Growing beyond manufacturing

Opportunities in India as an emerging auto product development hub

ACMA
Automotive Component
Manufacturers Association of India

Ernst & Young
Quality In Everything We Do

Growing beyond manufacturing

Opportunities in India as an emerging auto product development hub

Foreword

We are happy to bring to you a report on the current status and future opportunities for automotive R&D in India. Towards the overall enablement and progression of its membership, ACMA has been proactively engaging itself in knowledge assignments and this is one of many such initiatives.

Auto component players need to build and enhance their design and development capability to make a compelling value proposition for supplies to OEMs in India and in global markets. As OEMs introduce India-specific vehicles, the demand for design and development work to be carried out by auto component manufacturers in India will increase manifold. This merits and closer look at investment in R&D by auto component manufacturers.

A trend is already observed where Global OEM's and Tier 1 suppliers are expanding product development centers in India to cater to India and global needs. Indian automotive component manufacturers today report spending less than 1% of their turnover on R&D vs. global automotive manufacturers' average of 5%–8%. The internal R&D spend is further accentuated by an ecosystem support of government, OEMs, academia and institutional support. The ecosystem support in India is still in its infancy compared to some of the other automotive countries such as Germany, South Korea and now China.

ACMA is pleased to take a significant step in highlighting the importance of this future critical investment for automotive component manufacturers in India. This study aims to capitalize on the up-and-coming scale and market opportunity in India – from product development, process engineering, prototype testing and validation. To support India's emergence as a global product development hub, it is essential that Indian component manufacturers build progressive R&D capabilities and that a supportive ecosystem evolve for capacity and capability enablement.

This study has aimed to illustrate the progress and trends in design capability and product development, and the way forward for the automotive component manufacturers in India to move up the value chain through excellence in research and product development. Key areas which have been covered are:

- Current product development trends and likely future changes
- Triggers that lead to investment in R&D
- Approaches adopted by suppliers

Foreword

- Benefits to be realized
- Maturity of Indian ecosystem – Government support, OEM pull and institutional capacity and capability
- Roadmap for overall enablement of India's emergence as a development hub

We would like to place on record our appreciation for M/ s Ernst & Young for conducting this in-depth study. We are also grateful to our past presidents, ACMA member companies, OEMs, IPOs, SIAM and officials of the Government of India who have shared a wealth of their knowledge for this study.

We are hopeful that this study document will be useful to provide the basis for future reference, dialogue and policy formulation for the auto components sector.

With best wishes,

Dated: September 5th, 2012

Arvind Kapur
President, ACMA

Ashok K Taneja
Chairman, ACMA Committee for Economic Affairs, WTO & Knowledge Partner

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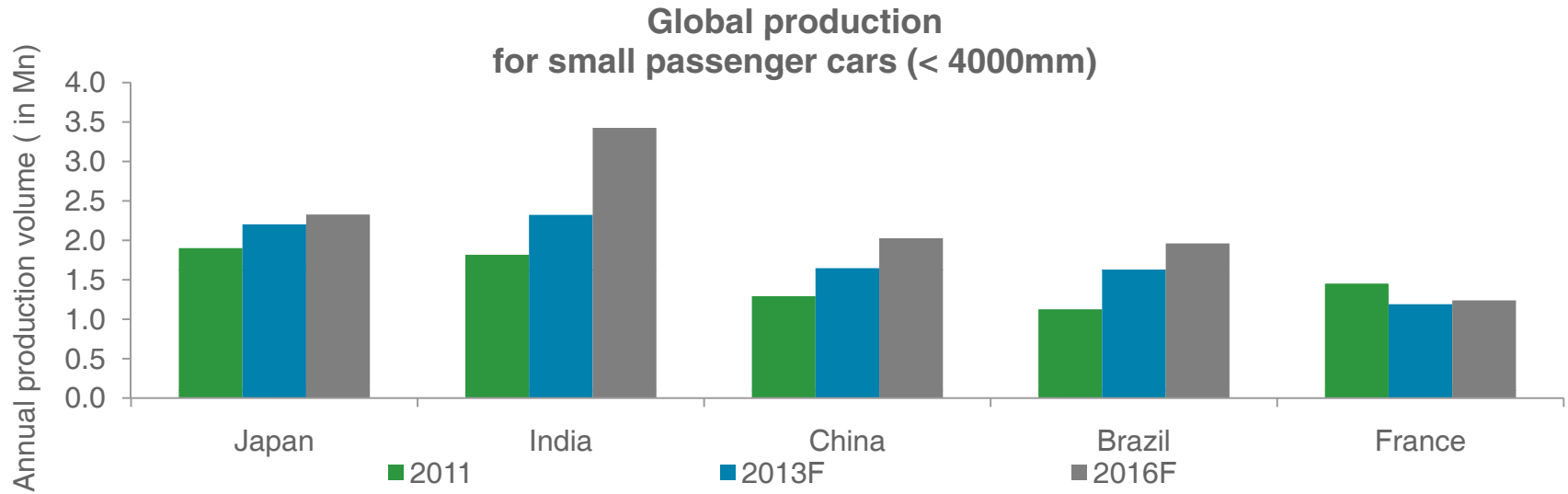
1. Expanding opportunity

The Indian automotive industry’s developing scale

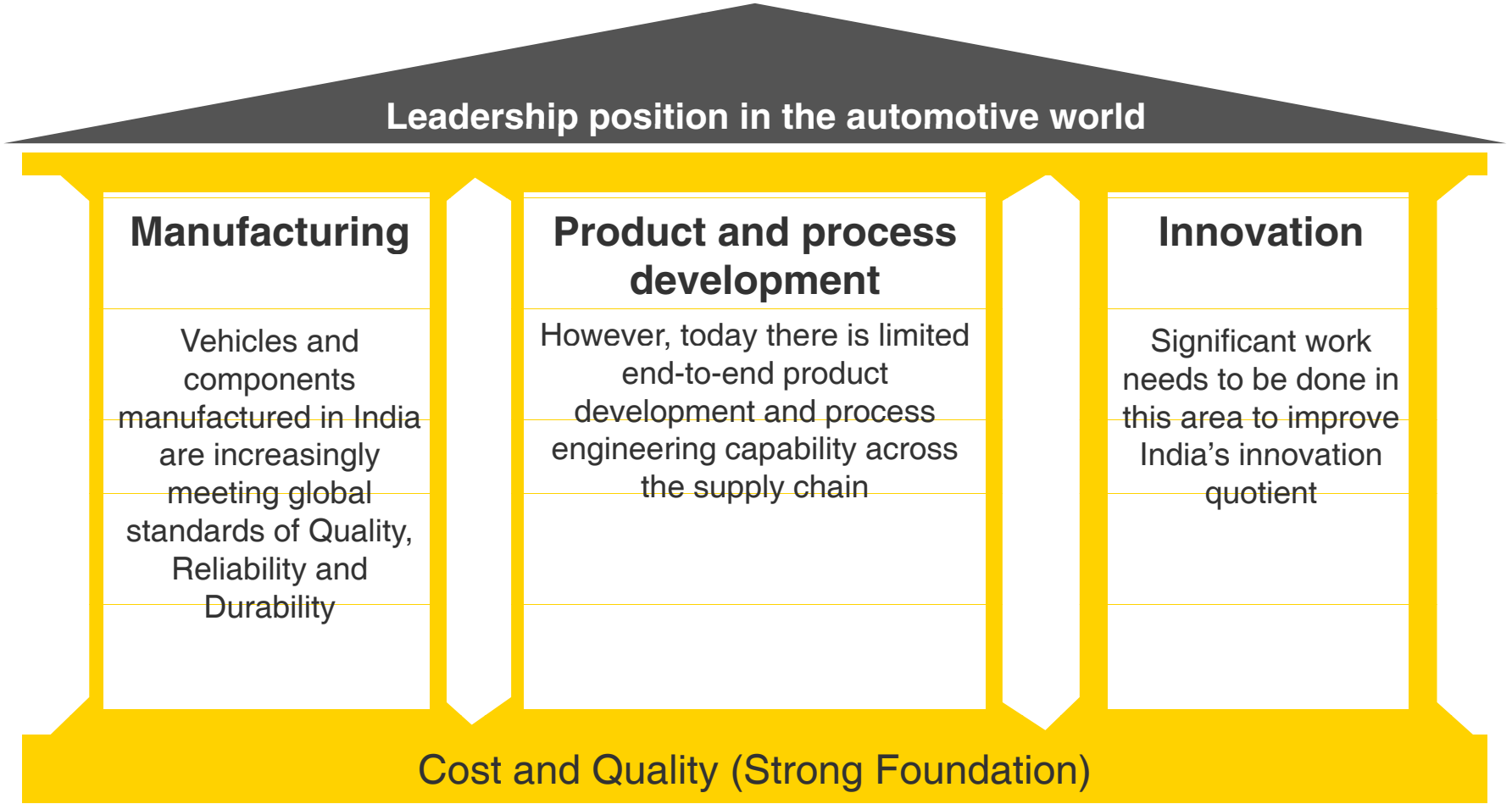
India is fast emerging as the one of the largest global manufacturing hubs for small cars and other vehicles



Source: LMC vehicle production and forecast database, IHS

- India is primarily a small car market, with more than 60% PV sales in India comprising of small cars. The PV production are expected to reach approximately 5 Mn by 2015 and 10 Mn by 2020, from current levels of c.3 Mn
- India is likely to emerge as the largest producer of small cars by 2013
- India has become the production base of small cars for most of the global OEMs like Hyundai (Santro, Eon and i10), Nissan (Micra/ March, PIXO), Ford (Figo) and Suzuki (A-Star/ Alto).
- OEMs have shifted production of some of their small car models to India (Nissan stopped its Micra production in UK, and shifted it to India. Hyundai shifted production of Santro to India from Korea)
- Further, India's production of small commercial vehicles (<3.5 T) has grown at >25% in the past five years; faster than the global average

To achieve global industry leadership, India needs to evolve as an integrated development & manufacturing hub

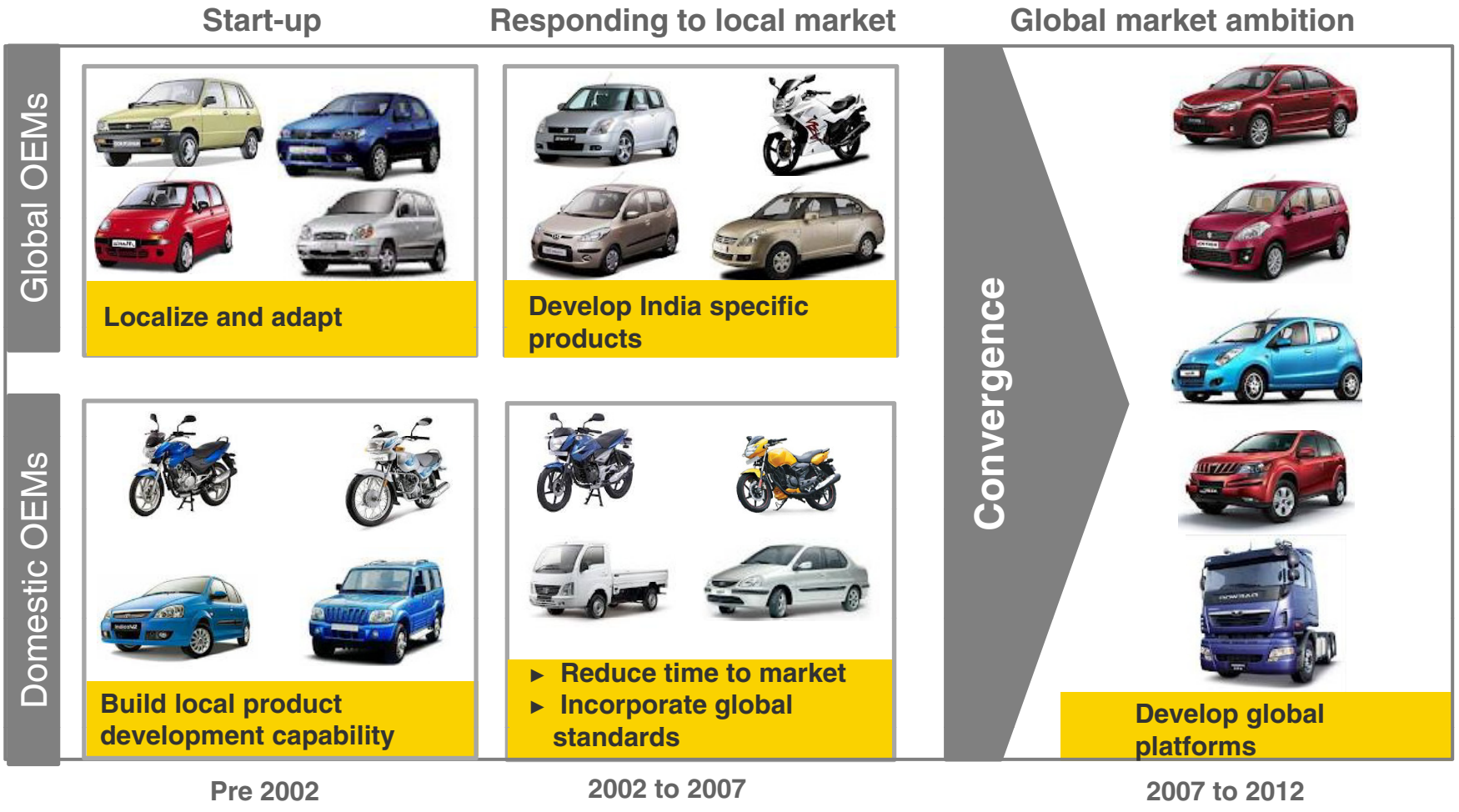


Source: EY Analysis

2. Leap ahead

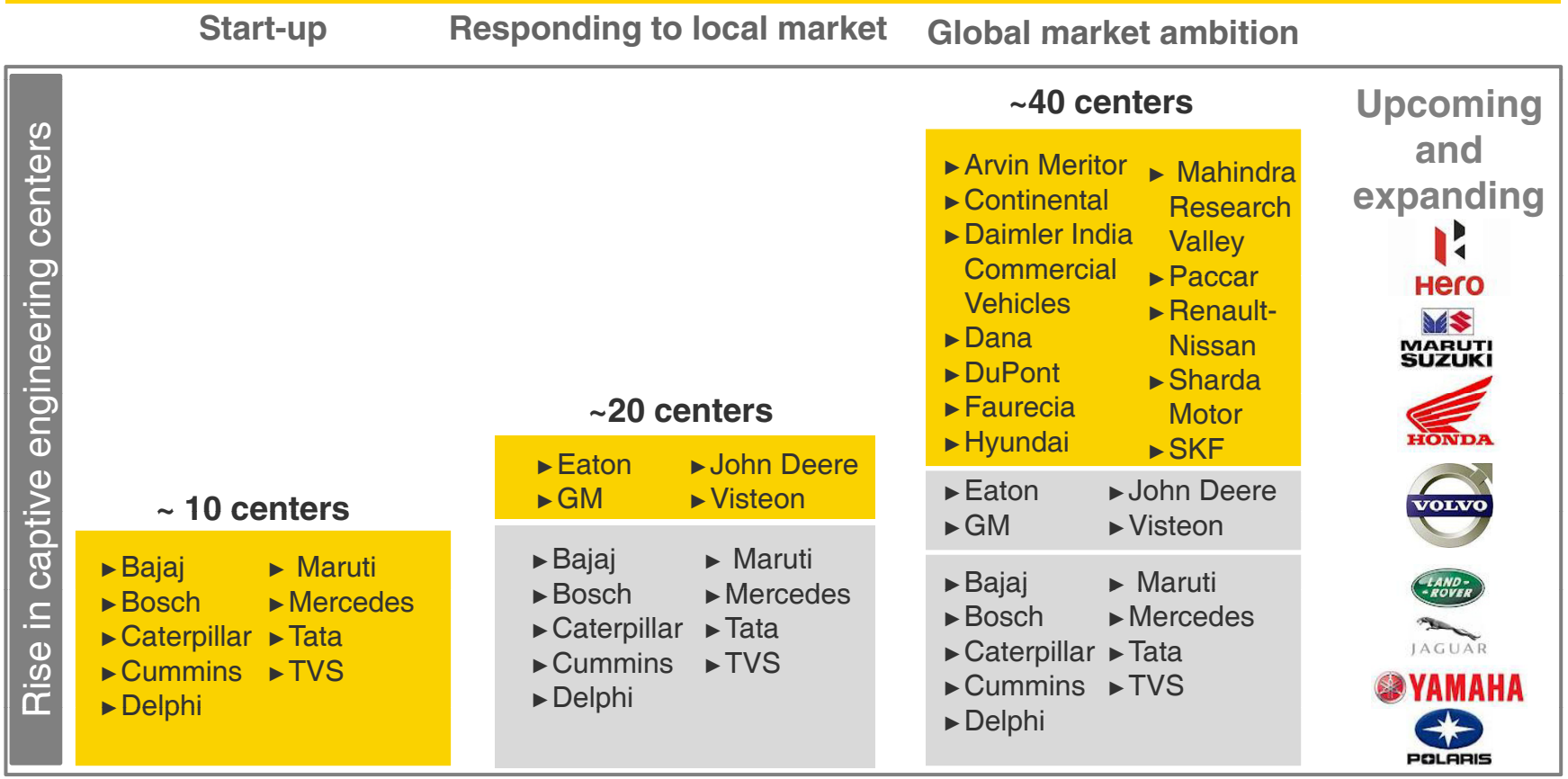
Progress made by India in product development

Rising customer expectations and increasing volumes have driven OEMs to evolve from localization to global platform development



Source: EY Analysis

OEMs and component manufacturers are responding to the opportunity by investing in local product development capabilities



The number of engineers employed in automotive product development centers in India is estimated to have grown from <1,000 in 2002 to >25,000 in 2012

Source: EY Analysis

To develop technology capability, OEMs and suppliers have adopted a mix of approaches

Illustrative List

Methods adopted by key automotive players for acquiring technology capability

	OEMs	Suppliers
Technical tie-up	Ashok Leyland, WABCO, Bajaj, Kawasaki, KTM	IPRings Ltd., NPR, AMTEK, SUMITOMO
Joint Venture	Ashok Leyland, Nissan, Eicher, Volvo, Ashok Leyland Nissan, Tata Cummins, Navistar, Tata Marcopolo	Sona Koyo, Lucas TVS, Rane TRW, Delphi-TVS Diesel Systems Limited, RICO Continental, Kosei Minda
Acquisition	Mahindra SsangYong, Tata Jaguar Land Rover, Mahindra Reva	Varroc Visteon, sedis India
Support from parent company	GM, Hyundai, Maruti Suzuki, Volvo, Honda, Nissan	Bosch, Cummins
Tie-up with education/ research institutions	Mahindra	Bosch, Sona, Cummins
On its own	Bajaj, TVS, Tata, Mahindra	Sona, Varroc

Though majority of players have acquired technology know-how through foreign partnership and support, there are few who have developed the capability on their own or through ecosystem support

