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ISO IEC ITU International Telecommunication Union

Agenda

- Networked Car for All
  - A ”TATA Nano” for Automotive Electronics?
- Aspirations of an Emerging Market Society
  - Opportunity at the Bottom of the Pyramid
- Managing paradoxes through innovation
- What are we doing at TACO Sasken AE?
- Implication and Conclusions

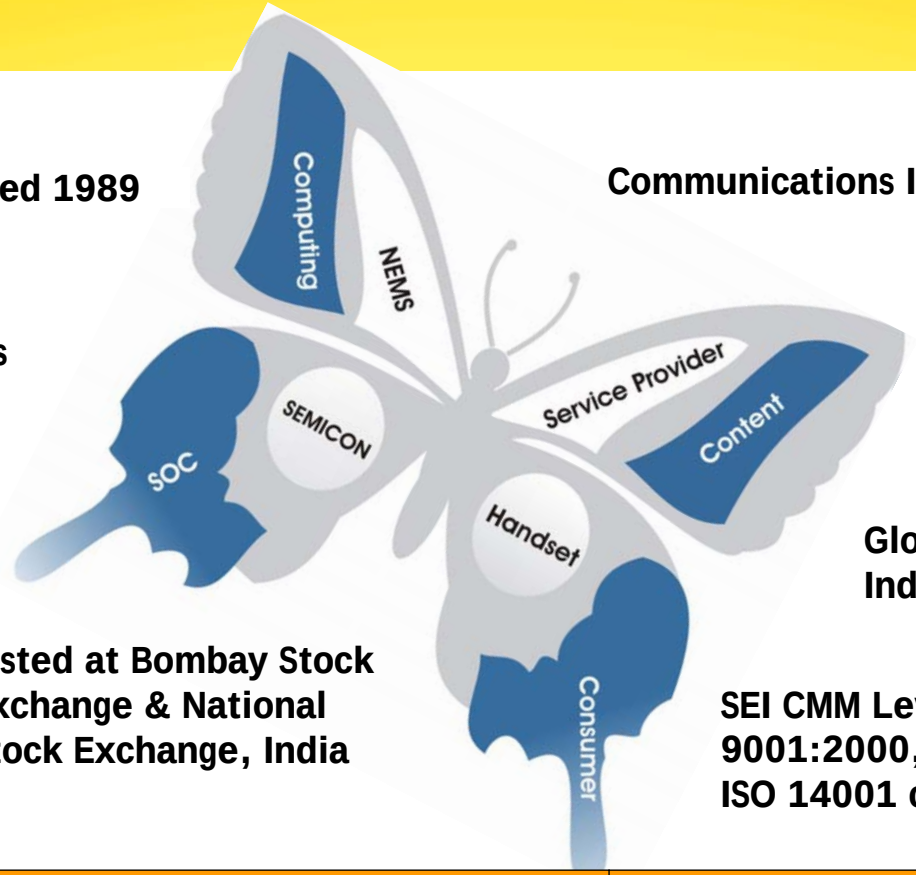
Introduction to Sasken

Established 1989

Communications Industry Focus

3000+ Employees

35+ Patents filed



FY 06-07 Revenues
- USD 106 Million

Global Development Centres - India, Finland, Mexico, China

Listed at Bombay Stock Exchange & National Stock Exchange, India

SEI CMM Level 5, TL 9000, ISO 9001:2000, ISO 27001 and ISO 14001 compliant

Sasken JVs	TACO Sasken Automotive Electronics	ConnectM
	Driver information, Telemetry and In-vehicle entertainment products	Remote asset monitoring for Industrial, Utility, Transportation and Medical sectors

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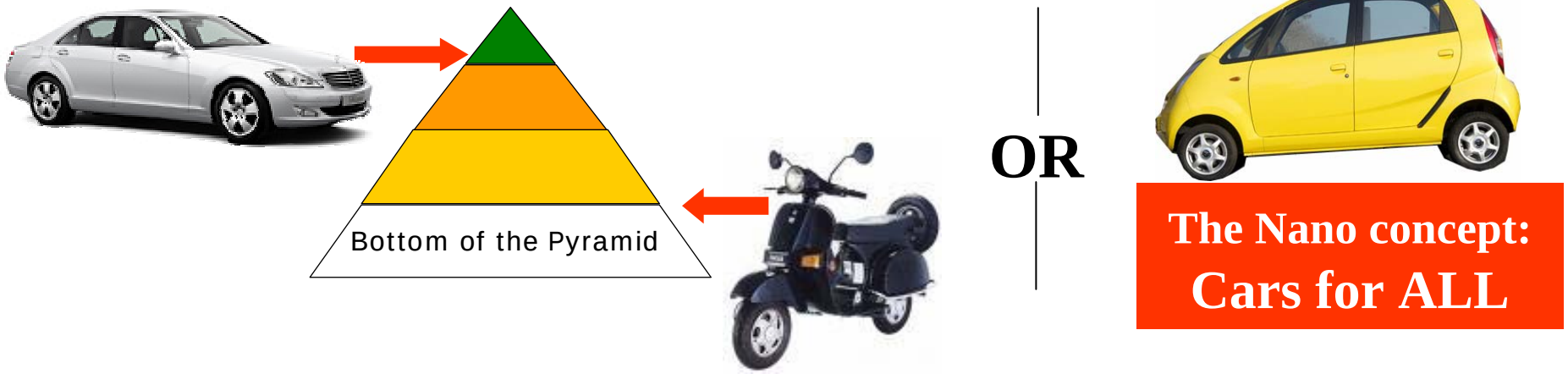
A "TATA Nano" for Automotive Electronics?



