China Drives the Future of Automotive Innovation

China in 2025 and the Implications for Auto & Steel Makers

Presentation by Bill Russo (罗威)
Managing Director, Gao Feng Advisory Company
Gao Feng’s Recent Auto Industry Publications

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The China Context

• China has emerged as the world’s largest automotive market since 2009 and remains the growth engine of the global automotive industry.

• The China auto market sharply decelerated on 2011 and 2012 - with growth slipping to 2.5% and 4.3%, respectively. This brief slowdown was followed by 14% growth in 2013 and 7% growth in 2014, with overall sales now exceeding 23M units.

• The world has entered a new era since 2008, with over half of the world population now living in cities, and this increasingly urbanized world challenges the established set of paradigms for personal and commercial transportation, especially in the densely populated urban centers in China.

• The unique context of China’s urban transportation challenge, the high rate of adoption of mobile device connectivity, combined with the rapid and aggressive introduction of alternative mobility and ownership concepts will compress the time needed to commercialize smart, connected car technology and related services.

China is poised to revolutionize the 21st century global automotive industry, especially in the area of the Internet of Vehicles, making vehicle connectivity the next great frontier of automotive innovation.
The China Context
The Personal Mobility Revolution
The Future of Automotive Innovation
The China Context - speed and intensity

Shanghai

20 Years Ago

Now
China’s economic “new normal”

China GDP
1999-2014 Unit: Billion USD (Current Value)

World Countries GDP Ranking
2013 Unit: Billion USD (Current Value)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>GDP ($ B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Netherlands</td>
<td>800</td>
</tr>
<tr>
<td>19</td>
<td>Saudi Arabia</td>
<td>745</td>
</tr>
<tr>
<td>20</td>
<td>Switzerland</td>
<td>650</td>
</tr>
<tr>
<td>21</td>
<td>Argentina</td>
<td>611</td>
</tr>
<tr>
<td>22</td>
<td>Sweden</td>
<td>557</td>
</tr>
</tbody>
</table>

China incremental GDP (2012-2013) is $661B, approximate to Switzerland’s total GDP

*Growth% uses real CAGR
Note: GDP numbers are nominal, only compares current value, does not include inflation and other economic factors
Source: China National Bureau of Statistics, World Bank Databank; Gao Feng Advisory Analysis
After a period of explosive expansion, China’s auto market has decelerated

Overall China Auto Industry by Sales Segments
(2008-2014, ‘000)

Total 2014 sales = 23.0M (+6.9% yoy)
Sales of PV + 9.9% yoy
Sales of CV - 6.5% yoy

- China’s overall auto industry sales have been growing rapidly, but growth is expected to decelerate out through 2020.
- Traffic congestion and pollution have reached a point where the government has implemented license plate restrictions in major cities. Alternative propulsion technologies and more aggressive regulations on emissions will impact both OEM product plans and consumer demand preferences.
- Predominantly inland, lower-tier cities will grow at rates faster than the mature coastal regions.
- Strong demand will continue to be recorded for SUV and MPV segments.

Comments

Source: CAAM, LMC, GF Securities, Gao Feng analysis
The gathering storm clouds raise the question: is the Golden Age over for China’s auto industry?

- Overcapacity…esp. at middle and lower end of the market
- Slower growth as the “New Normal”
- Rising inventory of unsold vehicles
- Looming Price & Incentives “war”
- Restrictions to address Congestion & Emissions
- Selective Targeting of Foreign Brand OEMs

The “old” automotive industry model – a way to provide mobility for middle-class consumers – may not fit the Chinese context, creating opportunities for innovation.

Source: Edward Tse and Bill Russo, “Restructuring will set stage for new golden age of China's auto industry”, South China Morning Post, January 21, 2015
The China Context

The Personal Mobility Revolution

The Future of Automotive Innovation
THE PERSONAL MOBILITY REVOLUTION

FUTURE AUTOMOBILES

The evolution of personal mobility...

- First form of vehicular travel
- Uses “horse power”
- Abundant use of wood, and little metals along with leather
- Furniture makers were a big part of the supplier chain

- 1886 - The birth of the modern “automobile”
- Self-powered vehicles fitted with internal combustion engines
- Early automobiles had to be lightweight for the low powered engines and were still wood-built coaches

- 1908 - The first mass produced automobiles
- More powerful and reliable engines with transmissions
- Assembly line, interchangeable parts, beginning the use more metals especially brass throughout the car
- Tire manufacturers were born

Source: Gao Feng Analysis
**Golden era**

- 1920-1970 Vehicles grew in size and were more powerful
- Fully enclosed cabins, standardized controls, creature comforts
- Abundant use of metals and innovation in features and functions, initially focused on mechanical and powertrain systems

**Modern Automobile**

- Engineered to optimize highway driving speeds and occupant safety – therefore over-engineered for urban mobility
- Initial deployment of alternate power sources or “new energy vehicles”
- Occasional use of composite materials and lightweight alloys
- Early adoption of modern smart devices and mobile connectivity with IOV

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**Future Personal Mobility Device**

- Designed specifically for city-use
- Lower driving speeds and V2V crash avoidance technology reduce crash protection requirements and enable smaller and lighter vehicles made primarily of lightweight composites

**Future Autonomous Cars?**

- What will power these vehicles?
- Space-age materials and features?
- How will vehicles be used?