Source: Secondary Research, EY Analysis

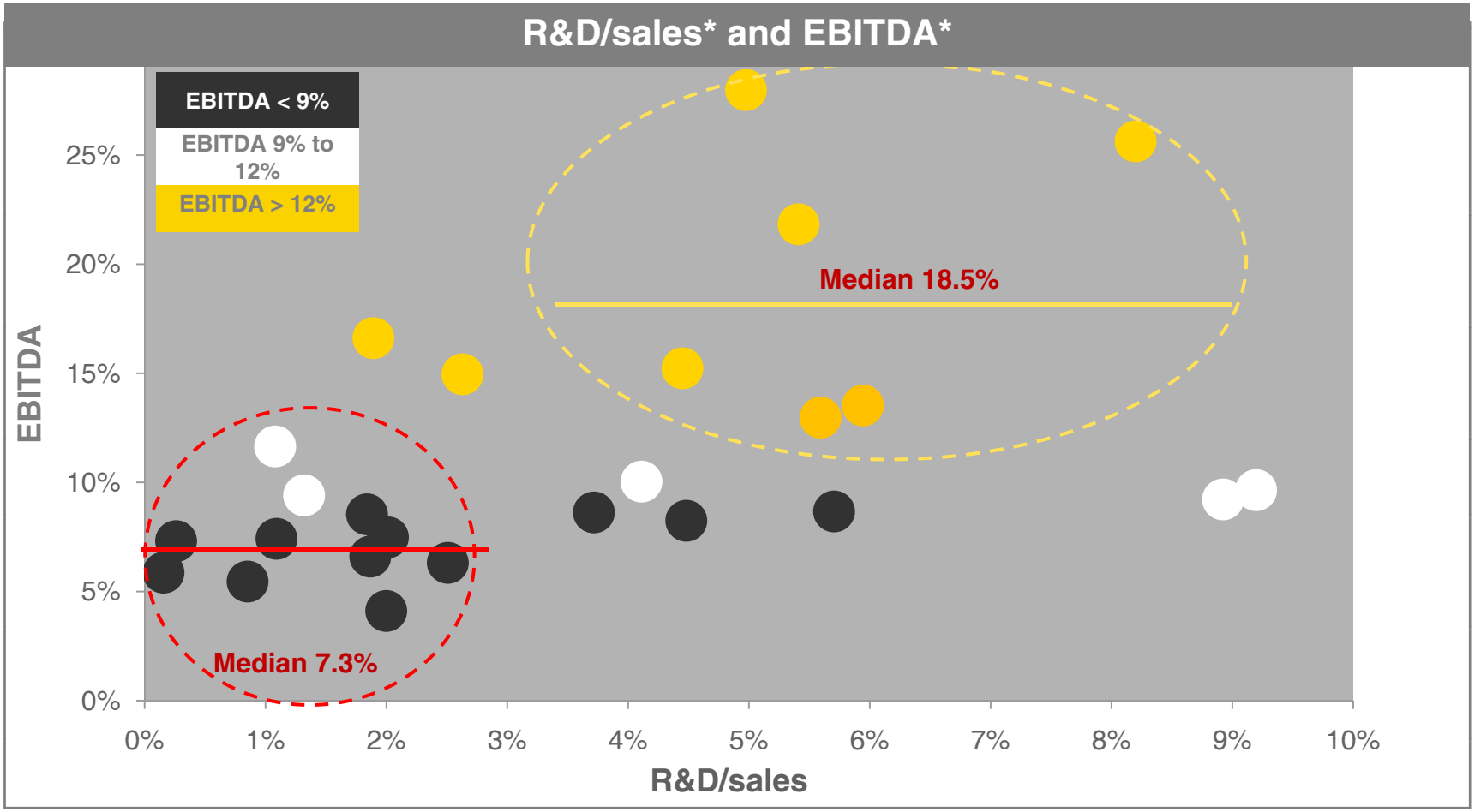
Organizations, who have invested into R&D in India, are taking up greater product development roles for local and global markets

Illustrative List

	OEMs		Suppliers	
Developed **End-to-End** product and process design capabilities	MARUTI SUZUKI Development of Eeco, New Alto	BAJAJ Development of Pulsar, Discover	SHRIRAM Engine components	Subros Low cost condensers
Development of **Global Platforms in India**	Mahindra XUV5OO	TATA Ace, Nano	DELPHI Development for global markets	BOSCH Ownership of global market products
Developed **Global Centers of Excellence** in **India**	HYUNDAI Global centre of excellence for virtual testing and analysis	GM Development of 3 cylinder diesel engine	Cummins One of the global product development hubs	EATON Global Centre of Excellence for gear pumps

Source: Primary Research, Secondary Research, EY Analysis

Our analysis of global suppliers shows that companies who are investing a higher percentage of sales in R&D, are achieving approximately 2.5 times higher returns



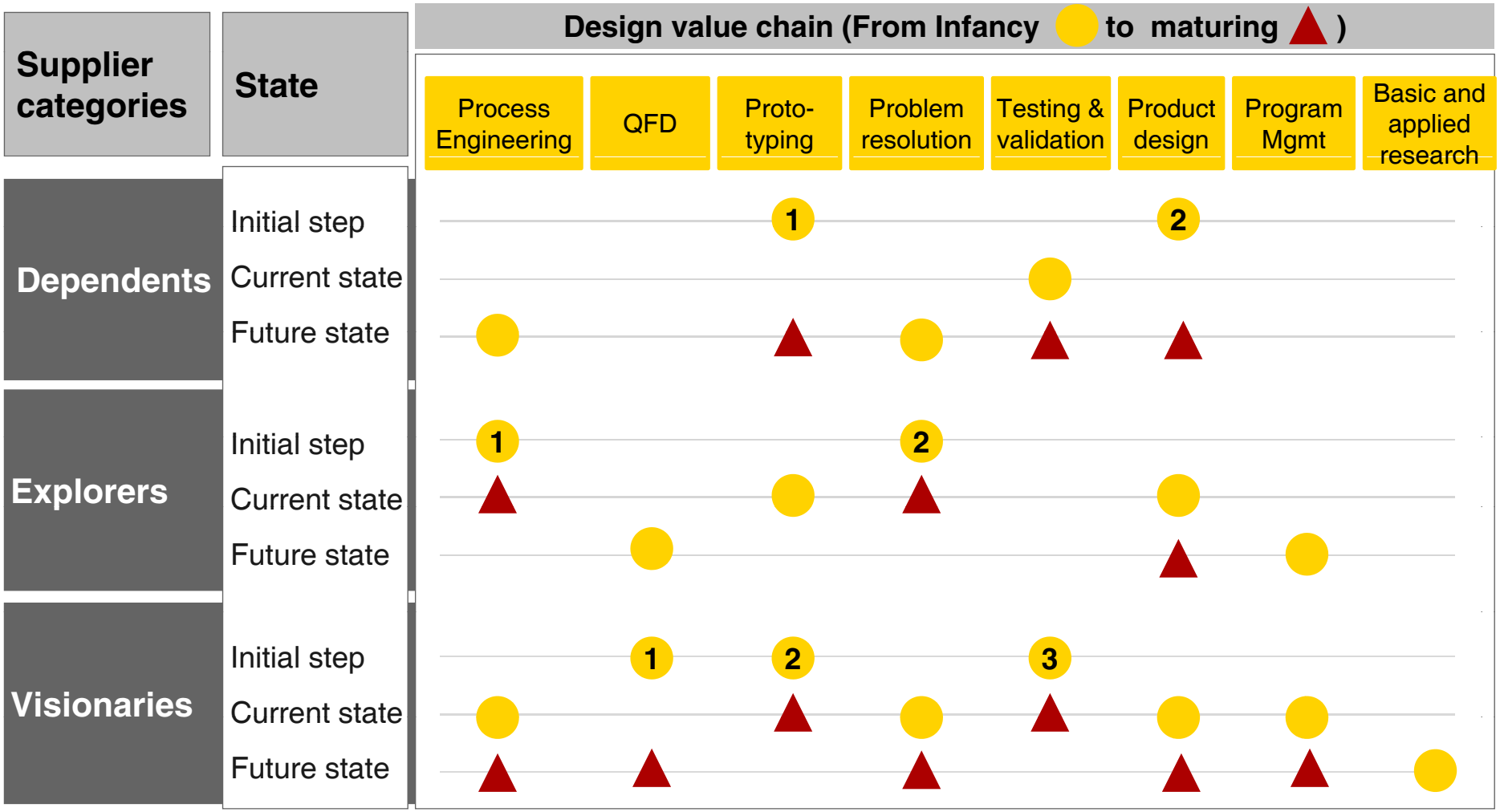
* R&D/Sales and EBITDA numbers are averaged over duration of 4 years (2008-2011)

Source: Primary Research, EY Analysis

3. Leading from the front

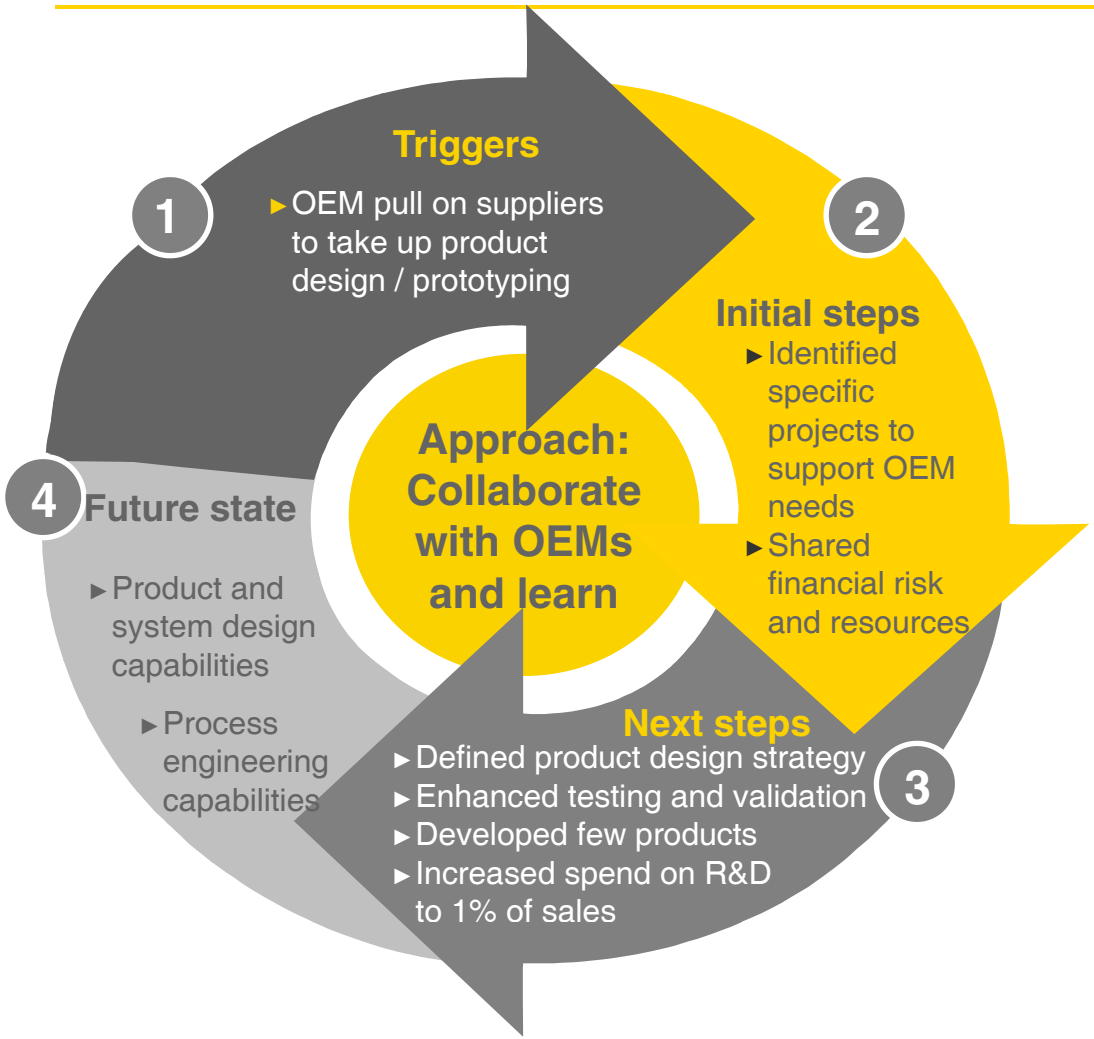
Case studies on growth through research

Analysis of Indian suppliers during our research reveals three paths adopted in developing capabilities across the design value chain

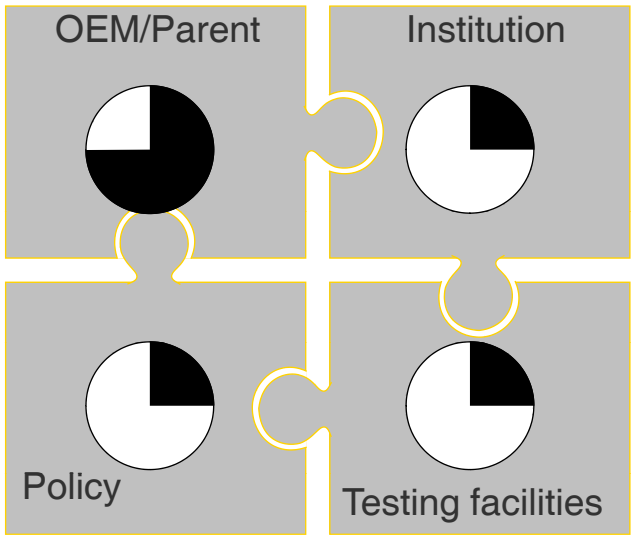


Source: EY Analysis

Dependents: Followed OEM pull towards better engineering capabilities to support faster product development cycles



Ecosystem enablers:



◔ LOW ◑ MEDIUM ◕ HIGH

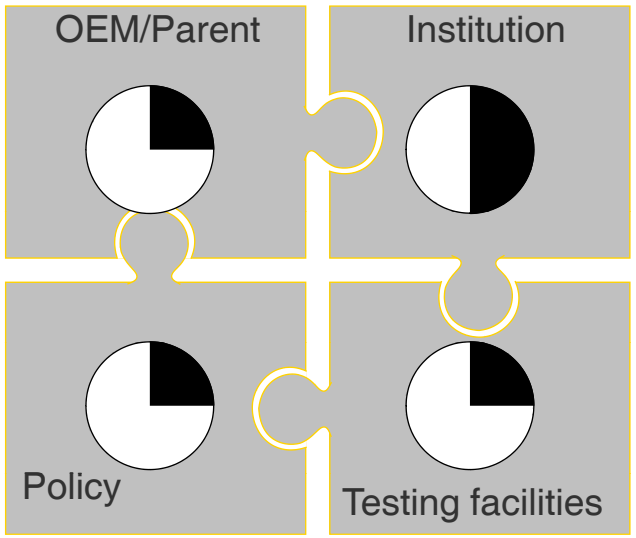
Investment

- Initially shared resources as "Collaborative learning" approach
- Increased after initial success

Source: Primary Research, EY Analysis

Explorers: Setup design cell to resolve design problems, understand product & process development

Ecosystem enablers:

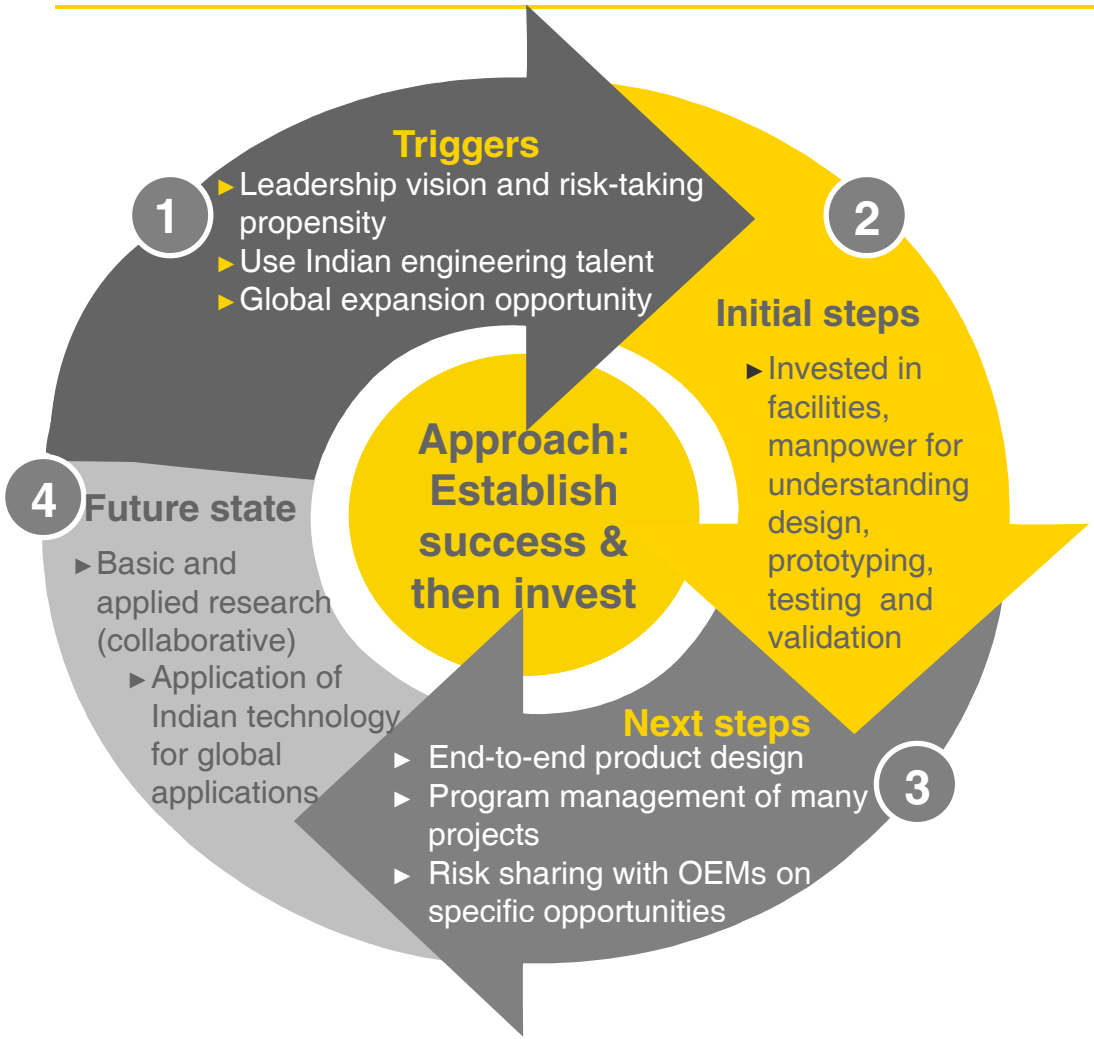


Investment

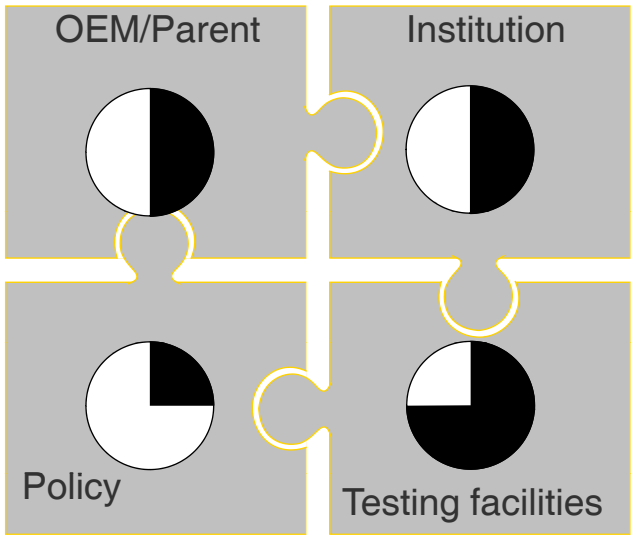
- Initially low investment as "Explore and watch" approach
- Increased after initial success

Source: Primary Research, EY Analysis

Visionary Technocrats:
Envisioned an integrated design and manufacturing capability



Ecosystem enablers:



Investment

- Planned investment in facilities and manpower development
- Advanced testing, research labs

Source: Primary Research, EY Analysis

3.1 Leading from the front

OEM case studies

Bajaj Auto –
Passion for innovation

Background

- Founded in 1961, Bajaj Auto is currently ranked as the world's third largest motorcycle manufacture & the largest three wheeler manufacturer. Company has three plants located at Waluj, Chakan and Pantnagar
- In the beginning, company was dependent on its foreign partners for new products and technology, engineering teams in India were limited to localization and basic development work
- Company was dependent heavily on scooter market and with its decline was forced to enter motorcycle segment on its own

R&D Steps

- Began with a core group of 10-15 young motorcycle enthusiast to develop its first in-house motorcycle Pulsar
- Creating IP has always been a critical goal for Bajaj as a means of creating differentiation
- Over the years Bajaj has created an eco-system in the company which has the capability to develop full end-to-end product in-house
- Company believes that following factors are very important for successful R&D function
  - Clear Brand & Product Strategy
  - People who are passionate about motorcycles
  - Right tools (CAD, CAE etc.), testing infrastructure and other hygiene factors
- Company believes in developing products on its own, suppliers are roped in for development only in cases of proprietary technology components

Key achievements

- Company developed Pulsar totally on its own, Pulsar is one of the most successful motorcycles in Indian market
- Since then a number of products under the brands; Pulsar, Discover & Boxer have ben developed and launched in India and Bajaj's export markets
- Bajaj has been at the fore-front of the technology development & adoption for its products, DTS-i technology being an important example

"After decline in its main business of scooters, company decided to develop motorcycles on its own and develop in-house capabilities. We have never looked back since."

