age 45-70 with 80% Male	
Vehicle Type	Real Low End EVs	Micro EVs	Real Low End EVs	Micro EVs	Real Low End EVs	Micro EVs
Users Profile	<b>Users</b> : mostly men > 45 years old		100% for Z100 20% for QQ	20%	50% for Z100 70% for QQ	70% - 80%
Buyers Profile	<b>Buyers</b> : partly different from user (husband or children)		50% is the husband 40% is the husband		30% is the user 70% is their children	30% is the user 70% is their children
Regulation	<b>Regulation</b> : no need of drivers licence, no compliance with traffic regulations					
Driver's License	<b>Usages</b> : sending kids to school, shopping, leisure, drunk driving...					
Risk vs Safety	<b>Safety</b> : higher than electric bikes, protection during bad weather, low speeds					
Ownership	<b>Car ownership</b> : 90% of owners already have a gasoline car in the family					
Mileage	<b>Mileage</b> : < 30 km/day for Unofficial MEVs, < 60 km/day for Official MEVs					
Other	<ul style="list-style-type: none"><li>• 90% of owners already have a gasoline car in the family</li><li>• Weifang City Center : 50% city, 30% countryside, 20% commuting</li><li>• Fresher design attracts younger customers</li><li>• QQ EV already 7 years, reputation of reliability and easy servicing</li><li>• Owners use their EVs &gt; 90% of the time vs their gasoline car</li><li>• Little proportion of black cab drivers</li></ul>					

# LOW SPEED EVs CHARGING AT HOME





# LOW SPEED EVs CHARGING AT WORK



# LOW SPEED EVs CHARGING FROM GROUND FLOORS

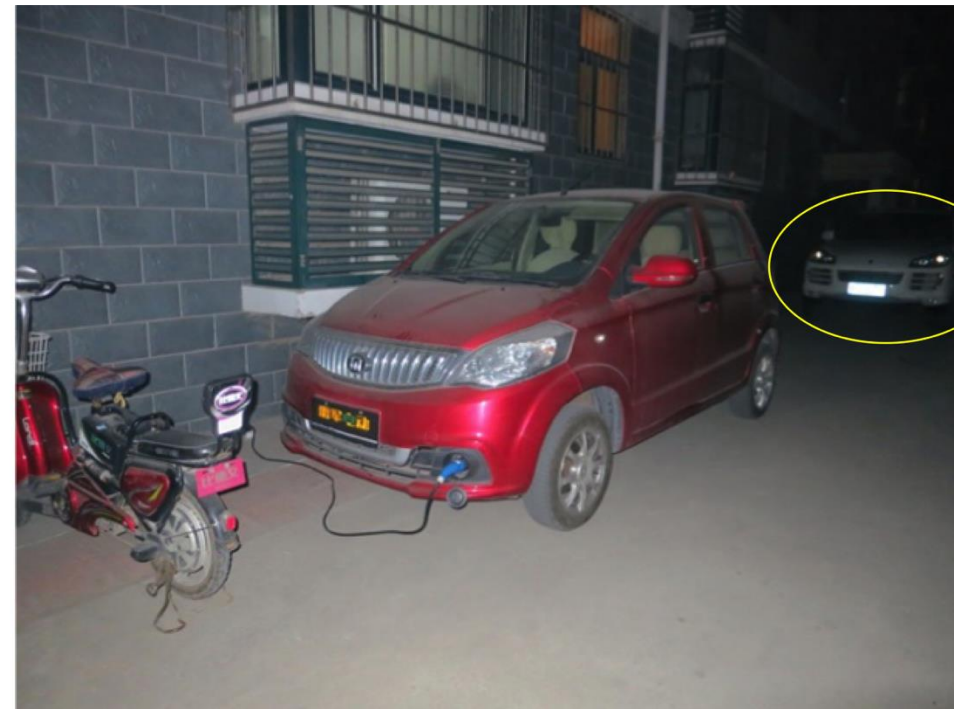
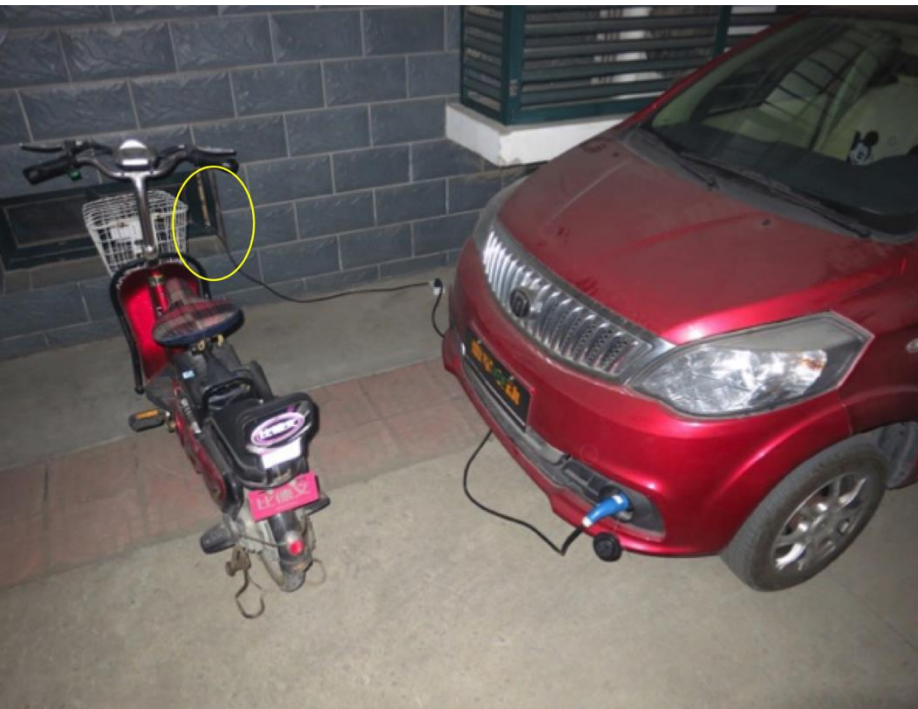