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Source: Gao Feng Analysis
6 major themes have emerged from our research

<table>
<thead>
<tr>
<th>Themes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IoT as Innovation Frontier</td>
<td>The Internet of Things has become <strong>the next great battleground for automotive innovation</strong>, driven by consumer expectations for ubiquitous connectivity</td>
</tr>
<tr>
<td>Digital Disruption</td>
<td><strong>Non-traditional players are disrupting the linear automotive value chain</strong>, providing an asset-light, services-oriented means of serving mobility needs</td>
</tr>
<tr>
<td>Power Shift</td>
<td><strong>Shifting power dynamics</strong> among players along the value chain, among both new and traditional players; and understanding of roles needed in the new ecosystem</td>
</tr>
<tr>
<td>Business model revolution</td>
<td><strong>Traditional automotive value chain players</strong> must re-assess their business model and approach following the entrance of new players</td>
</tr>
<tr>
<td>Future Car Vision</td>
<td><strong>Electrification, lightweight, energy efficiency and connected technologies</strong> become the core &amp; defining attributes of the future car</td>
</tr>
<tr>
<td>Personalized and On-Demand Services</td>
<td>The automotive experience for users will be much more service-oriented, offering <strong>a multitude of personalized and on-demand options</strong></td>
</tr>
</tbody>
</table>

Source: Press Research, Interviews, Gao Feng Analysis
The Internet of Things has become the next great battleground for automotive innovation

**Trends**

**Consumer pull**
- Chinese consumers are **highly-connected and internet savvy**, familiar with constant new technologies, quick updates of model cycles
- Internet firms can leveraging **big data and analytics**, to tailor products and services to individual needs

**Rise and significance of ICT in China**
- China ICT companies have become **relentless engines of growth and innovation**
- They enjoy **less regulatory restraints** relative to OEMs and international ICT companies due to less regulations on developing mobile technologies

**Technological and social connection**
- As the third space after the home and work, cars are becoming “**technologically and socially connected platforms**”
- **Seamless integration** of everyday tasks and activities from various facets of life to consumers is the ultimate purpose of connected mobility

“User data is leading to solutions for tailor-made services. Where data doesn’t matter, what matters is who owns them”
Digital disruption creates a multi-dimensional and disaggregated value chain

**Traditional Automotive Value Chain**

**Future Mobility Value Chain**

**China’s Disruptors**

- A diverse range of non-traditional industries will play a bigger, impactful role in the industry and will expand capabilities to compete with traditional players in their core business.

- Technology companies have great opportunities as they can leverage existing customer relationships with technology platforms, extending their reach eventually to vehicle technology development.

- Traditional OEMs are at risk of their business model being converted to a high risk, asset intensive, commoditized business to business channel for delivering hardware to successful service platform providers.

**“Companies we cannot see today will enter. Cooperation is essential; everyone has weaknesses and strengths but they move forward together”**
Shifting power dynamics among new and traditional players will redefine roles in the new ecosystem

“There are no secrets in today’s information-driven world; the difference is how you deliver value”

ICT Companies Are Game Changers

- Chinese technology giants are pursuing autonomous vehicle technology and new energy vehicles
- They have the scale, scope, and capabilities to provide innovative solutions to China’s growing car service and maintenance industry
- Strategic partnerships between online and mobile platforms create network effects and achieve economies of scale, integrating functions, products, services
Traditional automotive value chain players must re-assess their business model and approach

“Connected mobility is inevitably our future. We must refine our unique positioning and rethink the way we do business to gain traction”
The core and defining attributes of the Future Car will change significantly

**Key Attributes of Future Car**

<table>
<thead>
<tr>
<th><strong>HARDWARE</strong></th>
<th><strong>SOFTWARE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrified</strong></td>
<td><strong>Lightweight</strong></td>
</tr>
<tr>
<td>Electro-mobility links to connected mobility. Especially in China, electric cars play a pivotal role in sustainability of vehicular transport</td>
<td>Aluminium and plastic carbon fiber will be more common</td>
</tr>
<tr>
<td>Electric-powered cars could become mainstream</td>
<td>Compact design, instead of over-engineering for urban use</td>
</tr>
<tr>
<td>Battery technologies are still improving</td>
<td>Considerations will be around cost effectiveness and sustainability of entire production cycle</td>
</tr>
</tbody>
</table>