Source: Primary Research, Secondary Research

Bharat Benz –
Investment commitment and supplier collaboration

Background

- Bharat Benz is an exclusive brand to represent the entire Daimler India commercial vehicles (DICV) portfolio of trucks from 6 to 49 tonnes, a 100% subsidiary of Daimler AG. Trucks will be build on platforms such as Mercedes-Benz Axor & Fuso Canter
- Bharat Benz realized that quality and reliability are two extremely important factors for the end-customer, with a low total cost of ownership is deciding factor in majority of cases. To fulfill these criteria's company decided to develop and built products in India, for India

R&D Steps

- Bharat Benz set target to achieve >80% of localization content with focus on high quality and reliability for its products, to meet price and low cost-of-ownership expectations
- Set up R&D infrastructure for testing, supplier development and competitor product comparisons
- The company established a state of the art vehicle test track near its manufacturing facility at Chennai in 2009, that enabled testing of the products for meeting India specific requirements
- In order to deploy knowledge of the local market for product development, Company hired experience professionals with greater than 5 years experience in commercial vehicles industry

Key achievements

- Currently, around 60% of components by value are sourced from suppliers located within 50 Kms radius
- Company has built a strong team of 500+ R&D personnel
- INR 44,000 Cr. spent on building manufacturing, integrated R&D and test facility

The product range in light duty segment (based on Fuso canter platform) and heavy duty segment (based on Mercedes Benz truck platform) were tailored for the Indian markets by the Indian engineers, to meet the cost and quality requirements.

Source: Secondary Research

Mahindra & Mahindra –
Vision of being a world-class organization

Background

- Mahindra & Mahindra Limited (M&M) is a major automobile manufacturer of utility vehicles, passenger cars, pickups, commercial vehicles, tractors and two wheelers
- The Triggers for product development initiatives at M&M were
  - A vision to develop indigenously developed products
  - Global expansion opportunity arising because of innovative product launches

R&D Steps

- Company has invested 1.8 – 3.3% of sales in R&D to develop design capabilities . The investment was focused towards development of facilities
- The company also invested in recruitment and training of manpower for understanding design, prototyping, testing and end-to-end product development
- Scorpio was the first major passenger vehicle to be developed by Mahindra. The success of Scorpio was further strengthened by subsequent product development of Xylo and XUV 500
- Company recently opened a state-of-art R&D facility near Chennai, India named Mahindra Research Valley
- The R&D facility focuses on new product development as well as new technology development

Key achievements

- Company recently launched its first all-Indian global SUV "Mahindra XUV 500 developed end-to-end in India
- Company applied for 31 patents on this new SUV alone as a result of new R&D work done
- Company did extensive testing of the product, driving it some 2.35 million km over two years using 250 prototype in places such as New Zealand, South Korea, Austria, Dubai, Sweden, China, South Africa, US, and India

"With progression of time, Mahindra and Mahindra has been increasing part of product development done in India, for example earlier styling work for Mahindra vehicles was outsourced to global players, but for recently launched XUV 500, company did full design in-house"

Source: Primary Research, Secondary Research

Maruti Suzuki India Limited –
Focused investment in people and facilities

Background

- The Indian automotive sector was becoming more competitive in the late 1990‘s with the entry of Indian as well as established global OEMs‘
- The leadership position of Maruti Udyog Limited (MUL) was threatened and it became pertinent for the organization to introduce new models
- Until that point, R&D activities at MUL were limited to vendor development, localization, testing and validation

R&D Steps

- Maruti felt that unless local engineers are involved in conceiving products, it will not be able to offer the best in India
- Recruitment of engineers was done specifically for R&D in late 1990’s and R&D team size increased by c.100 engineers every year during the period from 2002 to 2012
- Maruti Suzuki in India and Suzuki Motor Corporation collaborated to provide on-the -job training of R&D engineers in Japan
- The company setup a design styling studio in 2000 and the first home-grown project was the Zen minor change in 2002
- Performance testing facilities were also enhanced to include advanced chassis-dynamometers, simulation testing etc

Key achievements

- The major contribution of Indian engineers began with the Swift, which was a revolutionary product in terms of its performance and styling
- Eeco and New Alto have been majorly designed, tested and validated in India
- Various minor change projects have been conceived and implemented in India
- Maruti Suzuki has plans to further expand its R&D facilities with a 700 acre R&D centre in Rohtak
  - The facility is to be the R&D hub for MSIL
  - A test course for high-speed and acceleration tests will be provided at the facility, which could undertake full vehicle design and development
  - It would also house a collision test area, emission labs and wind tunnel testing facility

Source: Primary Research, Secondary Research

Tata Motors Limited –
Vision of developing global vehicle platforms

Background

- Tata motors has been on a continuous journey of Product Development
- The first product introduced in passenger car segment was Tata Indica
- In the early 2000's. the customer expectations on Quality, Reliability and Durability were rising as more global brands were entering
- Tata Motors felt that a total shift in product development is required as international trends on technology and quality were different

R&D Steps

- The vision from 2000 to 2005 was to introduce innovative products
- The vision was also to raise the quality, reliability, durability standards to global levels
- Post 2005, the vision was to take Tata Motors to the next level and launch a whole new product portfolio
- This also involved introduction of new technology
- The aim was to do majority of development in house, while involving suppliers and design houses

Key achievements

- Innovative products such as Ace, Magic, Nano have been introduced
- Major facelifts such as Vista and Manza have been implemented
- Global truck platform: Prima has been introduced
- Super Ace and Venture have been developed for the global markets
- ZIP and IRIS has been introduced to address the last mile distribution as well as growing passenger needs for the rural and semi urban areas.
- New Global Light and Medium Commercial Vehicle platform is ready for launch.
- Low Floor City Transport Bus with advanced features launched
- Advanced Technology products CNG Series and Parallel Hybrid buses launched.
- ACE and VISTA EV has been launched in International market.

Source: Primary Research, Secondary Research

3.2 Leading from the front

Supplier case studies

One of the leading auto component manufacturers – Create a R&D vision and strive to achieve it

Background

- The company is a Western India based Indian multinational having end-to-end capability and manufacturing footprint across India, Germany, Sweden, US & China
- The company manufactures a wide range of highly engineered critical & safety components for several sectors including Automobile, Oil & Gas, Rail & Marine, Energy (across renewable & non renewable sources), Construction & Mining and general engineering
- Company management realized that to move from transactional relationship with OEMs to high-value added collaborative relationship, it needs to develop internal R&D capability

R&D Steps

- Earlier company used to "build to print", but later on it realized that factors such as quality, cost and delivery itself are not good enough for it to sustain profitably in long term
- As early as 1990s company started using state of the art technology CAD / CAM / CAE and virtual manufacturing (3D metal flow simulation), testing and validation for providing added value to its customers.

Key achievements

- Company has about 100 R&D and design engineers out of which 40-50 are involved in die designing, 15 each for CAD&CAM, 5-10 for 3D metal flow simulation, 5 each for CAE & fatigue testing.
- Company has collaboration with educational institutes such as BITS Pilani (2004), Warwick University UK (early 2006) and IIT B (2009) for on-site training and higher education.
- Collaborative research with other educational & research institutes is resulting into patents as well as technical papers into various SAE (Society of Automobile Engineers) conferences.
- Company's products are technologically superior to those of its competitors resulting into supplier by choice status. E.g. They have 15-25% higher fatigue strength, 6-10 % Light weight in design.

"R&D efforts at our company were not a result of customer demand but result of company's internal quest for better products for its customers and vision to be leader in industry"

Source: Primary Research, Secondary Research

Bosch –
Develop capability for full product development

BOSCH
Invented for life

Background

- Bosch started its India operations in 1953 and has grown over the years to include 13 manufacturing sites and seven development and application centers. These sites and centers provides technology and services in the areas of automotive and industrial technology, consumer goods and building technology
- Triggers which lead to building of local R&D capability are
  - The existing products in global markets are over design and expensive for India
  - Indian customers need products that are repairable and reusable
  - Value for money is a major factor in influencing decisions for Indian customers

R&D Steps

- From the very start, company viewed India as a potential end-to-end product development center, rather than a source for cheap engineering talent hub
- Accordingly instead of having partial developmental work taking place in India, company build teams with full end-to-end product development capabilities
- Bosch India R&D team has grew from a small base of 30-35 to almost 400 R&D engineers currently
- **Enabler:** Company emphasizes a lot on building robust industry – institute relationship, it has build working models with elite institutes such as IIT Chennai and IISC Bangalore for development work as well as getting its people masters as well as doctorate level of knowledge

Key achievements

- Over the time BOSCH India has developed as a R&D hub for certain product categories (inline pump, distributor pump, single cylinder pump, fuel injector, etc.), for which it acts as a global development center. BOSCH India carries out the entire product development activity of these product categories in India
- Small pump for common rail injection system
- Solution support for mechanical BS-III engine

Source: Secondary Research

Cummins –
Started with basic engineering service work and built on it

Background

- Cummins started its India operations in 1962 as a joint venture. Today eight legal entities span over 200 locations and are involved in design, manufacturing, distribution and service of engines, generators and related technologies
- Some of the main reasons sited by company for the emergence of India as one of its primary global R&D hubs
  - Availability of entire manufacturing infrastructure
  - Priority and focus provided by Indian R&D center
  - Closeness to the customer
  - Availability of cheap engineering resources

R&D Status

- Company started with basic developmental activities in India, taking advantage of cheap engineering resources available. With time the work performed moved up the value chain
- To nurture Indian talent and promote diversity, company has tie-ups with educational institutes such as VIT, College of engineering Pune, and has also established a Cummins College of Engineering for Women (CCEW)

Key achievements

- Cummins India R&D is one of the major global developmental hubs for the global R&D function in Cummins
- For "low horsepower" Power Generation products India is the center of excellence. All such products are now developed in India, whether they are sold in India or not.
- CRTI works as a major research and technology service provider for R&D projects of the company across the globe
- Cummins India indigenously developed a mechanical solution for meeting BS-III emission norms, when everyone else was going for more expensive common rail solution to meet BS3 norms

"Even though started with a aim of taking benefit of low cost engineering resources, Cummins India R&D functions has evolved as a major global R&D hub for the company"

Source: Primary Research, Secondary Research

Gabriel India –
Start with product engineering centre and build on it

Background

- Gabriel India started its operations in 1962 from Mulund Mumbai, and currently has 6 facilities in the country. Gabriel has tie ups with KYB Corporation, Japan, KYBSE, Spain and Yamaha Motor Hydraulic Systems, Japan for development of shock absorbers for passenger cars, commercial vehicle and two-wheeler segments

R&D Steps

- Started in 1960's, for the first two to three decades company did not have in-house development, and later on when it started with advent of leading Japanese OEMs it was a very small group focusing on technology function rather than development
- Slowly company started testing and validation and data thus collected served as input to R&D function later on
- Leading Japanese OEMs asked company to have technology tie-ups with Japanese companies

Key achievements

- Starting with product engineering center, company also developed their own production machines and now considers this as a core strength for the company
- Company emphasizes a lot on management of knowledge coming from Product development, and machine tool development
- Company also has several programs for knowledge management and improving innovation focus, such as orbit shifting innovation, top-down program, skilling workshops
- Over the last 6-7 years company has got 10 patents and expects about 50 more in next few years

"Company believes that having a comprehensive technology bouquet of product, process and equipment development is the key for having an edge over competition."

Source: Primary Research, Secondary Research

Lucas-TVS –
Utilize OEM support to internally develop R&D capabilities

Background

- Lucas - TVS was established in 1961 to manufacture Automotive Electrical Systems. Lucas-TVS is leading supplier of Auto Electricals in India with 50 years experience in design and manufacturing.
- Initially, the company was asked by a leading OEM to supply alternators and starter motors. At that time the company had limited understanding of passenger vehicle market
- With moral support from OEM client and experience of supplying alternators to large vehicles, company decided to develop the required capability in-house

R&D Steps

- Company started R&D activities in 1973, with focus on engineering to develop local sources and modify the designs; the R&D center has been recognized by DST
- **Trigger**: Supported by OEMs, and a desire to overcome constraints posed by licensed technology company decided to internally developed R&D capability
- Investment:- Over the years company has maintained above industry R&D to sales ratio of 1.5-1.7%
- People:- Around 270 people in main engineering team and 40 in advanced engineering function currently
- Testing infrastructure:- company has invested in reliability testing, environment testing etc
- Labs: The company had built a separate prototype lab so as to test and improve its products significantly early
- Concurrent engineering:- Product development, Manufacturing process development and Tool design happen at the same time so as to save time and cost, and improve efficiency, of overall innovation process

Key achievements

- Based on requirements /specification company received from Maruti-Suzuki, company came up with a design, and build a prototype of the product
- To perform validation and testing on its initial products when it did not have required infrastructure, it bought a Maruti-800, fitted it with company's product and drove it around with all measurement instruments attached to do the testing
- Boosted by its success in developing alternator and starter motors for OEM client management got convinced that company can develop and deliver products for the market

Source: Primary Research, Secondary Research

NRB Bearings Limited –
Futuristic frame of mind is critical to progression

Background

- NRB Bearings was founded in 1965 as a joint venture with French company Nadella. Currently company produce wide range of products in categories such as needle roller bearing, needle bushes and cages, Cylindrical roller and bearing, Ball bearing, Taper roller bearing, and Spherical roller bearings
- Company always had a vision of doing fresh R&D rather than replicating or reverse engineering older technologies/ products
- One of the major trigger that pushed company to involve in R&D was threat of better products and new technologies from global players

R&D Steps

- Company launched design center in 1997 with an initial investment of ~ INR 20 Cr
- A host of fresher's from leading technical institutes all over India were brought on board with fresh reference and open point of view to develop new products and technologies
- The engineering center focuses on Product research, Process design, product benchmarking, Product sample development, and Product testing and validation

Key achievements

- NRB took steps towards in-house development even though technology through collaborator existed and enabled their earnings to grow steadily at a CAGR of 20% ever since
- Dual-clutch project for Ford-Getrag where 80% of the bearings were solely supplied by NRB purely because of NRB's ability to develop and bring-in efficiencies
- A host of domestic and international clients were brought in as a result of in-house development backed by continuous research and innovation

"Companies should learn to play to their strengths and trust their employees and tier-II suppliers to provide efficiencies and innovation from within the system. Effort should be towards learning and developing greater competence."

Source: Primary Research, Secondary Research

Rane –
Invested in testing and validation

Background

- Rane group started in 1929, and currently has 7 units producing Manual steering and suspension system, Hydraulic power steering system, Valve train components, Friction material products, Steering columns & Electric power steering, Seat belt system and Die casting products to customers in segments such as Passenger Cars, Multi Utility Vehicles, Light Commercial Vehicles, Medium & Heavy Commercial Vehicles, Farm Tractors, Three-wheelers, Two-wheelers and Stationary Engines

R&D Steps

- Company increased R&D spend from <0.5% of sales to 0.8% of sales
- Majority of the spend was utilized towards testing (60%), software procurement and people development
- Company is doing some low-end engineering work and testing work for some of its partners

Key achievements

- The company developed a new mechanism for electrical steering system and it took it three years to convince its OEM customer about quality, reliability of the technology and product
- The technology is currently under production
- Seeing the benefits of R&D investments, the company is working on building a R&D cell to perform R&D activities
- The R&D spend is likely to increase to 1.5% of sales in the next few years

Source: Primary Research, Secondary Research

RICO Auto Industries –
Focused on affordable R&D for affordable products

Background

- Rico is a world-class engineering company supplying a wide range of high precision fully machined aluminum and ferrous components and assemblies to automotive OEMs across the globe.
- Rico's consolidated group total turnover is over US$ 285 Million (Rs 1100 Crore) with integrated services including design, development, tooling, casting, machining and assembly across ferrous and aluminum products.

R&D Steps

- Through alliances globally and targeted internal efforts RICO has progressed on both innovation and research driven product development across a breadth of product lines
- R&D capabilities span across design & analysis(Structural, Thermal, Fatigue, NVH (noise, vibration, harshness)), material research & development and testing & validation
- Supported by strong in-house engineering systems, RICO has also partnered with institutes like Fraunhofer to collaborate on research initiatives.

RICO's experience indicates key focus areas for the industry

Research, technology and development – **RTD, driven approach** towards innovation, where Technology is the area where India suppliers can excel

Indian **academia should be geared** towards development and deployment of practical and feasible solutions for the industry

Manpower robustness is key – companies can look at hiring skill set from across the globe – especially those who are challenged by opportunities in India and are keen to relocate

Emphasis on building **longevity of state policies** for the benefits to be realized by the component manufacturers for R&D spends

"For a price aggressive market like India, it is imperative that research and innovation be affordable such that affordable yet high quality products be developed for domestic consumption."

Source: Primary Research, Secondary Research

Sharda Motor Industries Ltd. –
Developed technology capabilities through partnership

Background

- Sharda Motor is a major tier-1 supplier in manufacturing of Exhaust System, Catalytic Converter, Independent Front Suspension, Seat Frames, Seat Covers (Two Wheelers & Four Wheelers), Soft Top Canopies, and Pressed part - Room Air Conditioners body etc.
- Starting in the year 1986 with Maruti Suzuki, Sharda Motor has developed strong technical capabilities backed by a series of partnerships

R&D Steps

- Sharda Motor joined hands with the UK-based Ricardo towards implementing independent, and state-of-the-art capabilities through development of R&D strategy
- Initial investments of close to INR 35 Crore were brought in towards development of infrastructure, hiring of manpower and establishing testing and validation competencies. Plans are to invest further INR 35 crores towards full scale development in coming months.
- Towards competency development SML hired one of the leading industry experts Dr. Sivanandi Rajadurai with over 30 yrs of industrial experience in SML's areas of interest
- Backed by strong R&D, SML has become key supplier to some of the leading passenger car companies in India

Sharda Motor's experience indicates key focus areas for the industry

Greater bandwidth should be made available at state sponsored testing facilities to develop

Developing **competent manpower** led by people with global experience in targeted technologies

"To develop global competencies and to be able to compete effectively, it is only imperative that research and innovation go hand-in-hand with manufacturing. It is innovation for survival."

Source: Primary Research, Secondary Research

Shriram Pistons & Rings –
Leveraged design capability for enhanced customer solutions

Background

- SPR is one of India's largest integrated manufacturers of Pistons, Pins, Rings and Engine Valves. SPR has technical collaboration with world leaders, including Kolbenschmidt AG (Germany) and Honda Foundry (Japan) for Pistons, Riken Corporation (Japan) for Rings and Fuji Oozx (Japan) for Engine Valves.
- SPR has over 4000 employees and an annual turnover of US$ 200 million (US$ 1 = Rs.50) in 2011-12. SPR has recently set up a second Plant at Pathredi, next to Bhiwadi Industrial Area, Rajasthan, about 60 kms. from Delhi. This is to expand capacity and offer latest technology products to customers in India and abroad.

R&D Steps

- SPR was one of the early movers to make investment in R&D and is today able to offer comprehensive Design and Development solutions to OEMs. Besides physical and IT infrastructure, SPR has made critical investment in skilled personnel having capability in FEA, 3-D Modeling, Rig Testing, Simulation, Engine Testing, etc. The R&D centre is recognized by DSIR (Department for Scientific and Industrial Research, Government of India).
- The R&D centre is supported by its technical collaborators, that includes continuous training of SPR's design engineers. Design work is done by SPR engineers and where required, validated by its global technical partners, to offer latest design solutions to customers, at affordable cost.