# LOW SPEED EVs CHARGING FROM UPPER FLOORS



# LOW SPEED EVs CHARGING FROM STORAGE SPACES



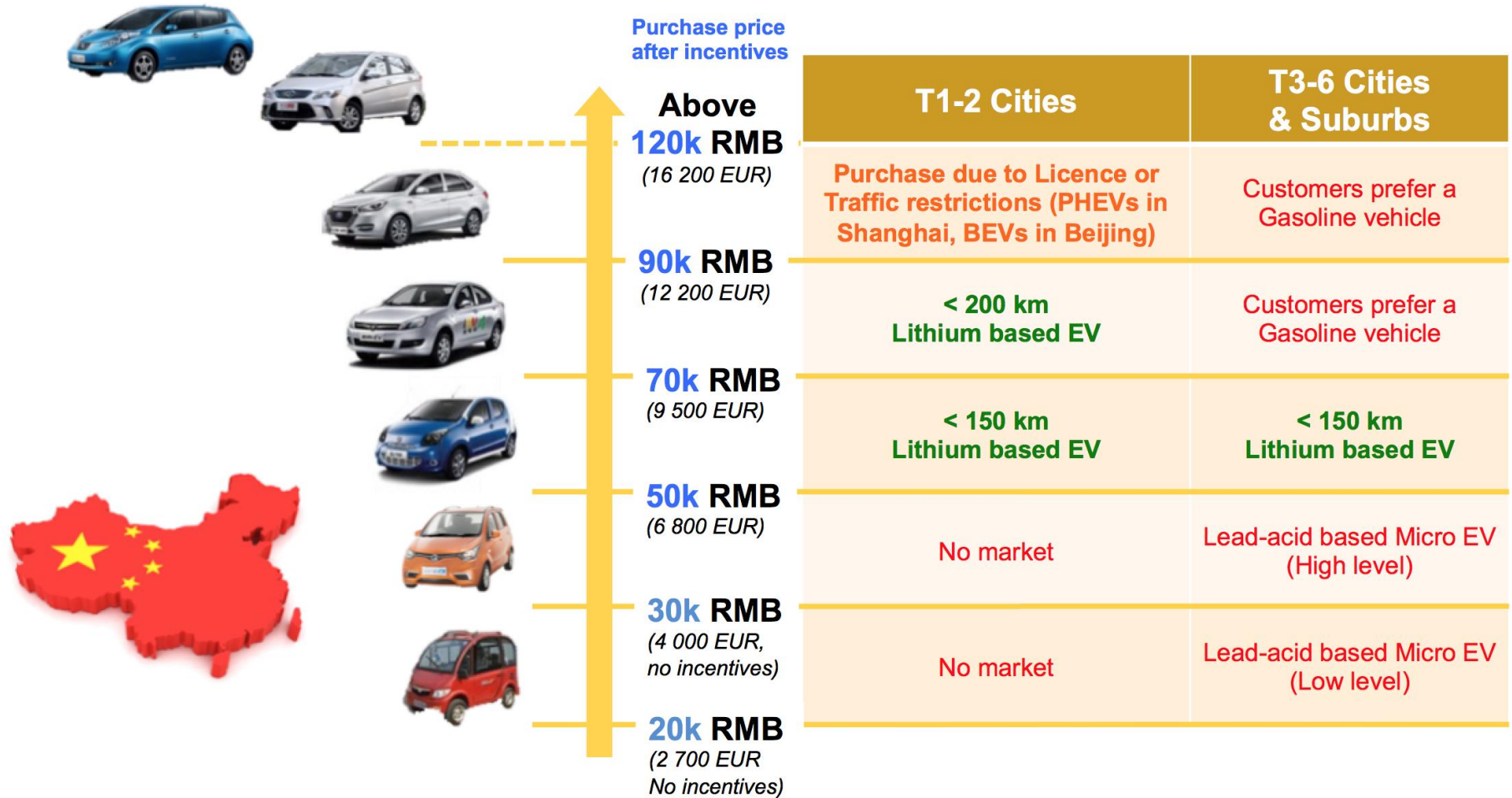
1. Market Status
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# THE LOW END EV APPROACH

## PRICING IS KEY





## Advantages of Low End BEVs

- **Volumes** generate CAFC credits
- **Good Enough Products** (Gadiesh & al., 2007), **Long Lasting Products** (Dawar & Chattopadhyay, 2002), ability to cope with variability (income, roads, charging)
- **Resistant to technology transfer** (non-technological design-to-cost value)
- **Multi-positioning:** Low End in T1/2 cities, Mainstream in T3/4 cities and Premium in rural areas
- **Multiple business models:** B2C + carsharing (low cost, low repair cost and robust vehicles)
- **Virtue of Marginality** (The Logan Epic, Midler et al, 2012)

## Capture the potential of 220V Charging

- **Peak grid strain** is lower with slow charging overnight : better up-scaling compatibility
- Both market evidences (MEVs, PHEVs) and literature suggest the **relevance of private 220 V charging**
- Capitalize on **existing 220 V infrastructure** while keeping faster charging abilities

## Deployment Territories

- **Lower tiers** cities + **Suburbs** of major cities



### M Économie

### Renault et Nissan veulent développer une voiture électrique à bas coût

Le Monde.fr | 01.02.2016 à 09h47 • Mis à jour le 01.02.2016 à 11h22 |

Renault and Nissan are considering developing a **new low cost electric vehicle** for the **Chinese market**, Carlos Ghosn announced on Monday, February 1, 2016.

"We must work on an affordable zero emission vehicle, because today our range of electric vehicles [Renault Zoe or Nissan Leaf models] is at the **heart of the developed markets** in terms of **price**, but **not in emerging markets**" says M. Ghosn.

The price [of EVs in China] paid by the customer is **between 30,000 and 100,000 RMB**, i.e. 4200 to 14000 EUR per vehicle.

For Mr. Ghosn, Renault and Nissan need to get in position to produce an affordable vehicle at the best price, **regardless of the various public incentives**, which will eventually phase out. "If we can develop such a vehicle and **sell it here, we can sell it worldwide**," says the head of the Alliance.

谢谢！

**Thank you!**

**Merci !**