“Electro-mobility will drive connected mobility. We now live in an era of cloud and self-organizing technologies, while ensuring sustainability”

Source: Press Research, Gao Feng Analysis
The automotive experience will be service-oriented, offering personalized and on-demand options

**3 Owned Smart Car**
- Enhanced V2X connectivity, electrification and technology-enabled in-car experience
- Disruptors: Tesla

**4 Personalized Mobility**
- Fully autonomous EVs at marginal usage cost
- Affordable, safe and intelligent mobility service with shared assets
- Potential Disruptors: Apple, Google, Baidu, LeTV, Pateo

**2 On-demand Mobility**
- Light-asset Internet-enabled platforms dynamically matching mobility demand and supply
- Timely and cost-efficient car-hailing services as disruptors (e.g. Didi-Kuaidi, Yidao and Uber) and rental companies (e.g. CAR, PPZuche)

**1 Owned Vehicles**
- 100+ years old, relatively undisrupted auto industry
- Hardware sales-oriented mindset and risk-averse
- Dominated by traditional OEMs and tier one suppliers

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"Ultimately, connected mobility is not merely about technology itself, but empowering users through enabling exceptional driving experiences not possible before"
The China Context
The Personal Mobility Revolution
The Future of Automotive Innovation
Largest and fastest growing, China’s auto industry is poised to enter a “new golden age”

**Local Impact**

- Engage with China’s new breed of **disruptors**
  - Baidu 百度
  - Alibaba Group
  - Tencent 腾讯

**Demand**

- Serve emerging demand for mobility in an **increasingly urbanized world**
  - Mega-city residents seek **new mobility solutions from new entrants**
  - Internet companies & automotive OEMs race to serve smart, connected car users

**Global Impact**

- A viable **path to energy saving and new energy vehicles** emerges
Conclusion:

As the leading automotive market, China is poised to revolutionize the global automotive industry, especially in the area of the Internet of Vehicles, making mobile vehicle connectivity the next great frontier of automotive innovation.

China’s rapid embrace of mobile internet, combined with the commercial aggressiveness of China’s internet giants are creating conditions conducive to the rapid commercialization of smart, connected car technologies.

Such developments are not simply altering the feature content of vehicles, but are also transforming the business model of the automotive industry.

Digital technology is driving the future of the automotive industry, and the commercialization pathway for future automotive innovation will travel through and may indeed originate from China.
Implications for the Steel Industry

Conclusion:
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Steelmakers must be proactively involved in the development of the new eco-system for mobility in China.

Key Implications

- Innovation in auto industry will dramatically change the steel makers’ way to play in the auto sector
- Steel makers must engage with non-traditional players to ensure that they have access to the future leaders in China’s mobility sector
- Steelmakers must build collaborative partnerships and seek opportunities to participate in the new mobility eco-system
Who is Gao Feng?

- A pre-eminent strategy and management consulting firm with roots in China and global vision, capabilities and resources network
- We help our clients address and solve their toughest business and management issues
- Our behavior is led by our values
  - We put our clients’ interest first and foremost
  - We are objective and we view our client engagements as long-term relationships rather than one-off projects
  - We view our people as strategic assets and not merely “units of capacity”
  - We believe that every member of our team can contribute to problem solving for our clients, from the most senior to the most junior
- Our seniors are former senior consultants at leading management consulting firms and/or senior executives at large corporations
Gao Feng’s heritage and our deep roots in China

- Our name *Gao Feng* 高風 is taken from the Song Dynasty Chinese proverb *Gao Feng Liang Jie* 高風亮節
  - *Gao Feng* denotes noble character while *Liang Jie* refers to a sharp sense of integrity
  - We believe this principle lies at the core of management consulting – a truly trustworthy partner who will help clients tackle their toughest issues
Contact us

Please find below contact details for our offices in Beijing, Hong Kong and Shanghai or contact us at info@gaofengadv.com

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Gao Feng WeChat Official Accounts: Gaofengadv
# About Bill Russo