Key achievements

- Key achievements include in-house end-to-end Design, Development, Prototyping and Engine Testing of Commercial Vehicle Pistons and Rings, with regular visit by OEMs to witness the engine performance. This not only reduced the time for the development of new models of Pistons and Rings, but also established a collaborative and trusting relationship between SPR and its key customers.
- SPR's R&D Department has designed and developed Pistons, Rings and Engine Valves for CNG engines for low floor buses India, developed customized products for multi-fuel vehicles for Brazil market, made breakthrough improvement in engine performance for several OEMs, by offering alternative designs for already launched products, etc.

Source: Primary Research, Secondary Research

Shriram Pistons & Rings –
Leveraged design capability for enhanced customer solutions (cont'd.)

Key achievements

- SPR has been actively planning to undertake support from Indian universities like DCE, IISc (Bangalore), to work on futuristic programs for improving fuel economy
- In addition to building a strong process towards new product development and bringing in efficiency into existing product processing, SPR has made special initiatives like:
- Knowledge management portal has been structured to capture project information including TGR/TGW and to create a repository of information for learning and best practices sharing
- Process is on to develop a Product Life Cycle System to provide customer real time access to the development cycle of products under processing

SPR's experience indicates key focus areas for the industry

Identify problem areas or pain points of OEMs for existing products and offer design solutions for the same.	While end-to-end design and development capability is desirable, leverage the knowhow of collaborators to fill in the gaps, validate the designs and to gain credibility with OEMs.	Separate prototyping facilities can considerably speed up design and development of new products.
Take support of academic institutions and Testing Houses, to supplement design and development work done in-house. This reduces investment in physical infrastructure, specially costly and sophisticated testing equipment that is required only once in a while.		Development of Tier-2 and Tier-3 supplies is important, to improve process efficiency.
Go beyond product design and development and invest in final engine testing, for a more trusting and collaborative relationship with OEMs. Provide suitably for design confidentiality.	Knowledge management portal, to record all successful and not successful design work provides good benchmark/base data, for faster development of next models.	

"The biggest source of improvement are customers. Choose your customers wisely, those who will pull you up and force you to raise your delivery standards and provide opportunities to learn from them."

Source: Primary Research, Secondary Research

Sona Koyo –
Focused approach at developing R&D capability

Background

- The Sona Group was founded in 1987 to manufacture components for the automotive industry. Currently the Group has 16 plants across India, three in Germany and one in USA, and provides steering and driveline components for the automotive OEM segment namely passenger cars, utility vehicles, commercial vehicles and specialty vehicles
- Sona Koyo, the flagship company of the Group identified the opportunity in the off-road segment (golf carts, garden utility vehicles etc.) and despite its dependence on Koyo for technology, the company decided to develop in-house product development capability to target this segment

R&D Steps

- Company established a electronics R&D facility (2004), with a focus to develop electronic power assisted steering development capability
- The company hired people varied backgrounds such as semiconductor industry, electronics laboratories etc. to create a team for Developing steering system
- A cross functional team (CFT) was created so as to meet with product development team and provide them with necessary inputs so as to develop the product
- The company roped in IIT Mumbai to help develop the electronic power steering system, with active participation from the M-tech and professors of the institutes
- Enabler: Support from the customer by being a partner in carrying out market feasibility and demonstrating its faith in supplier's technical capabilities is necessary for any auto-components supplier to invest in R&D

Key achievements

Sona Koyo designed an in-house Electronic Power Assisted Module (EPAM) for the off-road vehicle (golf carts, garden utility vehicles etc.) segment for the global market

- The company has filled 3 patents as a result of in-house design and development of EPAM
- The innovation has found acceptance from the customers, with commercial production of the product started in the year 2011

"A strong customer partnership and a desire to overcome reliance on external technology provider is a key trigger towards building in-house capability."

Source: Primary Research, Secondary Research

Subros –
Established success and then increased investment

Background

- Established in 1985, its is a Joint Venture company between Suri group, Suzuki and Denso. It has a full range of products for entire auto AC system such as HVAC, control panel, Rear cooling unit, compressor, cooling fan, condenser, hoses and tubes, temperature sensor, etc.
- Primary trigger was to build and deliver cost effective products, which was not entirely possible with expensive technology import from their collaborator, Denso, as was happening till 2003

R&D Steps

- Company started with assembling and localization as far back as 1985, and manufacturing with carry over design started in 1994
- Company opened a R&D center in 2003 in Noida, to work on Product Engineering and Technology development. It was set up with an upfront investment of 16 Crore INR with special focus on design and testing infrastructure. Over the years, the center has seen investments up to 50 crore

Key achievements

- The in-house research and development capabilities gave Subros made their products cost competitive and opened the doors to several customers over and above MSIL which they were serving originally.
- MF III, one of their first products to be designed and developed in-house was launched in 2007 with Maruti Suzuki SX4.
- Basis customer demand was Subros worked extensively to devise and execute their ‘design to cost’ model
- So far Subros has filed 11 patents (1-US and 10-India)

Source: Primary Research, Secondary Research

Subros –
Established success and then increased investment (cont'd.)

Initiatives/ Focus

- Company has identified three pillars to its R&D initiatives and has build following capabilities in these areas
  - Design Facilities:- Linkage to DNJP, PLM, Parametric design, Concurrent Engineering, System Selection, Coil designer, Unigraphics, CFD, CAE, CAD / CATIA
  - Testing Facilities:- Wind Tunnel, Sy. Calorimeter, Vibration Lab, Airflow Measurement, NVH Lab, Co. Calorimeter, FATC Evaluation Bench
  - Tool Room Facilities:- HVAC mold, Compressor part Die Dev., 100% in house tool dev. & Localization of critical Component tooling, etc
- R&D at Subros Ltd. has focused on
  - Cost leadership
  - Innovation
  - Time to market

Subros' experience indicates following major challenges for the ecosystem

Getting the right people to do the job and retaining them has been one of the key challenges. Subros have however countered the challenge by creating a repository of information and documenting knowledge

Local academia support has also found missing from Indian institutes where Subros found a lack of will and a huge time lag to schedule even minor interactions like paid training engagements etc.

"A strong will and a zeal to out-do competition, both domestic and foreign, made us take the first step which has paid off handsomely over the years with clients, OEMs and even our own people recognizing the advancement."

Source: Primary Research, Secondary Research

Turbo Energy –
Invested into technology and waited for market to mature

Background

- Turbo Energy Limited is India's largest manufacturer of turbochargers, catering to the requirements of the Internal Combustion engine industry
- Turbo Energy started investing into turbocharger technology from the mid 80s

R&D Steps

- This was a pure R&D investment exercise for the initial 10 years, as there were no takers
- Pollution measures were not stringent and therefore, turbocharger technology didn't have demand
- The company had 6-7 engineers and PhDs who were involved in purely R&D work
- There was a setup to do prototypes
- Engine Dynamometers were installed
- Engine testing was done in Germany with Turbo Energy's German collaborator
- The company invested over INR 30 Crores over the 10 year R&D cycle

Key achievements

- Pollution compliance became stringent in late 90s and that is when the company started gaining benefits of the R&D investment
- The R&D team has grown by 15 times
- The company was able to develop a thoroughly tested proprietary product line. All activities on the product development value chain: Testing, validation, simulation, prototyping, process engineering are being done by the organization

Source: Primary Research, Secondary Research

Varroc Group–
Started small and moved towards design ownership

Background

- Varroc Group is a major automotive supplier with customer base of 2-wheeler, 3-wheeler, Passenger and Commercial vehicle OEMs
- The Group felt the need to invest into R&D about 6-7 years back
- Till then, it used to be a build-to-print supplier
- 6-7 years back, OEMs got in the pressure of developing next stage products for emission and safety compliance

R&D Steps

- The Group decided to build capabilities in its three main product divisions
  - Electricals
  - Polymer
  - Metallics
- Major focus was given to Electricals division
- The Group felt the need to match up on technology and get ahead of the market leaders.
- The investment IN R&D improved from <0.5% to 3%
- The group started with a small team that has now grown to 600+ people globally

Key achievements

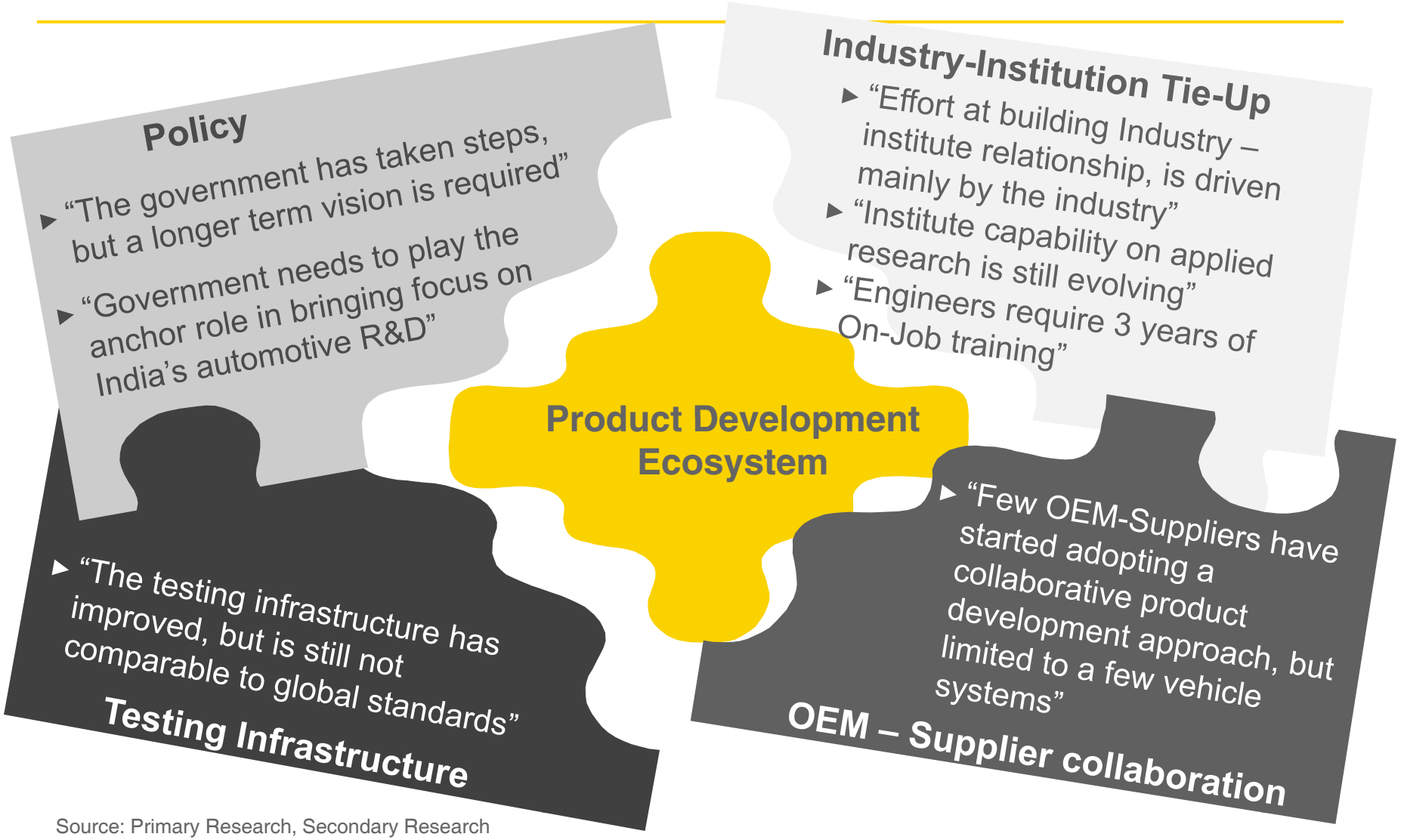
- Today Varroc owns the product design in half of its product lines
- In electrical division, Varroc owns the full design prints
- The company is trying to set up partnerships with world class engineering institutions outside India as commercialization of research (advanced research) is more prevalent outside India

Source: Primary Research, Secondary Research

4. Product Development Ecosystem

Institution-infrastructure-incentives propelling research

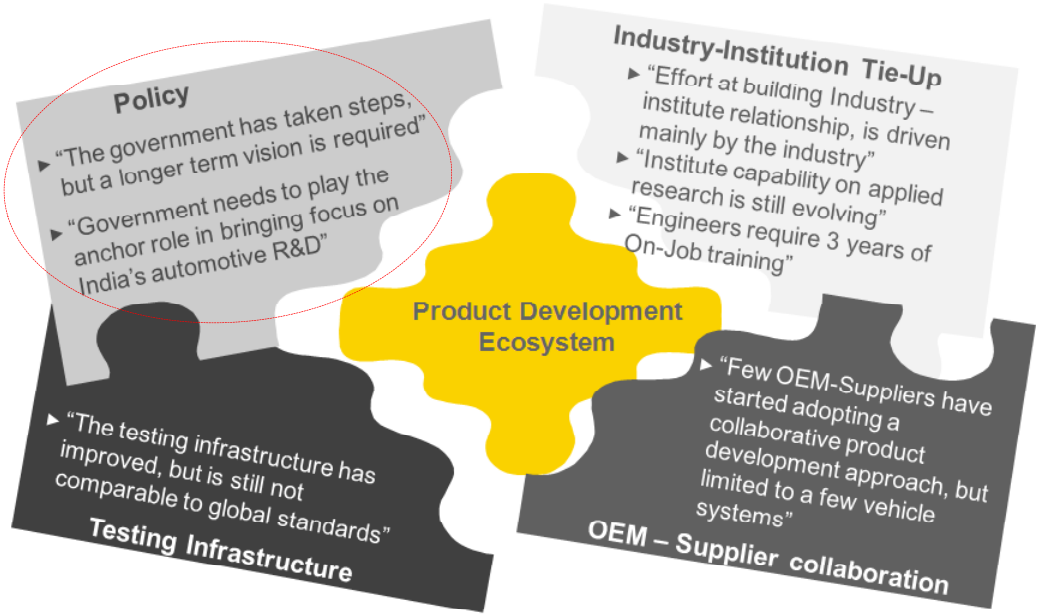
The product development ecosystem in India is in its infancy and is evolving



Source: Primary Research, Secondary Research

4.1 Product Development Ecosystem

Policy support



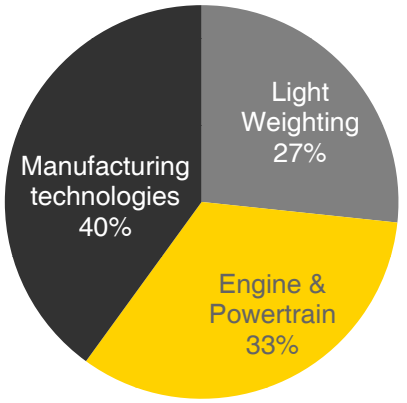
Government plans to invest INR 2542 Cr in the 12th five year plan. In addition government has decided to provide various other incentives to facilitate collaborative research in Automotive R&D

Twelfth plan budget for Automotive sector (in INR Cr.)	
NATRiP	992
Electric Vehicle Testing Infrastructure	305
National Automotive development board and automotive cluster development programme	205
R&D of electric mobility (xEV)	740
Technology up gradation and development scheme (TUDS) for auto component industry	300
Total	**2542**

- In Automotive Component Cluster Development Program, government plans to cover almost 460 auto companies
- TUDS Plan is to help auto component companies access finance at reduced rates of interest for their modernization/ upgradation / technology acquisition thereby helping them to become more competitive
- The following domains have been identified for R& D and technological intervention:
  - Light Weighting
  - Engine and power train
  - Manufacturing technologies

- This fund would be used to provide financial support to companies by financing 50% of the project cost by way of soft loan, with an interest subvention of 4% to be met from fund corpus.
- The firms using this facility would put in balance 50% of the capital required.
- Auto Component Manufacturers Association (ACMA) have indicated that the level of investment required by component industry for the period 2012-16 would be 15,000 cr., of which 7,500 cr. is proposed to be financed through soft loans with interest subvention

Focus areas for financial assistance



Policy and regulatory steps have been taken, though there is still room to develop the efficacy and longevity of the plans and actions in their execution and impact on the industry.

Source: WG Committee Report for 12th 5 year plan, Secondary Research, EY Analysis

India adopted National Electric Mobility Mission Plan 2020; 6-7M electrified vehicles by 2020, total investment up to $4.1B

National Mission for Electric Mobility

- India's National Council for Electric Mobility (NCEM) has adopted the National Electric Mobility Mission Plan 2020 (NEMMP 2020), which is the mission document for National Mission for Electric Mobility (NMEM)
- The NEMMP 2020 lays the vision, sets the targets and provides the roadmap for achieving significant penetration of electric vehicles (including hybrids) in India by 2020
- The NEMMP 2020 has set a target of 6-7M units of new vehicle sales of full range of electrified vehicles, along with resultant savings of liquid fuel of 2.2 – 2.5MT to be achieved in 2020

Role of Government

- The Government will provide the initial impetus through demand support measures to facilitate faster consumer acceptance of these newer technologies which have a higher cost of acquisition
- In addition, Government will also facilitate automotive R&D and put in place charging infrastructure
- The Government last year had approved the NMEM and the establishment of a high-level apex structure in the form of the NCEM and the National Board for Electric Mobility (NBEM) for faster adoption of electric vehicles and their manufacture in India
- NMEM ranks among the most significant recent initiatives taken up by the Government for the automotive sector

Investment

- Total investment required will be in the range of Rs 20,000–Rs 23,000 crores (US$3.6–$4.1 billion) , of which the support required to be provided by the Government will be to the tune of US$2.2–$2.5 billion over the next 5-6 years
- The industry will also make large investments for developing the products and creating the manufacturing eco-system

Associated benefits

- Aside from the benefits by way of liquid fuel savings, lowering of carbon emissions, lowering of other emissions, and job creation, the intervention is projected to also encourage the Indian industry to shift to newer, cleaner technologies so that it builds its future competitive advantage around environmentally sustainable products, high end technologies, and innovation, thereby helping to improve the competitiveness of domestic automotive industry

Way forward

- The NEMMP-2020 document is planned to be formally unveiled to the public soon. The work for implementation of the plan is being headed by the Department of Heavy Industry with the support of NATRiP and will involve finalization and roll out of comprehensive array of interventions, schemes, policies and projects during the next few months

Source: Secondary Research, EY Analysis

Government policies in other automotive hubs have facilitated and anchored a long term R&D roadmap

China

Government defines strategic direction for future R&D

Policies ensure that FDI is accompanied by technology transfer

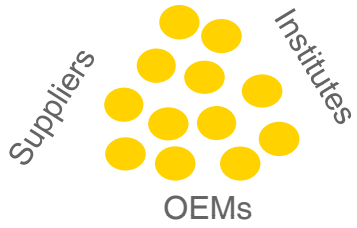
Korea

Ulsan - Auto Parts Innovation Center

Government funded efforts to strengthen local R&D capability

Germany

Policy led to automotive innovation clusters in Bavaria, Baden-Wurttemberg Bavaria, Baden-Wurttemberg