- Ratan Tata: "The biggest challenge when the project started was there was no brief, no benchmarks, and it had never been done before,''
- "At every stage, we tried to cut costs by reducing the number of parts that went into each component,''
- Nano's Vital Statistics: 624 cc, 34 bhp, rear-mounted, Four-door monocoque, Efficiency 20 kpl, Top speed 105 kmph , Gearbox Four-speed manual, Safety Survived frontal crash at 48 kmph
- By the time the car was finished, the company had filed 34 patents in all; and some more are in the pipeline.

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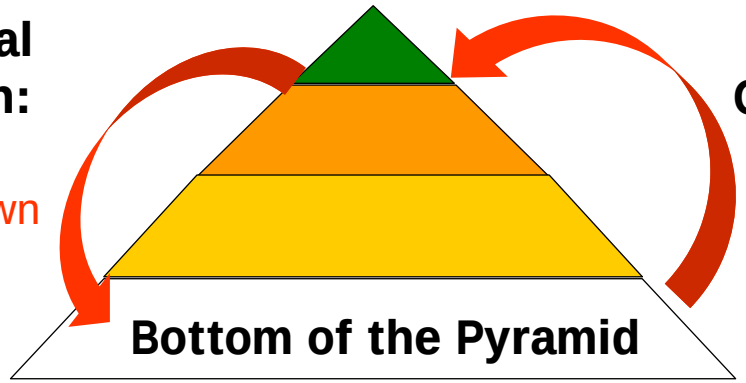
New needs at the bottom of the pyramid

Traditional Approach:

Trickle down



Emerging Opportunity:

Bubble up

Telemetry for all
Unit cost: $300 → $80
Monthly fee: $20 → $2

Two-wheeler owners do a lot of self maintenance

Migrating them to cars should not increase their maintenance costs

Is remote maintenance through telemetry a need at the bottom of the pyramid?

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Telematics and Infotainment- a comparison between markets

TRIAD Markets

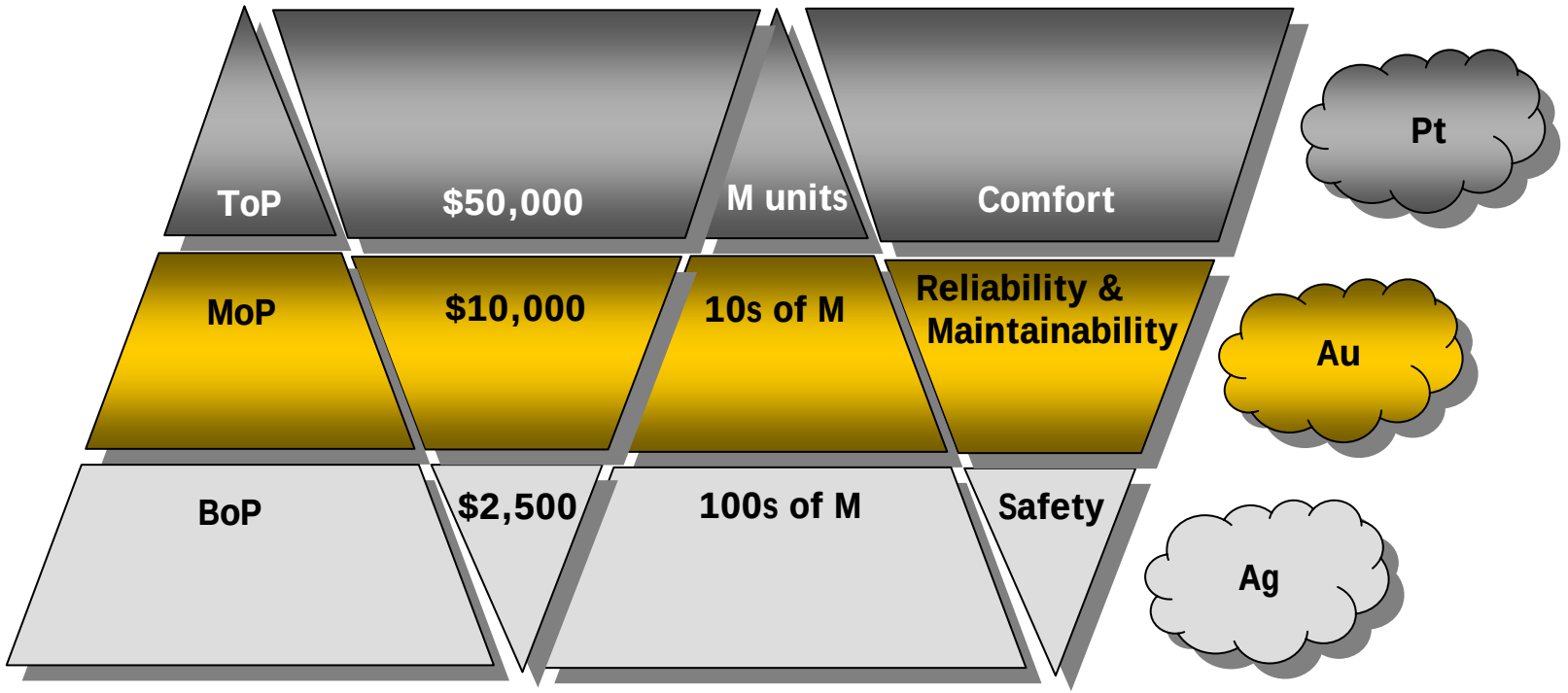
- Mercedes-Benz Teleaid, BMW Mayday, Toyota Gbook, Renault Odysline
- Services work through On-board telematics unit with GPS and GSM modem
- Entertainment through FM radio, CD/DVD MP3/WMA player, Video and Navigation, Hands-free telephony
- RDS/TMC real-time traffic information