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<tr>
<th>Overview</th>
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| Managing Director  
Practice Lead Automotive  
Bill Russo | Led transition team for absorption into Daimler Benz AG in cooperation with 10 executive colleagues (team assembled by Chrysler CEO). Leveraged a qualitative feedback system to determine obstacles. Devised process improvements including cross-functional Issue Resolution Teams. Achieved $1B operating costs reduction (within 1 year, vs. 2 year timetable) in collaboration with Chrysler and Daimler Benz personnel by combining the finance, IT, and HR departments | Leader of the Chrysler business in Greater China from 2004-2008 |
| Executive Summary | Led a project for the pre-acquisition planning associated with the $1.8Bn acquisition of a European OEM by a Chinese automaker | Served as a board member of DaimlerChrysler China Ltd., and Chairman of Chrysler's sales companies in North East Asia |
| Relevant experience | Internationally recognized expert on new energy vehicles, connected cars, and the electrification of transportation | Successfully negotiated agreements and obtained government approvals to localize 6 new vehicle programs over a 3-year period |
| Education | Author and opinion leader on matters related to the China automotive industry, with regular appearances in major television (Bloomberg News, CCTV) and print media (China Daily, The Wall Street Journal, Financial Times) | Leader of initiative to reengineer the new vehicle / product development process to reduce cycle duration to as low as 24 months. Earned U.S. Patent for a Chrysler Development System product development process innovation |
| | As head of Product & Business Strategy, spearheaded mission-critical initiative to consolidate 3 key planning functions: 10-year strategy, long-term product development, and 5-year capital investment ($6B annually) | |
## Contact us

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Appendix
Connectivity transforms the car into an intelligent mobility services platform

**EXTERNAL**

- **V2I**: vehicle to infrastructure – sensing the road infrastructure, e.g. traffic jams, red lights, paying tolls, etc.
- **V2V**: vehicle to vehicle - increased safety as vehicles can communicate with each other and pass warning messages on dangerous situations such as wet roads.
- **V2X**: vehicle to external communication – communication with any Internet capable device.
- **V2E**: vehicle to enterprise – connect to all existing and future ecosystem players, from gas stations, car park operators, to music streaming, navigation, insurance providers and new web services.

**CONNECTIVITY**

- **Active Safety**
- **Assisted Driving/Parking**
- **Remote Diagnostics**
- **Navigation Platforms**
- **Traffic Coordination**
- **Telematics**
- **In-vehicle Navigation**
- **Environment Sensing**
- **Autonomous Vehicles**

**VEHICLE**

- **EV Eco-system**
- **Parking Information System**
- **Traffic Analytics**

Source: Gao Feng analysis
Steel accounts for more than 50% of the weight of an average passenger car.

### Materials in a Passenger Car
(By % of total weight)

- **Steel**: 56%
- **Plastics**: 11%
- **Rubber**: 12%
- **Iron**: 12%
- **Aluminium**: 6%
- **Glass**: 4%
- **Others**: 8%

### Major Steel Applications in a Car

- Electrical steels for starter motors and alternators
- Cold steels tuned for machinability and hardenability
- High strength steels for crash performance
- Steel tubes for hydroformed subframes and other chassis parts
- Steel for suspension and engine parts
- Alloy steel rod for high-temperature applications, e.g., engine valves
- Ultra-clean steels for precision parts, e.g., diesel injectors
- Thick section strip and tube for structural reinforcements and seat structures
- Electroplated strip for brake and fuel lines, and electrical parts
- Deep drawing quality steels for complex shapes
- Deep drawing quality for surface appearance
- High-grade wire rod drawn into tyre cord
- Ultra high strength steels for “B” pillars
- Steel for chassis bolts and rivets
- Advanced high strength steels for lighter vehicle structures
- Aluminium-coated strip for exhausts
- Engineering services to prove out materials selection and engineering solutions. Services to make and weld blanks for vehicle structural parts.
- R&D services to assist selection of materials for formability and weldability.

Source: SMMT, Corus, Gao Feng analysis
Urban driving requirements will increase the potential for ultra-light electric vehicles (ULEVs)

- **Typical Mid-Sized Sedan**
  - Over-engineered to meet almost all conceivable needs for transporting people and cargo over both short and long distances
  - Weighs 20x as much as its driver
  - Can travel 300 miles without refueling
  - Is able to attain speeds well over 100mph
  - Requires more than 100ft² for parking
  - Is parked more than 90% of the time

- **Potential Ultra-Light Electric Vehicle**
  - Designed specifically for city-use to transport a few people and light cargo over short distances
    - Lower driving speeds in cities and V2V crash avoidance technology reduce crash protection requirements and enable smaller and lighter vehicles
  - Demand for urban mobility will rise
    - 25 Megacities >10M inhabitants, doubling every 15-20 years
    - Traffic jams have increased by 188% from 2007 to 2011

Source: Reinventing the Automobile (Mitchell, Borroni-Bird, Burns), Press Research, Gao Feng analysis
Implication for players in the new value chain

Collaborative Partnerships

- Collaborative partnerships may be necessary in order to bid out an expanded mobility services ecosystem
- They must align their go-to-market models with underlying customer needs to effectively capture the loyalty of customers to their brands and unique value propositions

R&D Focus

- Automakers and suppliers must heavily invest in R&D, especially in this new mobility ecosystem
- They must determine their way to play in this emerging Online-to-Offline (O2O) business or risk losing the customer relationship to aggressive online portals