Universities/Research Institutes

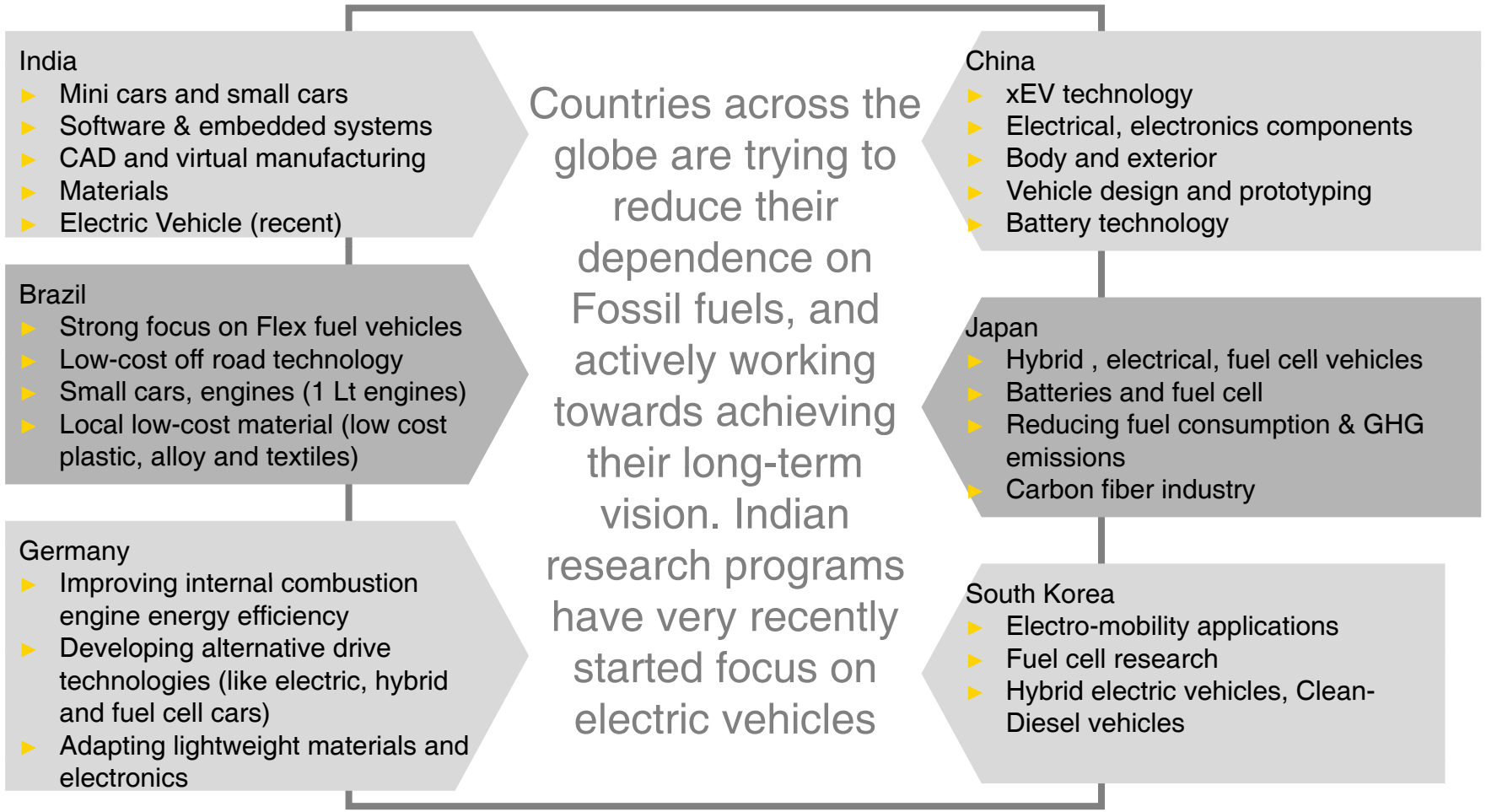
Inputs

Areas of basic research for country

Indian policy needs to anchor a long term product development roadmap

Source: Secondary Research, EY Analysis

Countries such as China, Japan and Brazil are focusing on Automotive technologies development based on their long terms vision programs

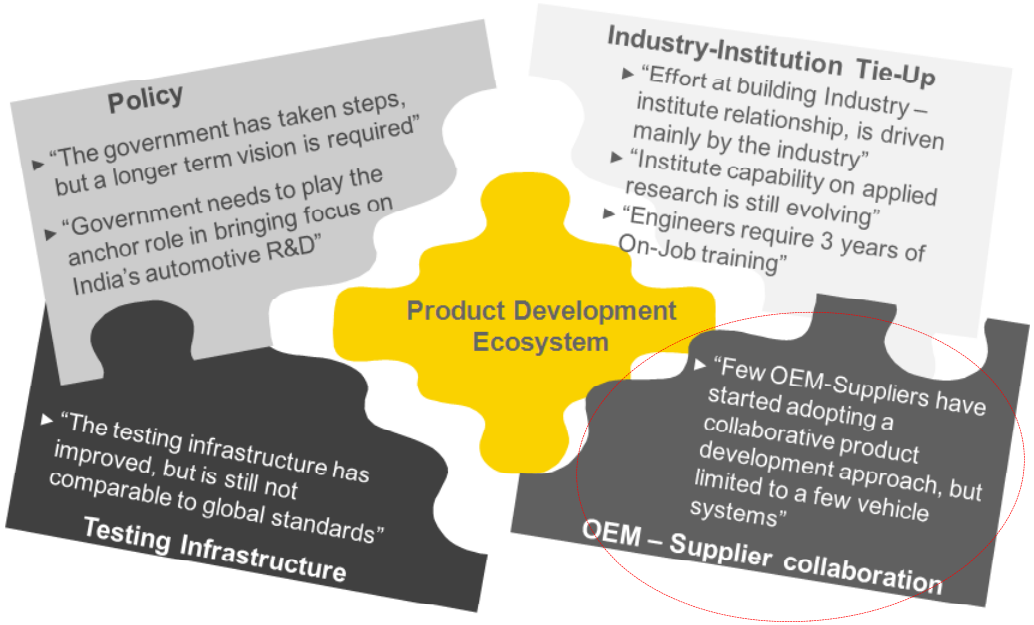


Different countries and their focus areas in automotive research

Source: Secondary Research, EY Analysis

4.2 Product Development Ecosystem

Supplier OEM collaboration



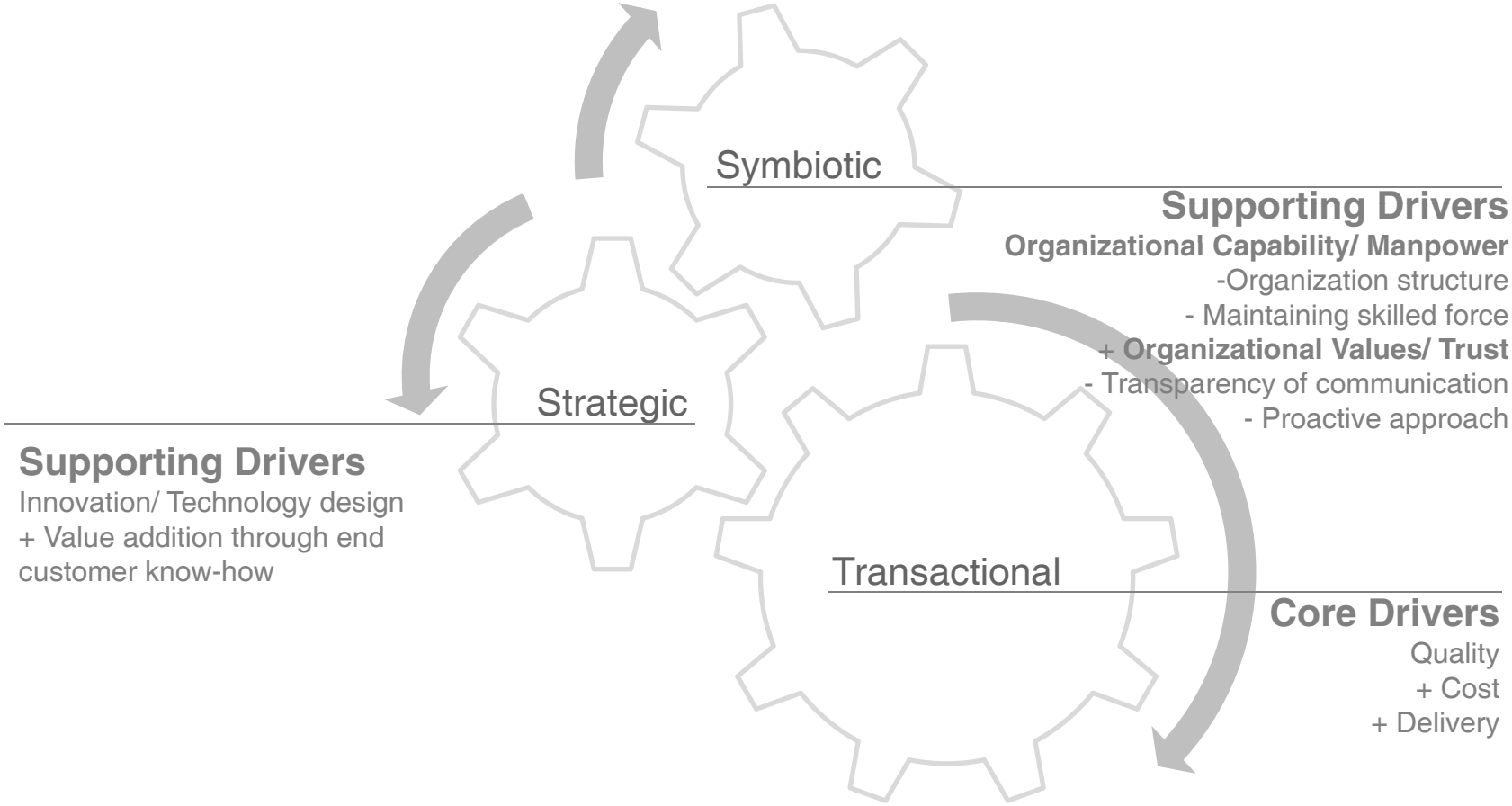
OEM-Supplier collaboration is dependent on three critical pre-requisites and nine supportive enablers….

- Purpose of any OEM - supplier relationship is to create value for all stakeholders involved, this will include monetary and commercial both type of gains
- To improve collaboration between OEMs and Tier-1 suppliers several success factors have been identified
- Cost, Quality and Delivery are 3 critical factors defining success of any relationship
- In addition to these three, further 9 key-enablers help build a sustainable and strong business relationship

Towards Affordable R&D and Affordable Products

Source: “Insights Into Supplier –OEM Relationships, A Benchmarking Study” by ACMA and JDPAP

….Different factors govern the relationship at different stages of relationship



Source: “Insights Into Supplier –OEM Relationships, A Benchmarking Study” by ACMA and JDPAP

The product development relationship between suppliers and OEMs is showing a gradual shift towards collaboration, yet….

OEMs:
"Several Indian suppliers are coming up with solution systems of their own for our problems rather than using old designs - suppliers are showing capability for early stage involvement"

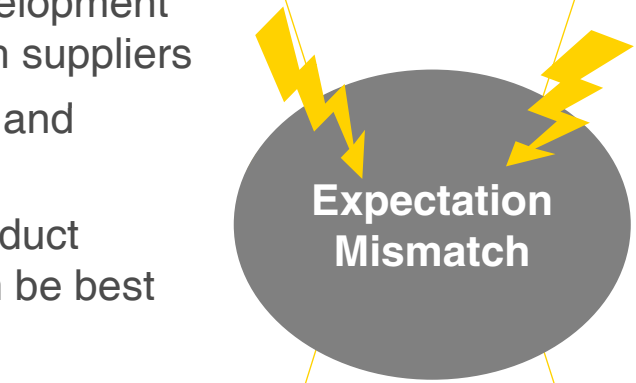
Suppliers:
"Many OEM's are showing interest in taking inputs from suppliers while product is still on the drawing board, enabling better involvement from these suppliers"

Source: Primary Research, EY Analysis

Yet an expectation mismatch exists between OEMs and suppliers on the approach to develop suppliers' product development capabilities

Suppliers' Expectations

- Explore joint development opportunities with suppliers
- Share resources and financial risks
- India specific product development can be best done in India
- Honor commitments during design/development phase



OEMs' Expectations

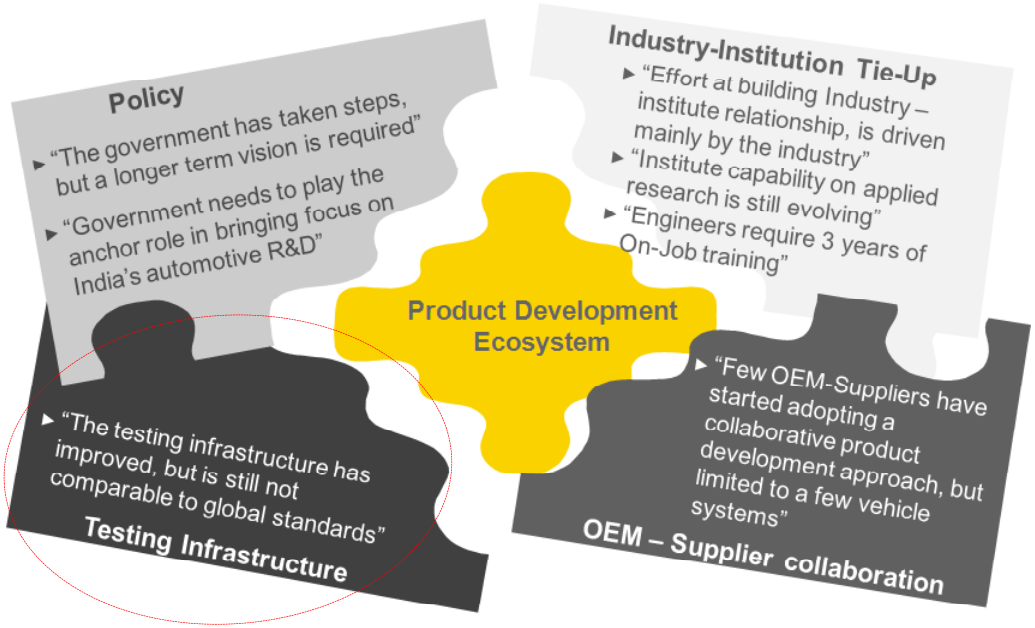
- Suppliers should build capabilities in basic areas
  - Problem solving
  - Design understanding
  - Program management
- Invest in testing facilities
- Collaborate with other suppliers to provide a system solution
- Provide proven products

To take advantage of affordable R&D and develop India as an integrated hub, OEM's and suppliers need to increase collaboration for mutual benefit

Source: Primary Research, EY Analysis

4.3 Product Development Ecosystem

Testing infrastructure



Product development infrastructure , especially the product testing infrastructure, has grown over the past decade

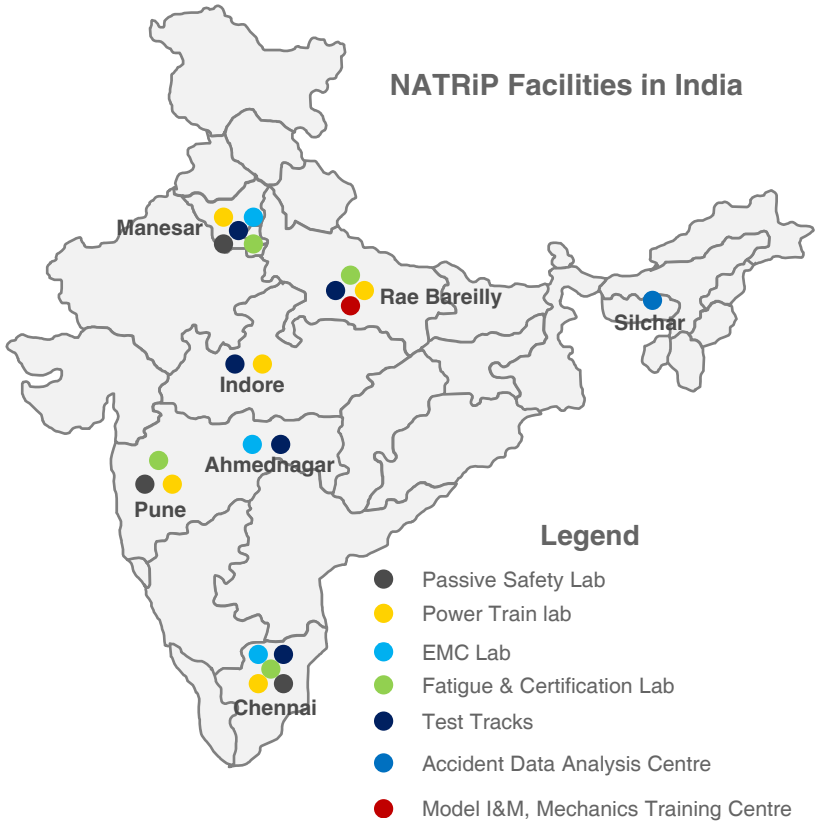
India has seen a surge in automotive testing facilities, with OEMs, suppliers and government setting up new testing infrastructure across country.

Cities	Key automotive testing facilities
Ahmednagar	NCAT
Bangalore	BISS, CM Envorsystems, Bosch's ECU Reliability Testing Centre, Mahindra Reva, GM, Cummins, Delphi
Baramati	Piaggio
Chennai	Global Automotive Research Center, Adams Technologies, Micro-Poise Measurement Systems, Mahindra Research Valley, Ashok Leyland, Mercedes-Benz, Nissan, Visteon
Coimbatore	Bosch's ECU Reliability Testing Centre
Delhi NCR	TUV SUD, HMSI, Yamaha, Suzuki Motorcycle
Hyderabad	Hyundai Motor India Engineering (HMIE)
Indore	National Automotive Test Tracks (NATRAX)
Jaipur	Hero Motocorp
Manesar	International Center for Automotive Technology (iCAT)
Pune	ARAI, SGS Auto laboratory, SAJ Test Plant Private Ltd, Tata AutoComp Systems, Honeywell Sensing and Control, Bajaj, Mahindra two wheelers, Tata, Volkswagen, Cummins
Rohtak	Maruti Suzuki
Rae Bareilly	Centre of Excellence on Accident Data Analysis (NCVRS)
Silchar	National Institute for Automotive Inspection, Maintenance & Training
Jamshedpur	Tata

Source: Secondary Research

National Automotive Testing and R&D Infrastructure Project (NATRiP), is a collaboration between the Govt. Of India, State Governments and Automotive Industry

- Conceived in 2005, NATRiP has been funded by GoI with a to-date investment of over INR 2200 Crores INR with an aim to support developmental activities in the Indian automotive Industry.
- The project is playing a key role in the build-up and expansion of homologation and testing facilities in different parts of the country to aide manufacturers who are limited by time and resources to make similar investments on their own.
- NATRiP is also playing critical role in bringing together state and industry stakeholders through contribution to projects like NAB (National Automotive Board) - a proposed permanent, professional, expert body for the automotive sector., NMEM (National Mission for Electric Mobility), etc.
- Another key would be to segregate testing and homologation under once NAB is set up.
- Leading centers related to NATRiP are:
  - ARAI - Pune
  - iCAT – Manesar
  - NATRAX – Indore
  - NCAT – Ahmednagar
  - East Center – Silchar
  - GARC - Chennai



Source: Secondary Research

NATRiP's aim is to create a state of the art Testing, Validation and R&D infrastructure in the country

NATRiP
Driving India Into The Future

Towards a robust ecosystem

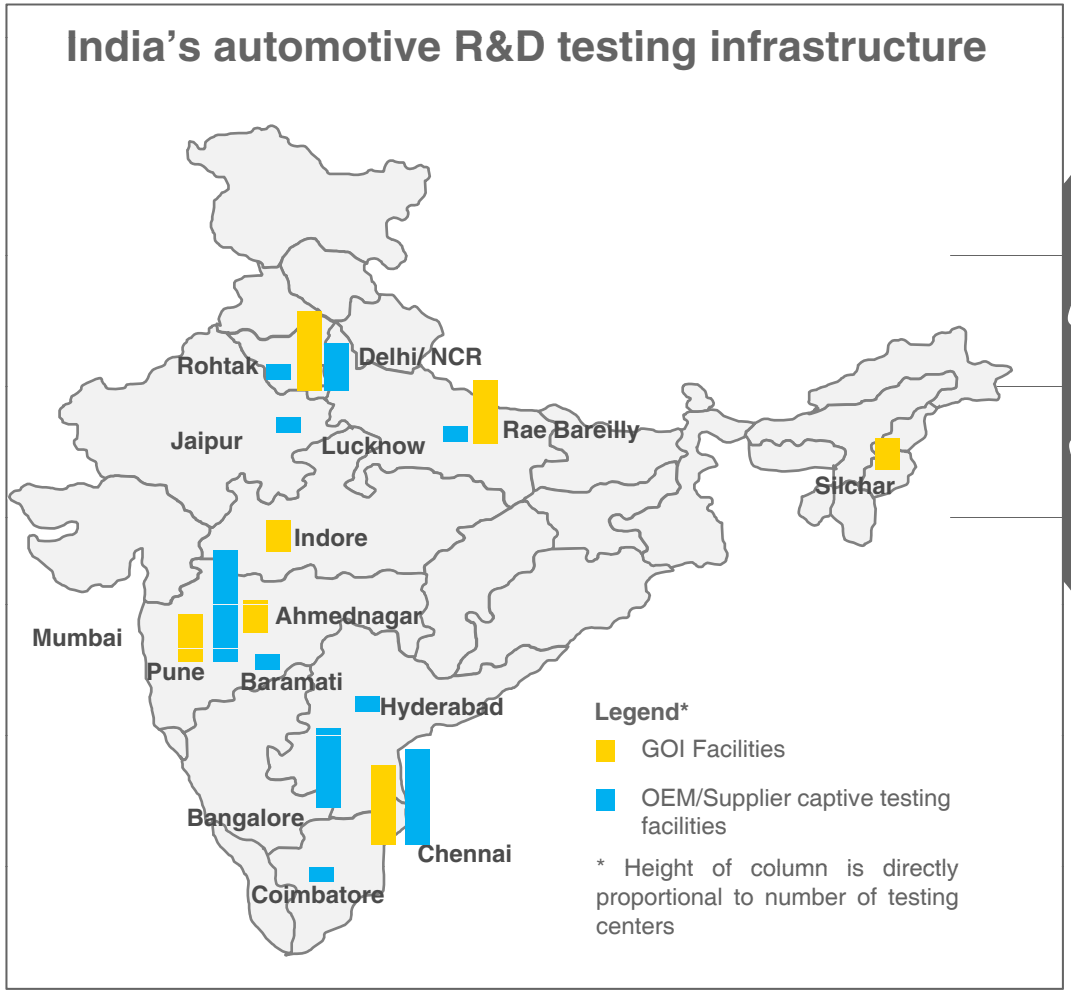
Academic Environment	► Training and skill development initiatives have been launched under UNIDO ► Steps are being taken to standardize delivery of training and services across centers by enabling planning and regulation
Government support	► Government has put in several initiatives – both confirmed and proposed for development of manufacturing, though more push needs to come in terms of incentivizing and even subsidizing research and innovation development in this sector

Industry initiatives	► More efforts need to go into future critical investments and to encourage engagement of ACMA members
	► Further developments from industry are to be seen in the following key areas:
	  ► Understanding and indentifying areas with immediate manufacturing benefits and using R&D to reduce complexity
	  ► Collaborating with other industries to find scale and share best practices
	  ► Most critical is the ability to source technology

"As seen in other countries, the industry in India needs to wake up to futuristic developments and investments like that in electric vehicles and alternate mobility. This should largely stem from OEM pull taking lessons from other global markets."