Emerging Markets

- Non-existing telematics
- Entertainment with low cost after market fitted FM and CD, MP3 / WMA player
- Non-existing Navigation because of lack of digitization of maps and points of interest

The basic needs are the same across the pyramid

Legend = Top of Pyramid; Middle of Pyramid; Bottom of Pyramid
Source: CK Prahalad, Fortune at the Bottom of Pyramid



"Sachet" experience at the bottom – Rich experience at the top

Dimensions of Communication

Time → / Functions (Need) ↓	Real time (Synchronous)	Non real time (Asynchronous)
Individual (Car to Car or Car to Person)	Simple Call Emergency call Remote operation	Car booking Car location update Passenger pick up and drop information Downloads (maps, POI)
Collaborative (Car to many cars or Cars to central dispatch!)	Fleet call Emergency broadcast Road congestion data Stolen vehicle tracking	Telemetry Prognosis and Diagnosis File sharing

What do the Consumers want?

Safety & Security	VRM and CRM	Infotainment through FM, local media. GPRS and EDGE	Location based Services	Concierge Services
- E-Call - Breakdown call - Stolen vehicle tracking - Remote operations	- Remote diagnostics - CRM channel with brand management	- FM channel music and information - Local media CD/DVD/USB based music - Internet Radio - Personalized Music - Personalized News - Productivity applications - Personalized alerts - Personalized social networking	- Off-board navigation - Points of Interest navigation - Location based commerce enablers	- Car booking with IVR - Car booking with SMS application - Pay per use POI maps -Buy Games

Simple or Three Party Calling	SMS Peer to Peer	MMS	Video Streaming/ Download
Voice	**Text**	**Image**	**Multimedia**

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What are we doing at TACO Sasken AE?

- Low-cost Commercial Vehicle Tracking solution to address the growing price-sensitive VTS market of India
- Highly innovative Instrument Clusters for Compact & Micro-Compact Cars
- Passenger Vehicle Telematics Solution (in-vehicle hardware and service solution) for the Indian market

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Affordable electronic products needs resolution of paradoxes

The wireless channel is unpredictable	Vs.	Media experience needs predictability
Lower the BOM	Vs.	More Features
More Models per Year Reduce Time to Market	Vs.	Reduce the Research & Development Cost
Improve the User Experience	Vs.	Should Work with Constrained Systems
Design for Reuse	Vs.	Allow Customization

Re-use platforms, frameworks and solutions from high volume industries like consumer and mobile phones

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Conclusion

- The Networked Car is for All
  Different applications may be needed at different levels of the pyramid

- The Networked car experience is for All
  Deliver the experience in “Sachets” at the bottom of the pyramid and in its fullest form at the top

- Developing a scalable electronics platform to deliver solutions at both ends of the pyramid needs resolution of some design paradoxes

Thank You

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Image Courtesy

www.mercedes-benz.co.in | www.tatanano.inservices.tatamotors.com | www.scootershop.com

