The future of transport systems – Approaches in South America

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South America X Latin America – Why is important to differentiate?

South America is a geographical definition and Latin America is cultural

In vehicle production three main players:

• Mexico – Linked to the USA Market
• Brazil – Linked to Argentina to form a regional Market
• Argentina
  – Both Brazil and Argentina developed a closed market to imported vehicles. Exports are mostly limited to other countries in the region.
  – For a very long period, product life-cycle was much longer than in other markets
  – Technological development is to fulfill local demands and are difficult to export (Ethanol fuel)
Background

Kombi 1957 – 2013
• Liquid cooled engine in 2005 (new emission standards)
• Cost to develop airbags caused the demise
• Said to be biggest profit maker for VW
Energy

Mexico – Oil

Brazil – Hydropower, Oil and Gas, Biofuels
    Nuclear, Wind and Solar are still marginal

Argentina – Hydropower, Gas and Nuclear

In the region Venezuela has the largest oil reserves. However, politic and economic problems have made even the oil to be close to collapse.
Economical, political and population data

South American GDP (2017) in USD (billion) - 6541

Brazil – 3219 (aprox. 49% of the region)
Argentina – 911
Colombia – 712
Chile – 452

Population 414.7 millions of inhabitants (2018 acc. census and projections)

Brazil – 209.1 (49.4%)
Colombia – 49.8 (11.6%)
Argentina – 44.1 (10.4%)
Peru – 32.7 (7.5%)
Background

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP 2018 (USD trillions)</th>
<th>GDP 2017 (USD per capita PPP)</th>
<th>Growth 2017 (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>$3.22</td>
<td>$10.000</td>
<td>0.7%</td>
</tr>
<tr>
<td>China</td>
<td>$12.2</td>
<td>$8.830</td>
<td>6.7%</td>
</tr>
<tr>
<td>India</td>
<td>$2.60</td>
<td>$7.060</td>
<td>8.2%</td>
</tr>
<tr>
<td>Russia</td>
<td>$1.58</td>
<td>$10.743</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

- Rich in natural resources
- Politically unstable
- Economically unstable
- Different levels of development
- Poor road conditions
Background

Land transport with different challenges
City X Country side
People X Goods
Road conditions
Safety
Energy supply
Pollution
Current Situation - Brazil

Recovering from an economic disaster in 2014

Vehicle Sales

2012: 3,801,859
2013: 3,797,254 (first decrease in 10 years)
2014: 3,497,805
2015: 2,569,014 (OMG_1!!)
2016: 2,050,327 (OMG_2!!)
2017: 2,239,403 (relief ?)

Expectations: A lost decade for the automotive sector. Sales levels of 2012 are to be repeated only by 2020 (optimistic).

Local engineering and development were drastically reduced.

GM has sent 500+ ppl from its local design and engineering to Michigan.

Asian manufacturers and suppliers – Almost no local development

New policy for the sector announced in 2018 (Nov.)
Bio-Fuels

- Ethanol as a replacement to Gasoline
  - Early research 1930’s (UK, France and Brazil)
    - Main oil reserves in the USA + Mexico
    - Discovery of oil fields in Central Asia and Arabia halted research
  - Brazil 1974
    - Country mostly dependent on foreign fuel sources
    - Increase in oil prices led to re-development of ethanol as fuel
      - Sugar cane culture
      - National source of energy
      - Otto-cycle engines only (limited to cars and small pick-ups)
Bio-Fuels

- 1985 Almost 100% of passenger cars were produced with ethanol engines
  - Fully developed nationally
  - Corrosion
  - Cold start
  - Energy disadvantage (about 70% of energy per mass unit compared to gasoline)
  - Higher compression ratio
  - Added to gasoline to replace lead (up to 25% on regular gasoline sold in Brazil)
- Currency crisis and spike on sugar prices made the producers decide to produce sugar
  - Fuel shortage crisis
  - Confidence crisis
  - Ethanol as fuel almost non-existent by 1995
Bio-Fuels

- 2003 “Flex-fuel engine” launched
  - It runs on every mixture of ethanol and gasoline
  - Fuel injection adjust according using the emissions data
  - Users can which fuel they can buy
  - Energy disadvantage (about 70% of energy per mass unit compared to gasoline)

- Societal issues
  - Fuel or food?
  - Land use and deforestation
  - Sustainability
São Paulo – One of the world’s “Mega-cities” (Pop. 12,1 million)
Current fleet (Jul. 2018)
Pax. Cars – 6,1 Million
Buses – 47 thousand
Vans and light trucks – 1,1 Million
Heavy Trucks – 170 thousand
Two-wheelers (with engine) – 1,2 Million
City Transport

“First Mile-Last Mile”

First mile/last mile solutions
City Transport

“First Mile-Last Mile”

Project XD – Cooperative development Brazil and India
City Transport
City Transport
Vehicle main specifications:

- Power: 1.2kW
- Electric
- Torque: 45Nm
- Max. Range: 50km
- Max. Speed: 20km/h
City Transport

VEHICLE MEASUREMENTS

Width: 250 mm

When folded (L x W x H):
600 x 250 x 590 = 0.088 m³
City Transport

Application
• Main tool to access the vehicle
• Control panel
• Map
• Station finder
• Main interface for shared use
Goods Transport

Long distance transport
• Done by Diesel powered trucks
• Distances of more 3000km in difficult road conditions
Goods Transport - Long distance

Long distance transport

- Investment on railroads is of difficult return
- No possible way to electrify or use alternative power
- Old technology still in use
  - Euro 3 or older (current production in Brazil is Euro 6)
  - No control of emissions (most cities)
  - Subsidized fuel
- New oil reserves present a prospect of continued use of Diesel
- Contradictory policies
  - Brazilian congress proposed a total ban on IC Engines in 2060
- Closed and large enough market to be not affected to world trends in mobility