Source: Secondary Research

Testing and validation infrastructure is critical to product development in India and needs to be strengthened further



There has been an effort towards improvement of testing and validation infrastructure in India

The testing infrastructure is still insufficient for India's product development ambitions

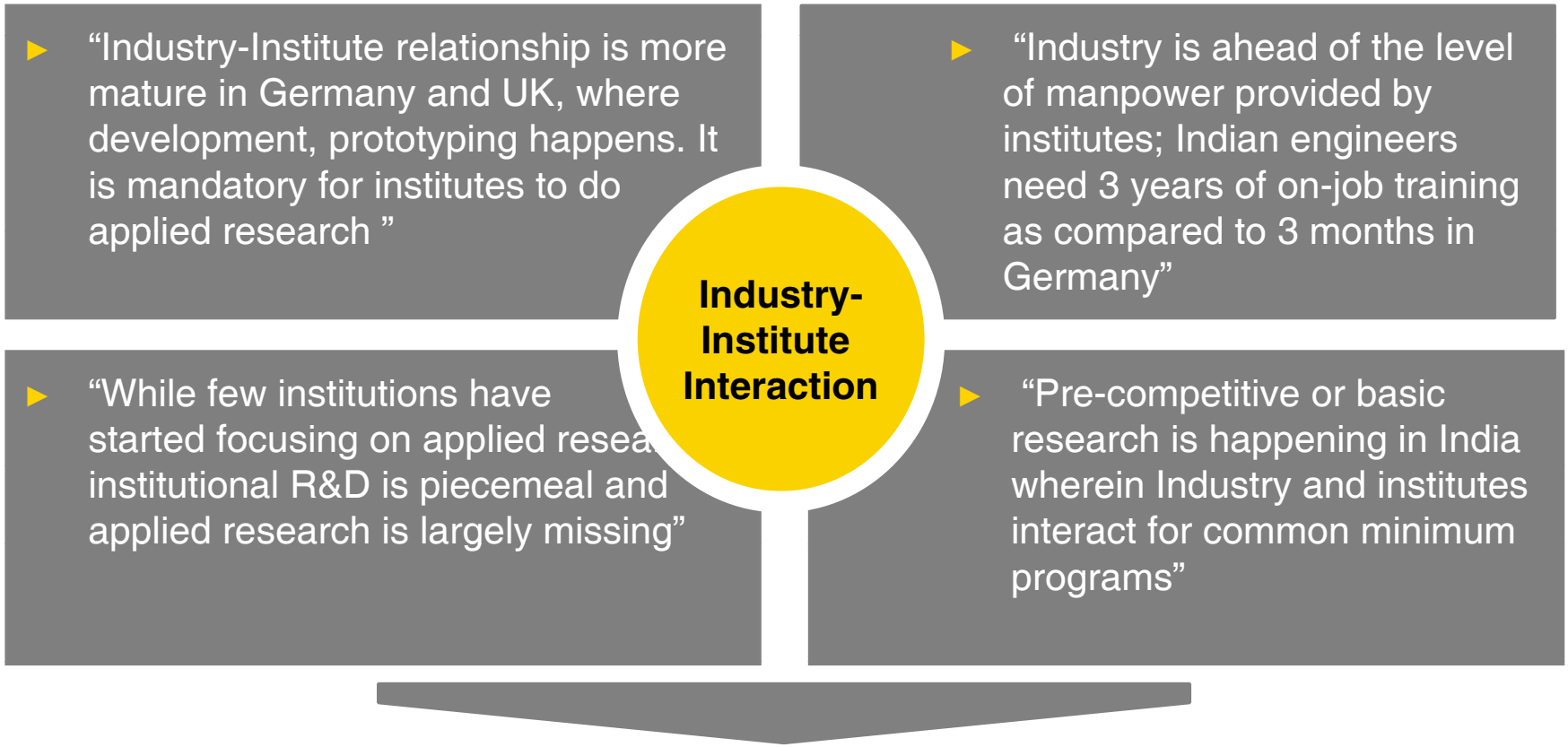
Visionary OEMs and suppliers have not waited for infrastructure to come up, they have invested in own advanced testing facilities

Source: Primary Research, EY Analysis

4.4 Product Development Ecosystem

Industry-institute tie-ups

Industry–institute tie-up is an essential part of the ecosystem, wherein Institutes provide basic and applied research input



Institutes need to be mandated and incentivized for applied research

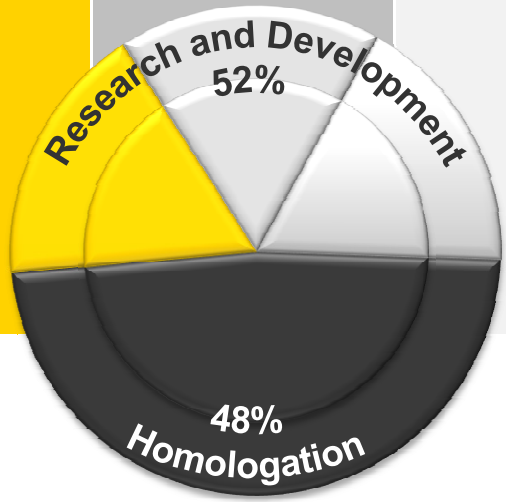
Source: Primary Research, EY Analysis

Automotive Research Association of India- (ARAI) has tried to bridge the industry-institute interaction gaps by providing research based inputs to OEMs and suppliers

Govt. Sponsored
Several national projects including road mapping, anthropometry bank, etc. launched jointly with govt.

Self Funded
Invested INR 32 crores over past seven years on self-funded research

Industry Projects
Need driven business projects undertaken for OE and component manufacturers.



Source: Primary Research, Secondary Research

Achievements

- Complete in house development of 1.5 liter engine for Cars (and LCVs under progress)
- ECU development for two-wheeler fuel injection system

Challenges

- Encouraging participation and trust from Indian companies on research capabilities
- Need for greater project facilitation from government

Way Forward

- Institutional tie-up to procure technology in India and abroad
- Increase in investments on self-funded futuristic projects like Vision 2020

ARAI has also been working towards improving collaboration between Academia, Government and Industry

Towards a robust ecosystem

Academic Environment	► Partnering with institutions and academicians should be key to acquiring technology and taking lessons from existing work. ARAI has tied up with universities in India and abroad to build up on technical competence. ► Just academic experience is not sufficient, close tie-up between industry and institutes is needed. Case in point is Mercedes and University of Stuttgart, and VW and University of Braunschweig ► Facilities at academic institutes also need to be revved up
Government support	► Government has come forward to support key initiates for the industry through ARAI. ► On similar lines, greater facilitation role is expected from the government to ensure that projects initiated are on track with both time and cost and that there are no overruns.
Industry initiatives	► Innovation should not be limited to product, rather should encapsulate process, organization and service delivery. ► Today, Indian tier-I manufacturing has reached a maturity where failure of basic components is a thing of the past, what we need is finesse. ► Project management system needs to be established where organization direction is provided on innovation. There needs to be projects, opportunities and freedom for people to innovate and do well on research. ► R&D spends should be viewed as investments, where RoI is considered from a long term viewpoint. ► About 4-5% of the revenues earmarked for R&D every year

"Companies come to talk about using facilities and doing research projects, but in the end the realization of such projects is quite low…it will probably take time to build confidence in Indian competence. With the investments and self-invested work that we are doing, that confidence should go up"

Source: Primary Research, Secondary Research

Fraunhofer – Taking lesson from global best practices to build ecosystem in India

Fraunhofer

- Collaborative approach for co-development using teams created in India and Germany

Research Model

- Demand has been for projects related to design competence, material inputs to the manufacturing process and building resource efficiency

Demand

- Client who pays for the technology gets the technology and wherever applicable exclusive rights to products developed. Patents however reside with Fraunhofer

IPR

"Given the long gestation periods, R&D projects typically get stuck into a financial decision making - and if there is a more than 6 month window, companies start exploring off-the-shelf purchase opportunities which does nothing for long term growth of innovation at these companies."

Source: Primary Research, Secondary Research

Fraunhofer – Taking lesson from global best practices to build ecosystem in India

Industry

- R&D needs to be seen as an ongoing activity necessary for future and built into the company DNA rather than a product purchase exercise.
- Incremental innovation also needs to be built in with new minds who can challenge status-quo and are able to think fresh.
- There is also need to encourage information sharing within the industry which is not happening owing to competitive mind-set

Government

- India should encourage *innovation clusters* instead of just real-estate modules like SEZs, as seen in Germany, US, UK and Sweden. Germany for example has many innovation clusters under PPP model, which bring all stakeholders together to propel and expedite developmental activities.
- Suppose industry says light weighting is an issue, under this cluster government will put 40% funding, gets 60% from industry, all stakeholders are brought together and a plan of action for that activity is developed

Academic

- The institute and industry interaction needs to be nurtured
- While some institute focus on applied research through curriculum and practical training, applied research is largely missing. Unlike EU institute-industry collaborations, Indian academia needs to show that the theory that they are doing has shop-floor feasibility and benefits

Source: Primary Research, Secondary Research

5. Way forward

Recommendations for suppliers and ecosystem

India can become a global automotive industry leader, however, it needs to evolve as an integrated development & manufacturing hub

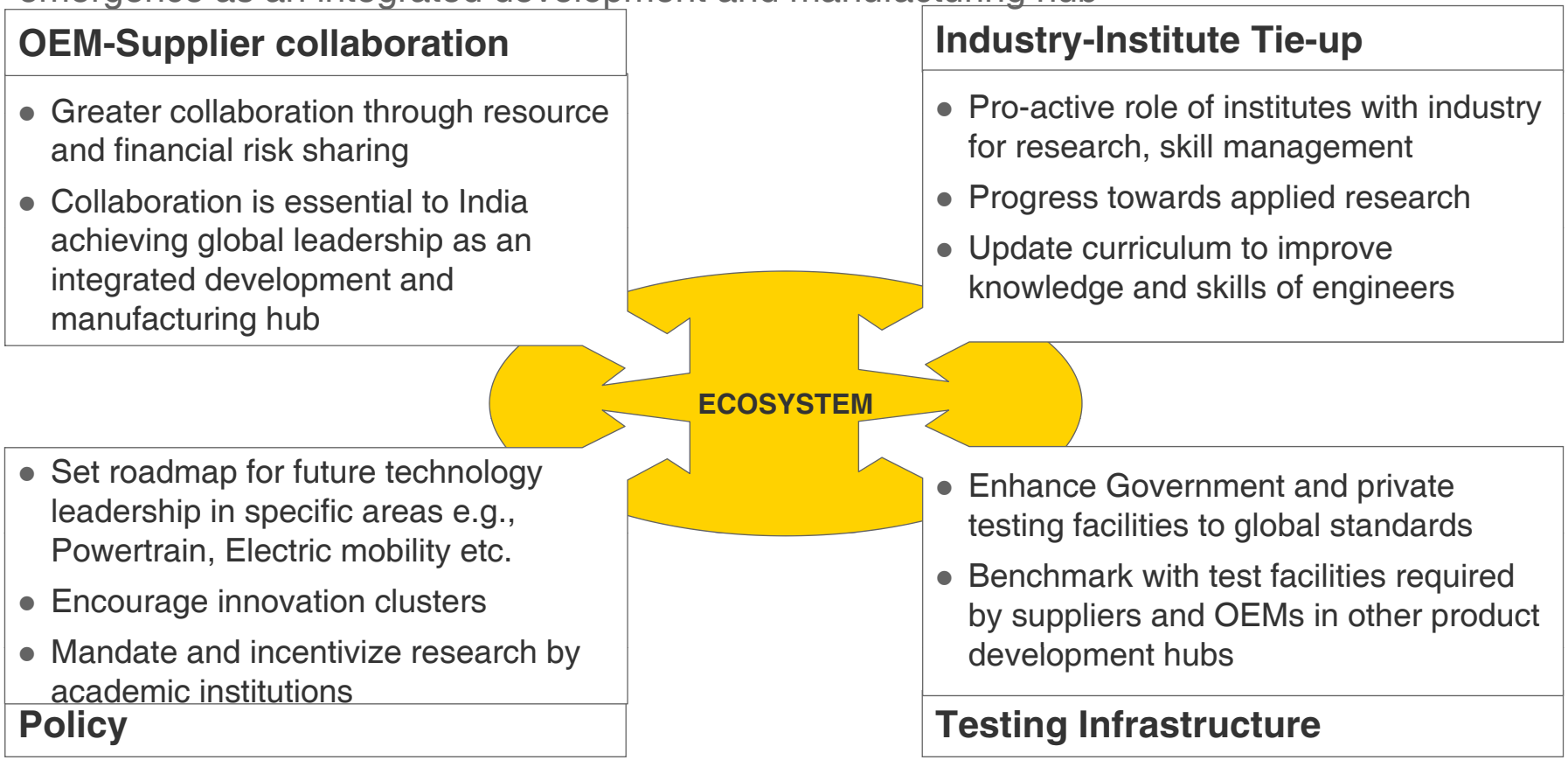
For India to emerge as an integrated development and manufacturing hub, focused initiatives and a cohesive approach will have to be undertaken by suppliers, OEMs and stakeholders. Interviews conducted during the course of the study and case studies of organizations indicate certain essentials for the sector's product development ambitions

A	**Leadership vision**	Organization leadership is a critical enabler. The leadership determines the vision for technology leadership, determines evolution path and invests towards manpower and facilities
B	**Collaboration**	OEM-Supplier collaboration is a key enabler to build/enhance Indian model of affordable R&D solution. The risks and returns associated with investment in Design and Development can be shared
C	**Culture**	Sustenance of development and innovation initiatives in an organization are dependent on absorption of an organization-wide design and innovation culture
D	**Profitability**	Investment in design capabilities is unlikely to have a favorable short-term ROI. However, it ensures consistent profits, customer satisfaction and sustainable competitive edge in the long term
E	**Ecosystem**	Ecosystem (Policy, Infrastructure, Institutes) is a key enabler. It needs to evolve to meet stakeholders expectations on deployment monitoring, applied research and testing facilities

Source: EY Analysis

Roadmap for Automotive Product Innovation and Development (RAPID) for the Ecosystem

Globally, a robust ecosystem (Policy, Infrastructure, Institutes, OEMs) has been an essential enabler for auto component industry in developing design capabilities. India also needs its product development ecosystem as an essential enabler in its roadmap for emergence as an integrated development and manufacturing hub



Source: EY Analysis

Roadmap for Automotive Product Innovation and Development (RAPID) for the Suppliers

Product innovation & development needs to be looked at as an investment to be evaluated from a long term gain and sustainability stand-point. Basis current involvement and future targets, the manufacturer can choose to take 3 paths towards development competence:

	Dependents	Explorers	Visionaries
Initial steps	• Identify areas of need with OEM on a specific component/ product design	• Setup design cell – Problem resolution – Process engineering – Component design	• Setup PD vision – Product strategy – Technology strategy – Investment plan
Essentials	• Basic testing facilities • Advanced facilities shared with OEMs • Access to technology/design skills	• Setup team of high performing individuals • Test facilities for problem solving and new product testing	• Setup PD centre • Build advanced test facilities • Hire experts for product design
	Knowledge and Skill Management Tie-up with institutes for training and research		
Initial investment	• Investment would depend on nature of product/cost of technology	• Initial Investment in R&D is not substantial as basic facilities	• Investment is higher as manpower and facilities need to evolve quickly

Source: EY Analysis

6. Growing beyond manufacturing

The study

Background and study objective

Auto Component Industry: Ready for the Transition!
ACMA Annual Convention 2012

Background

- **To support India's emergence as a global product development hub**, it is essential that Indian component manufacturers build progressive R&D capabilities and that a supportive ecosystem evolve for capacity and capability enablement.
- **This study aims to capitalize on the up-and-coming scale and market opportunity** in India – from product development, process definition, prototype testing and validation. The endeavor is to understand where we stand today and what are the means to achieve this future critical capability.

Research Methodology

- **Primary discussions** to cover various aspects of the product development value chain and develop case studies on best practices and trends thus far
- **Structured analysis and brainstorming** towards assessment of India's R&D capability to develop understanding of strengths and gaps
- **Action research** to define opportunities in the auto product development value chain and develop progressive roadmap for auto comp players to exploit these opportunities

Study coverage

OEMs

Component Manufacturers

Members of the Ecosystem

ARAI – Progress through Research

NATRiP – Driving India Into The Future

Fraunhofer

Total number of companies/institutes interviewed: 27

- Foreign and Indian OEMs
- Tier-I Suppliers
- Academic and State Institutes

Discussions conducted through a series of telephonic and face to face meetings over July ~ September 2012 by EY Project Team

The team analyzed primary and secondary inputs on various stakeholders from the industry such as OEMs, Suppliers, Engineering & Testing Institutes

OEMs	Component Manufacturers	Institutions
Bajaj Auto Ltd.	Leading auto components Mfr.	Automotive Research Association of India (ARAI)
Daimler India Commercial Vehicles Pvt. Ltd. (Bharat Benz)	Bosch Ltd.	Fraunhofer India
JCB India Limited	Cummins India Ltd.	National Automotive Testing and R&D Infrastructure Project (NATRiP)
Mahindra & Mahindra – Automotive Division	Gabriel India Ltd.	Indian Institute of Technology, Delhi
Maruti Suzuki India Ltd.	Hi Tech Gears Ltd.	
Tata Motors Ltd.	Lucas-TVS Ltd.	
Leading tractors and farm equipment mfr.	Minda Group	
	NRB Bearings	
	Rane Group	
	RICO Auto Industries	
	Sharda Motor Industries Ltd.	
	Shiram Pistons & Rings Ltd.	
	Sona Koyo Steering Systems	
	Subros Ltd.	
	Turbo Energy Ltd (TEL)	
	Varroc Engineering Pvt. Ltd.	