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Backup

Automobile and Society Trends in Emerging markets (e.g. India)

- Huge interest from OEMs in pushing for micro, small and compact cars to drive up volumes (price range of $2500 to $10,000)
- Road infrastructure improving leading to more family travel within and outside cities
- However at the same time, commute time increasing and hence people craving for better utilization of this time
- Migration of people between big cities leading to many unknown areas of the city
- Growing infrastructure and changes in landscape
- Digitization of Maps and growing database of points of interest

Mobile Communication Trends in Emerging markets (e.g. India)

- Mobile telephones penetration one of the highest (every month 5 Mn new subscribers being added in India)
- Value added services and new applications being launched on Mobile phones
- New mobile-phone-centric lifestyle getting defined
- GPRS coverage getting better
- Trends toward adopting wireless broadband
- Introduction of navigation applications on PNDs and Mobile phones
- WiFi and WiMax infrastructure on the rise

Value orientation-based market structure model

Category	No. of HH in each class in 2006 in Mn.
Hand to mouth existence = Destitute (Not buying)	17
New entrants into consumption = Aspirant (Have cycle/radio/fan)	33
Cash constrained benefit seekers = Climber (At least 1 major durable e.g. Mixer; sewing machine; TV)	78
Cost benefit optimizers = Consuming class (Bulk of the branded consumers; 70% of 2 wheelers, Refrigerators and washing machines	75
Benefit Maximizers = Rich (Have most cars, PC's)	6
Total; (Note Average HH size ~ 5.5; so Pops = 1.15 Bn.	209

Source: Rama Bijapurkar, We are like that only, Quoting NCAER 2006; HH = House holders

Value orientation-based market structure model

Affluence layers based on income							
Income classes	Annual HH income Rs. '000	% HH in each class	No. of durables per 100 HH in each income class				
			2 wheeler	Color TV	Refrigerator	Air Conditioner	Car
Deprived	<90	71.90	7	5	4	0	0
Aspirer	90-200	21.90	47	40	34	2	4
Seeker	200-500	4.80	70	74	62	13	29
Striver	500-1,000	0.91	75	69	64	28	54
Near Rich	1,000-2,000	0.29	66	89	68	32	66
Clear Rich	2,000-5,000	0.11	77	113	81	40	69
Sheer Rich	5,000 – 10,000	0.02	91	117	100	38	77

Source: Rama Bijapurkar, We are like that only, Quoting NCAER 2006; HH = House hold

Aspirations of Consumers in Emerging Markets society

- Life-style needs of an average consumer almost independent of the price of the vehicle he/she drives
- Average car owner craving for better utilization of unproductive (?) driving / commute time
- Has a strong need for information and entertainment on road which is location and context based
- But is a very strong Value conscious consumer which may not be Price Sensitive

Is there an opportunity at the Middle and Bottom of the Pyramid?

- An opportunity for providing conventional telematics services as in Triad markets for the growing volume of cars in emerging markets
- Serve diverse consumers with information and entertainment services through a Mobile channel in vehicles
- Offer unique services to Owner driven and Chauffer driven cars
- An opportunity that leverages convergence of conventional Telematics and Connectivity oriented Infotainment through on-board vehicle integrated mobile device

Why is it a challenge to do a TATA Nano?

- Today's basic telematics unit costs for the owner $300 and approx. $20 per month in the Triad markets
- Today's entertainment unit costs for the owner $1000 in the Triad markets
- Emerging market Value Conscious consumer's affordability: Sub $100 and monthly fee of $2
- Entertainment unit affordability: $100
- Market challenge is to alter the Price-Performance envelope and build an eco-system of content and service providers with sound business model
- User interface to suit service delivery of services

Technical Challenges

- **Connectivity:** GPRS or over CDMA 1xRTT supporting IP connectivity protocol (for streaming). Typical bit rates are 24-32 Kbps for GPRS and 48-64 Kbps for CDMA. In addition, the data network are built for "best effort" delivery whereas Audio/Video require a defined QoS
- The wireless channel Bandwidth and error is bursty in nature and poses some challenges to layers below: buffering before starting playback, loss of packets and error handling schemes
- Additionally, each cell can support a limited number of data channels. As priority is given for voice channel, the data channel will be dropped if the cell becomes congested

Technical Challenges

- **Media layer:** Implementation of low bit rate codecs on limited computation / Memory platform coupled with the channel characteristics presents a real challenge. Typical codec characteristics are: bit rates are 24-64 Kbps, stereo for mobile platforms. Need for a robust error handling and post processing capability (noise reduction, 3d Effects)
- Error handling and post processing techniques are generally proprietary and defines the quality of the application
- **Product Development approach:** Rapid turn-around of applications through changes in On-board device software
- **Cost:** Design of a system and choice of components and architecture to meet very aggressive target cost