7. Annexure

Learning from other sectors and countries

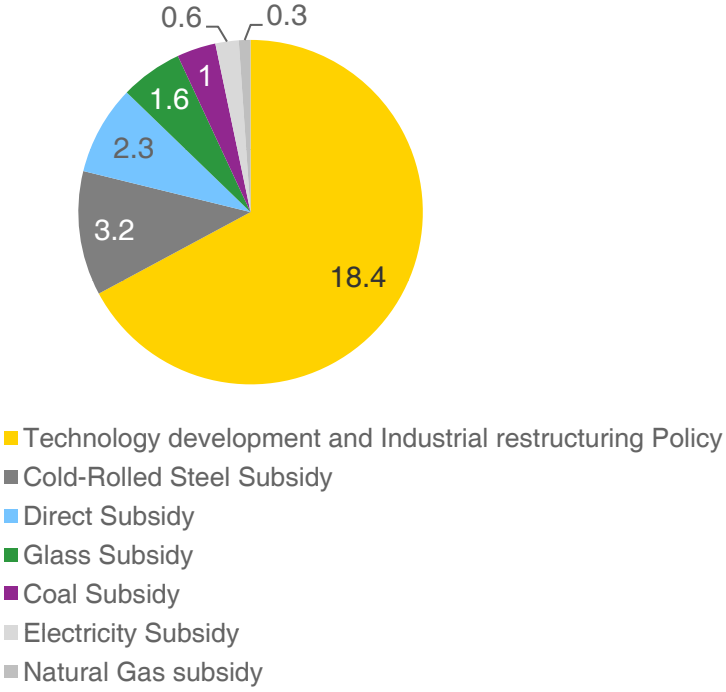
7.1 Annexure

Policy details of other countries

Chinese government has been supporting growth of Auto-components industry in various ways

- Automotive Industry has been designated as a pillar industry for China, giving it favorable treatment in policy making and other decisions
- Chinese government heavily encourages JV's with foreign OEMs
  - Foreign OEM's need to have JV with local firm (with stake limited to 50%), to produce passenger vehicles in the country
  - In 2011, Beijing announced that foreign auto companies that want to expand in China must launch new brands with their Chinese partners
- Requirement for 50% of government vehicles to be domestic makes, and favorable treatment of local auto manufacturers for loan grants and financing
- Since 2001, the Chinese auto-parts industry has received about $27.5 billion in subsidies, and over the next decade, Central government has committed around $10.9 billion in subsidies for the auto-parts industry
- China currently allows R&D enterprises to deduct 50% of R&D expenses as tax incentives

Subsidies to China's Auto-Parts Industry (from 2001 to 2011, In USD billion)



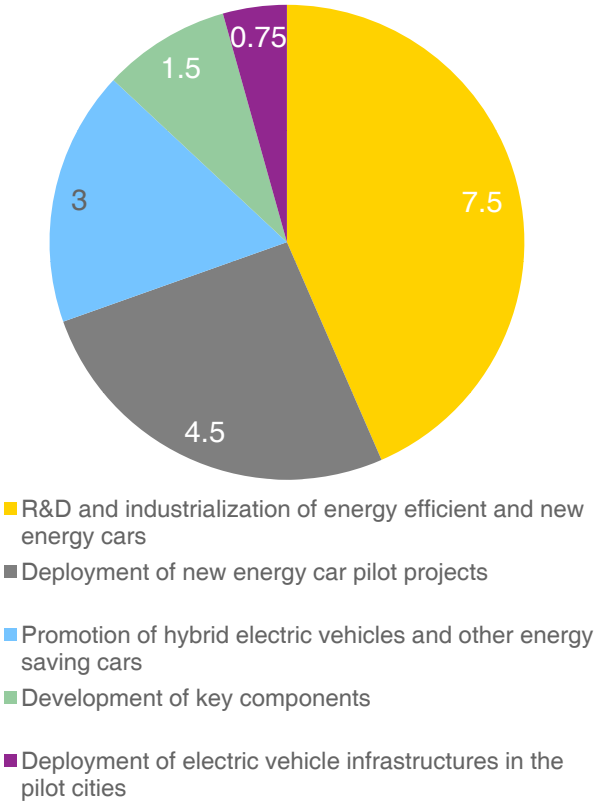
"With this (JV) rule, the government hopes to force global automakers to contribute more technology to their joint ventures" - China Automotive Technology and Research Center (CATARC)

Source: EPI Briefing Paper #316, Market Analysis Report: China's Automotive Industry by APCO Worldwide

Between 2011 to 2020, Chinese government plans to allocate ~RMB 100 billion (USD 15 billion) for development of energy efficient and new energy vehicles

- Country has also identified new energy vehicle as one of the seven emerging strategic industries
- The current strategy of the Chinese government concerning the development of electric vehicles is supported mainly by three major policy fields:
  - Support for R&D
  - Support for the related industry
  - Support for private and public consumption
- The plans set the following key targets for the new energy vehicle industry by the end of 2020:
  - China will aggressively support the development of key components of energy efficient and new energy automobiles. China hopes that three to five "backbone" enterprises will emerge with their combined market share exceeding 60% for electric motors and batteries manufacturers
  - China will produce 5 million new energy vehicles and become the number one producer of new energy vehicles in the world by 2020
  - Average fuel economy of passenger vehicles will be 4.5 L/100 kilometers by 2020, the same as European standards

Planned investment (in USD billion)



Source: Market Analysis Report: China's Automotive Industry by APCO Worldwide

Germany is the automotive leader globally with huge investment, favorable government policies, huge concentration of private players and research institutions

- Germany invests close to EUR ~20 billion overall in automotive R&D annually, out of which ~15 billion come from industry
- With almost 10 new patents getting registered each day; Germany is the most innovative auto nation in the world
- The auto industry in Germany thrives as a result of the diversity of companies active in the sector: large and medium-sized auto manufacturers alike are to be found in Germany, as are system and module suppliers, not to mention numerous small and medium-sized tier 2 and 3 suppliers.
- Germany has the highest concentration of all European automotive OEM and tier 0.5 supplier R&D centers. This makes the country the most important automotive development activity location in Europe. German based suppliers and service providers profit from close client interaction starting from the pre-development stage

R&D investment	R&D FTEs	Research facilities	Patent
▸ In year 2010, internal spending on automotive R&D in the country was Euro 14.8 billion, with almost Euro 4.8 billion being spent by external stakeholders	▸ In 2010, Germany had close to 88,221 R&D FTEs working in the automotive sector	▸ Country has following number of research facilities ▸ OEMs – 17 ▸ Suppliers – 30 ▸ Research Institutions - 40	▸ In 2011 country filed approximately ~14500 automotive related patents ▸ Over 60% are form a small number of companies, mainly large corporations

Source: “The Automotive Industry in Germany” by GTAI

All this is possible because of government support for R&D and other related activities across full range

R&D Project Grants	► Funding is available under incentives programs aimed at reducing the operating costs of R&D projects ► These programs operate at the regional, national, and European level and are wholly independent from investment incentives. At the national level, all R&D project funding has been concentrated in the so-called High-Tech- Strategy to push the development of cutting-edge technologies
Early Stage Investment: Project Financing	► VC funding be accessed through the *BVK (German Private Equity* and Venture Capital Association) ► Special conferences and events like the German Equity Forum provide opportunity for young enterprises to come into direct contact with potential VC partners ► Public institutions such as development banks (publicly owned and organized banks which exist at the national and state level) and public VC companies also offer partnership programs at development stage
Later Stage Investment: Project Financing	► Companies with established cash flow can take debt for day-today business (working capital loans), can help bridge temporary financial gaps (bridge loans) or finance long-term investments (investment loans) ► Subsidized loan programs (with attractive interest rates in combination with repayment-free start-up years) from state owned and regional development banks are available for small and medium-sized companies
Cash Incentives for Investment Projects	► Cash incentives are provided in the form of non-repayable grants applicable to co-finance investment related expenditures such as new buildings, equipment or machinery ► In Eastern Germany, investment grants are complemented by an investment allowance, which is usually allotted in the form of a tax credit but which can also be provided in the form of a tax-free cash payment
Labor-related Incentives	► Labor-related incentives play a significant role in reducing the operational costs incurred by new businesses. The range of programs offered can be classified into three main groups: programs focusing on recruitment support, training support, and wage subsidies respectively

Source: “The Automotive Industry in Germany” by GTAI

Government has identified and supports various specific R&D related program in the country

The National Electromobility Development Plan

- The National Electromobility Development Plan has been drawn up to promote all aspects of electric driving including the development of battery technology, grid integration and market acceptance for electric vehicles
- Federal government has made more than EUR 500 million in funding available as part of its initiative to put one million electric vehicles (EV) on Germany's roads by 2020.
- However major investment will come from private industries, industry has committed to spend Euro 10 -12 Bn in alternative drive technologies from 2012 to 2014
- Focus area will be battery development and production, and preparing automotive industry for new business opportunities in the energy and mobility market

Public-Private Partnership – Germany's High-Tech Strategy

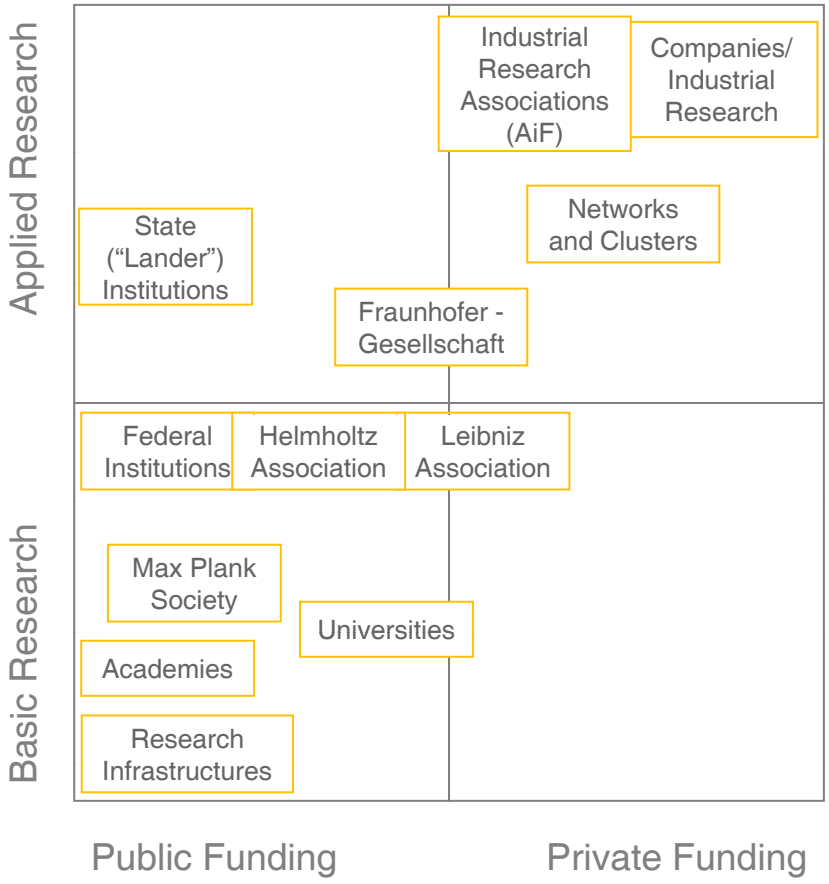
- Industry and the public sector have made a commitment to spend around three percent of national GDP per year on R&D activities.
- This amounts to approximately EUR 70 billion R&D spending each year.
- In addition, an unprecedented campaign to foster the advancement of new technologies has been launched by the German government
- This campaign - known as the "High- Tech Strategy" – is combining the resources of all government ministries, committing EUR 4 billion annually to the development of cutting-edge technologies.
- German government has set a biofuels share by energy content target of 12 percent by 2020 – seven percent above the stated EU target
- Some other focus areas for automotive R&D are:-
  - Improving internal combustion engine energy efficiency
  - Developing alternative drive technologies (like electric, hybrid and fuel cell cars)
  - Adapting lightweight materials and electronics

Source: "The Automotive Industry in Germany" by GTAI

Much of the automotive R&D in Germany is concentrated in southern Germany and is supported by various R&D performers

- **Baden-Württemberg Cluster**: Automotive and engine manufacturers in this area account for sales of €38bn in 67 factories.
- The region's automotive companies have a long tradition of technological innovation with achievements such as airbag technology, cruise control, fuel injection systems and anti-blockage braking systems
- About 60% of all patents are from Southern Germany (Bavaria and Baden-Wurttemberg)
- Research spending in Baden-Württemberg is above the average of both Germany and the EU.
- Public and private R&D investment in the EU is 2% of GDP and 2.5% in Germany as a whole. But in Baden-Württemberg, total R&D outlays amounts to 3.7%
- Patent applications from this area are nearly double the German average at 112 per 100,000 inhabitants compared to the national average of 58

Overview of research-performing organizations in Germany



Source: Federal Ministry of Education and Research, Germany

7.2 Annexure

R&D learning from other sectors

Key findings from other industries

Pharma

- Indian companies have been doing strongly in certain areas of drug development value chain such as CRO, CMO, and Generics
- Companies have been utilizing India's cost competitive talent pool with strong capability in process chemistry, medicinal chemistry and analytical chemistry for drug development and research
- Low-cost FDA approved plants in India have also helped in custom manufacturing for pharma development
- Clinical trial and research industry has benefited from easily available drug evaluation candidates for low-cost

Engineering R&D

- India commands almost ~22% of global ER&D offshoring market with strong emphasis on embedded systems and CAD/CAM
- Companies have benefited from huge supply of skilled talent pool at low cost
- Indian companies have been at the forefront of IT-BPO outsourcing worldwide, and with time and competencies they created a foothold in high-value segments such as ER&D
- Factors such as developing products for local demand, changing demographics among western countries have also helped in growth of the ER&D industry

Bio-Tech

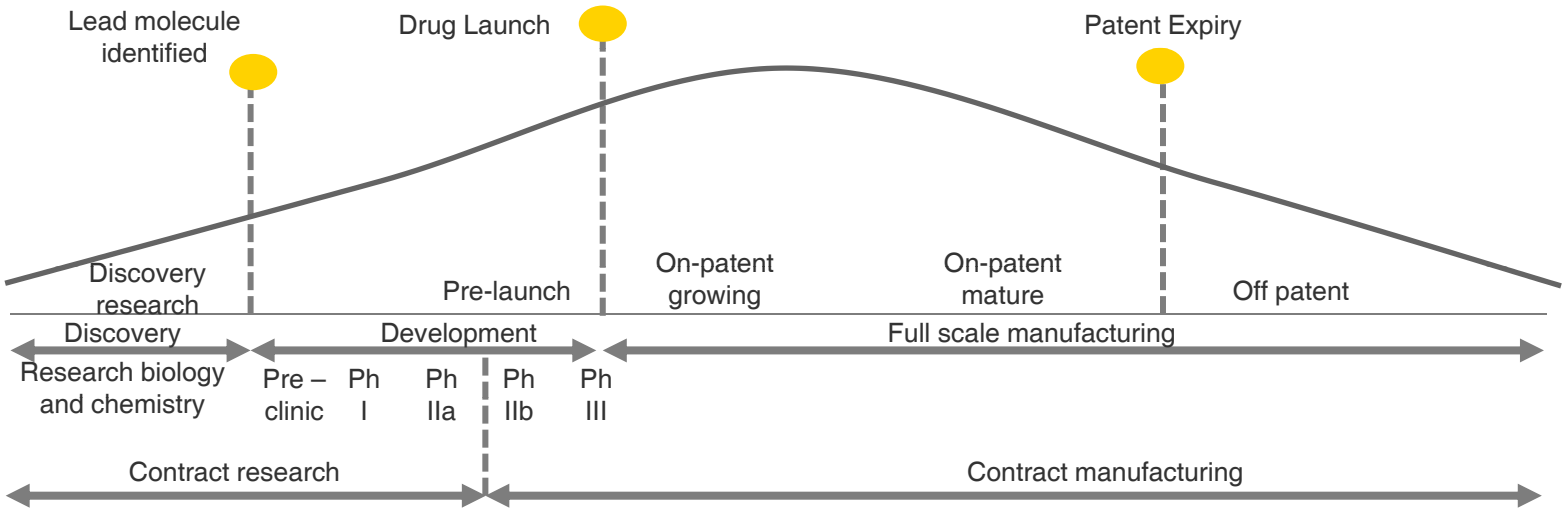
- Indian biotechnology industry has been growing at a CAGR of ~29% over the years
- Biopharma, Bioagri and Bioservies are the major segments with share of more than ~73%
- India has benefited from a large talent pool with low cost of innovation and manufacturing
- Strong domestic market for vaccines, BT Cotton and diseases such as diabetes have also contributed in the growth of the biotechnology industry in the country
- Support programs from Department of biotechnology have also helped the industry in its growth

All of these industries started with most basic development work, and by using India's huge pool of low-cost talent they are now working on high-end research and development activities

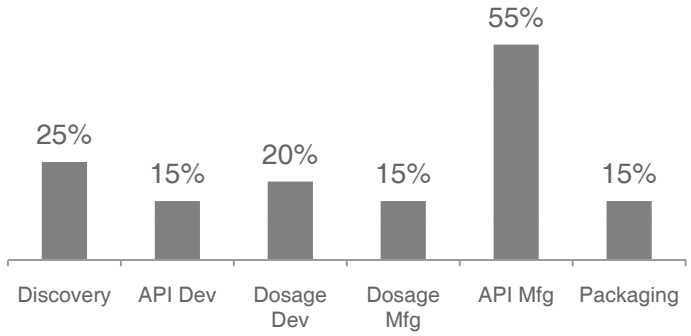
India has demonstrated similar strengths in other industries…

Pharma 7.2.1

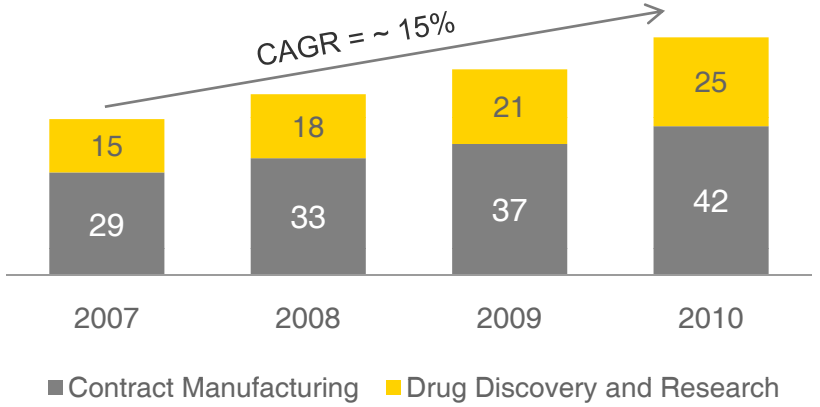
Pharma product development value chain and outsourcing happening globally



Extent of outsourcing in Pharma product development value chain globally



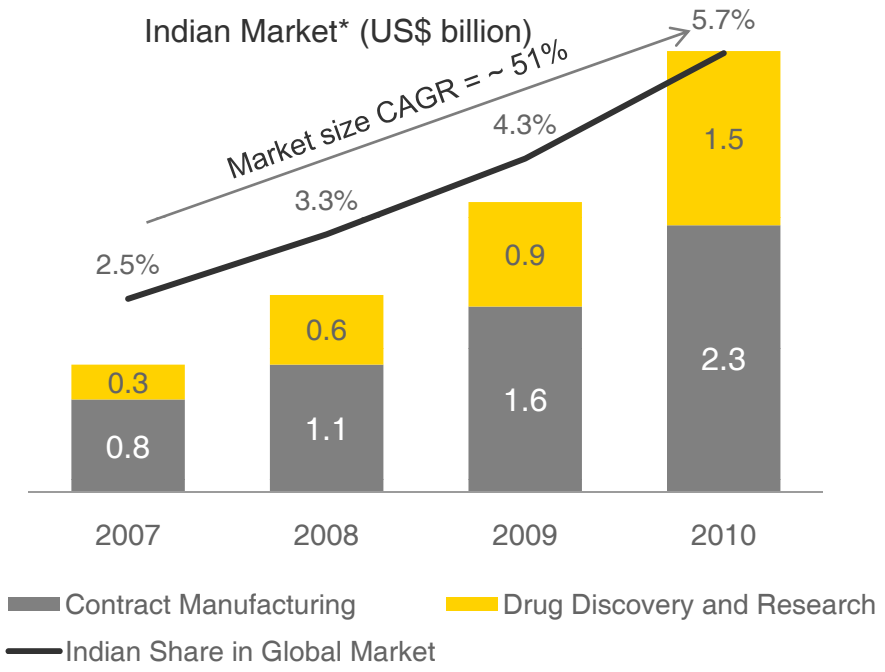
Pharma product development outsourcing market globally (US$ billion)



Source: Secondary Research, EY Analysis

India is playing an increasingly important role in global Pharma product development value chain

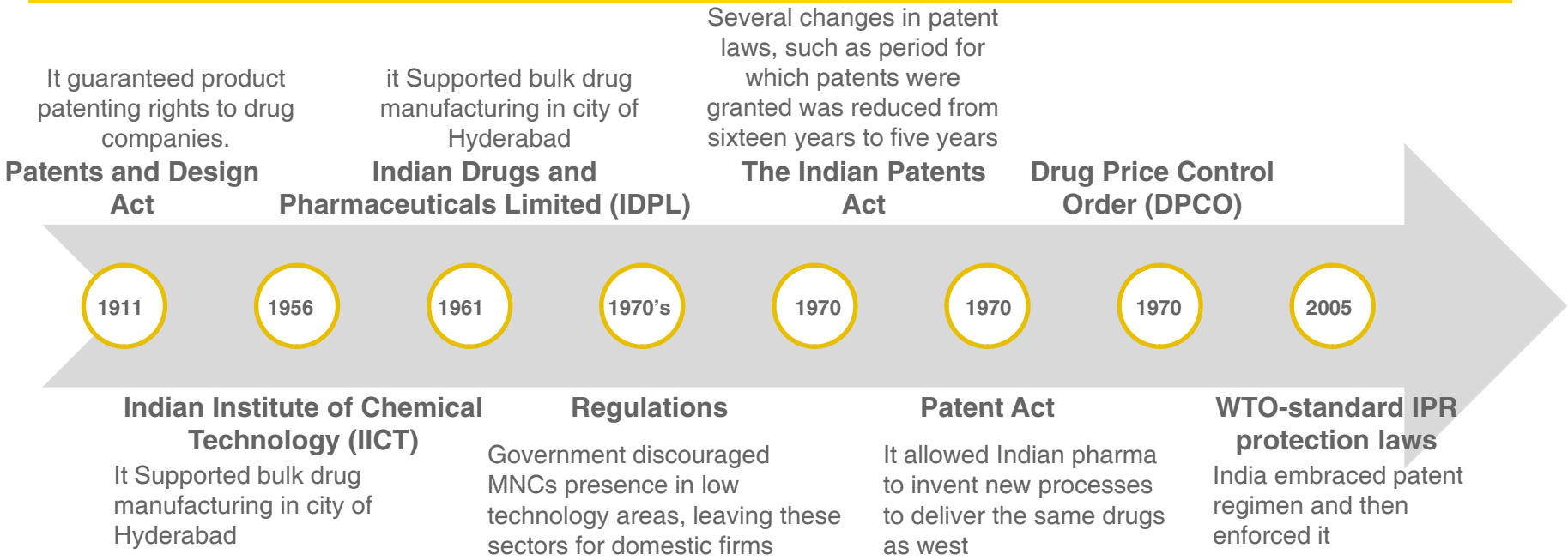
- Out of the estimated US$ 3.8 billion market in 2010, approximately US$ 2.3 billion pertains to contract manufacturing. Chemical synthesis being the major contributor followed by formulations & packaging
- Contract research market size at US$ 1.5 billion displaying strong growth driven by chemistry capabilities, skilled man power and cost value proposition
- Approximately 60% of the total US$ 2.3 billion Indian CMO market relates to chemical synthesis followed by formulation and packaging, which constitutes about 40%
- Indian players have taken in-organic route of acquisition to gain access to customers, regulated markets of America and Europe and niche technologies like sterile injectables, cytotoxics to build strong franchise for themselves



* Does not include number of clinical trial services market

Source: Secondary Research, EY Analysis

Triggers that helped in growth of pharma R&D and outsourced manufacturing industry in the country



Other factors that worked in favor of India

- India's Council of Scientific and Industrial Research (CSIR) developed many technologies that were used by even the top pharmaceutical firms in India
- Under the protective cover of state support, domestic firms developed reverse engineering capabilities in chemicals-based processes for pharmaceutical production
- Strong domestic market also supported pharma industry in India
- The large supply of skilled professionals in these countries at relatively low costs is a highly crucial one
- India and China are encouraging return-migration of their skilled professionals to energize high technology entrepreneurship back home

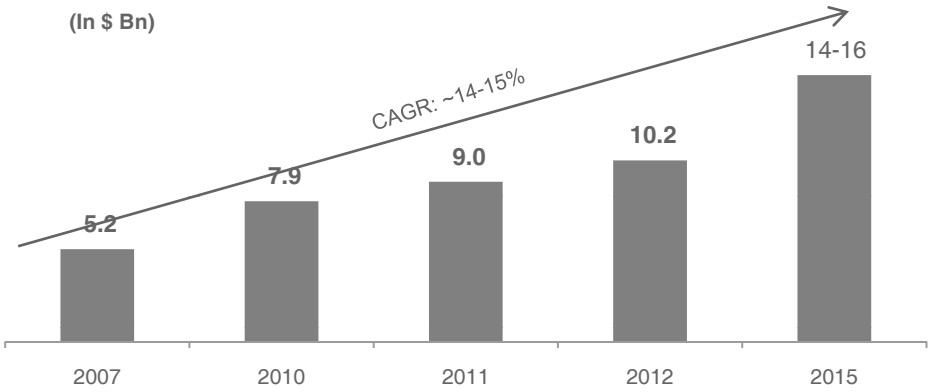
Source: Secondary Research, EY Analysis

India has demonstrated similar strengths in other industries…

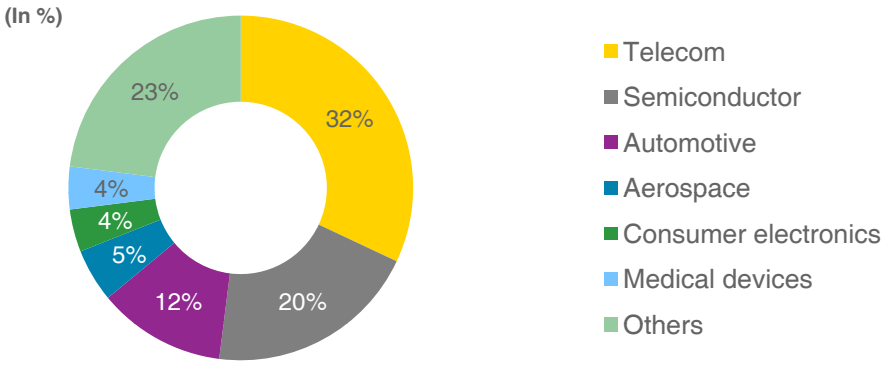
Engineering Research & Development 7.2.2

India has a strong foothold in the ER&D outsourcing market, with ~22% share in global ER&D offshoring revenues in FY2012

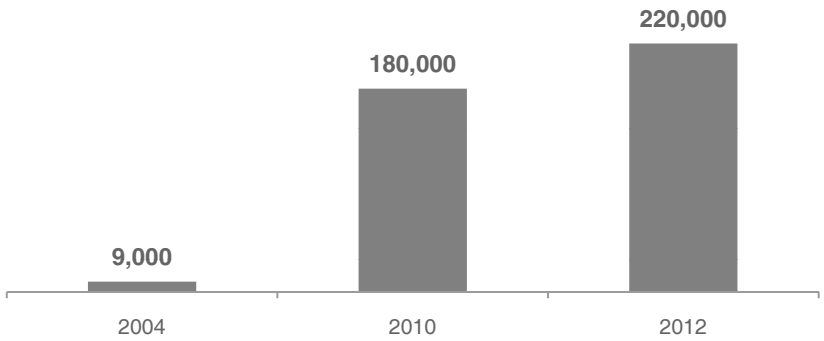
Indian ER&D service export



Offshore ER&D revenue by different sectors (2012)



Number of engineers - captives & service providers - India

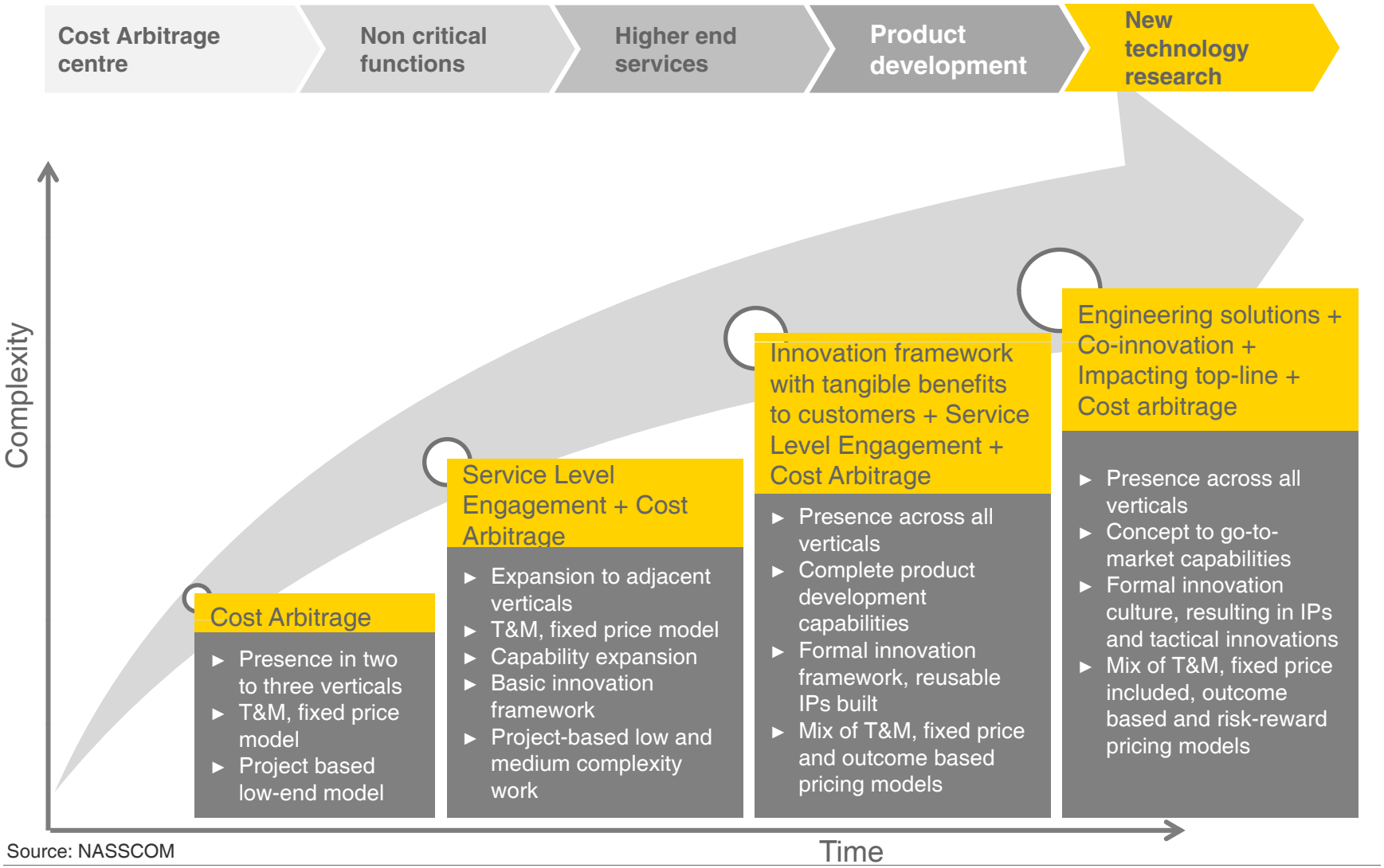


Source: NASSCOM Strategic Review 2011, NASSCOM Global ER&D Report

Definition

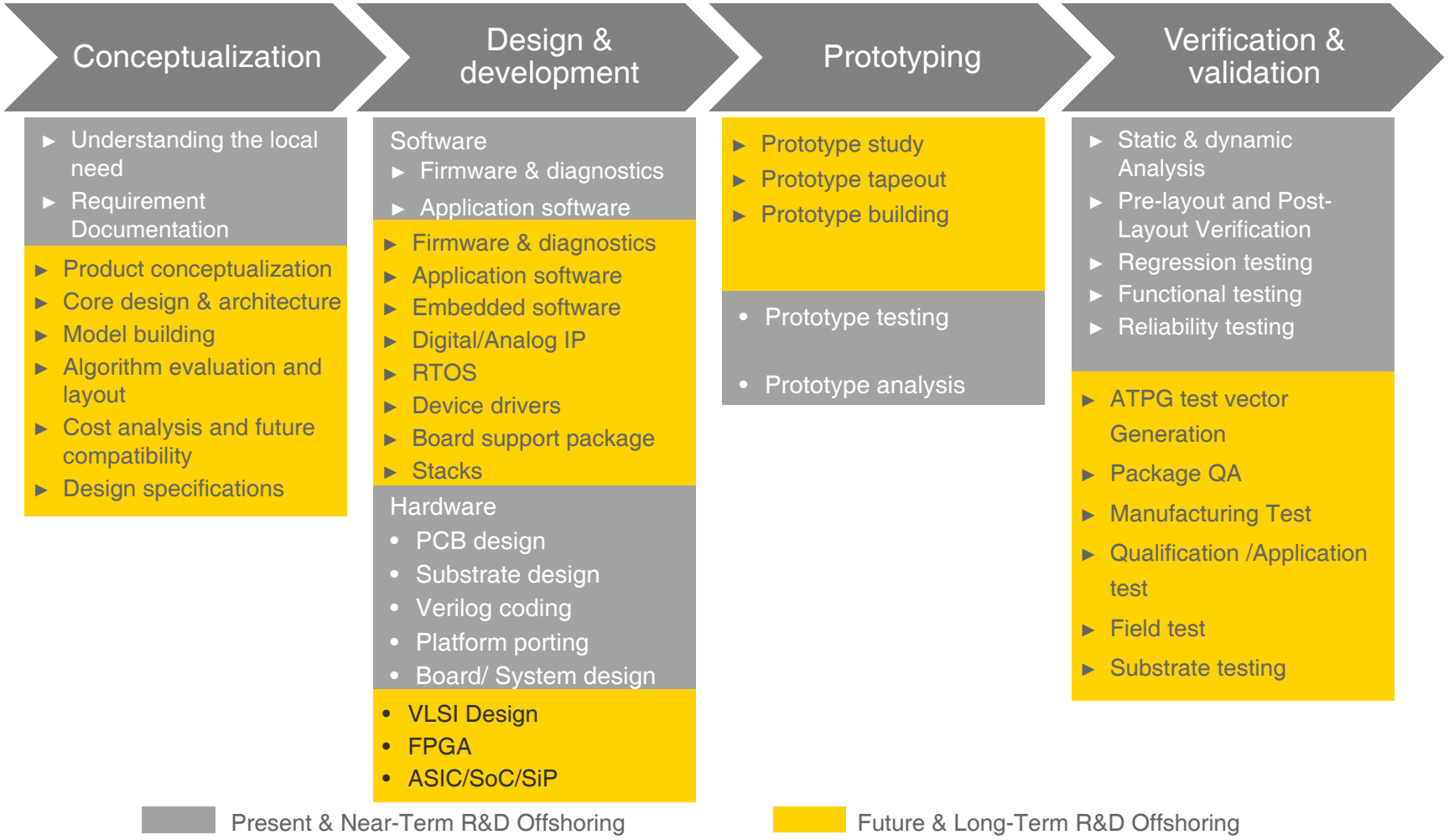
- ER&D services are those that augment or manage processes that are associated with the creation of a product or service, as well as those associated with maximizing the life span and optimizing the yield associated with a product or asset. This not only includes design elements of the product or service itself, but also encompasses the infrastructure, equipment and processes engaged in manufacturing/delivering them.
- R&D service involve providing research and development for hardware and software technologies, as well as development of software running on embedded systems. This includes computer-aided design (CAD)

Indian ER&D players have been steadily moving up the value chain in terms of complexity of work performed over the time



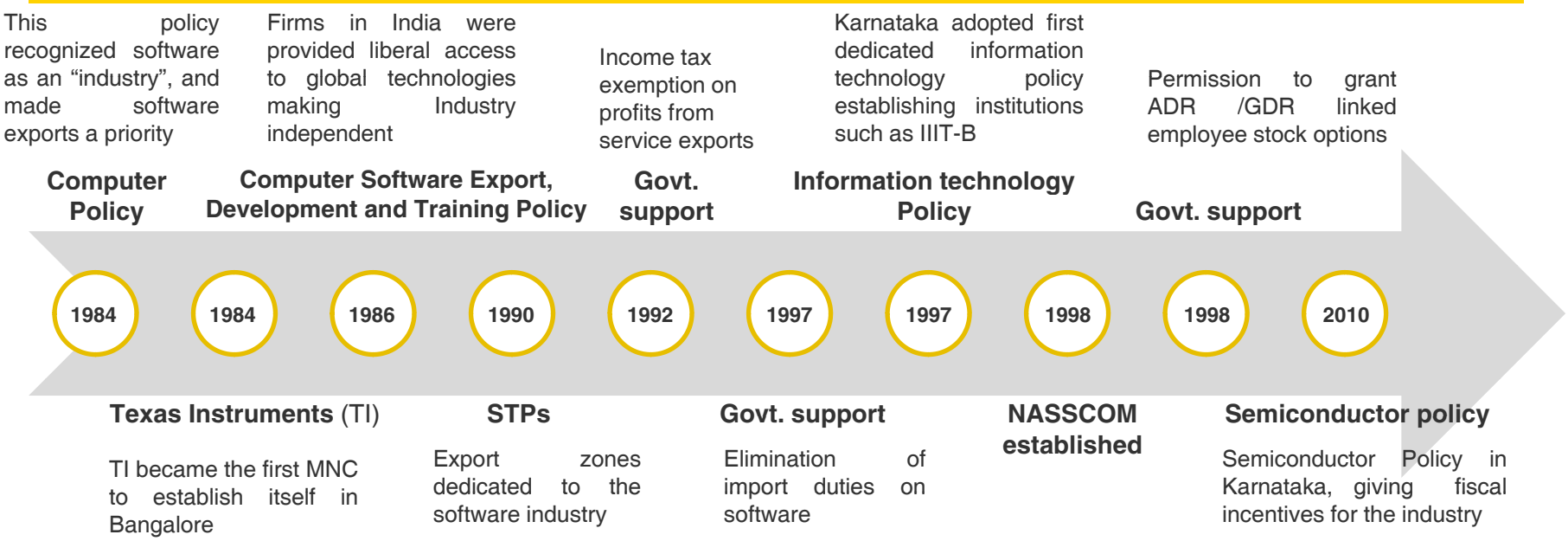
Source: NASSCOM

In the case of embedded systems, India is gradually expanding its capabilities—high-end R&D in embedded domain is yet to be offshored



Source: NASSCOM

Triggers that helped in growth of industry in the country



Other factors that worked in favor of India

- India has necessary **skill/cost advantage**
- **Language advantage** – Indian had the advantage of a huge young population which was comfortable in working in English
- Indian firms focused on adopting **industry-wide certification norms**, such as the ISO-9001/9000-3 standards prescribed by the International Standards Organization, and the Software Engineering Institute's five-level Capability Maturity Model (SEI-CMM)
- Slowly but steadily, with years of experience on serving export market, Indian firms started building capabilities of their own, also many **entrepreneurs** who were **returning home** not only with years of design experience but also vital exposure to sales and marketing in the global arena also contributed in the growth of market in the country

Source: Secondary Research, EY Analysis

Biotechnology 7.2.3

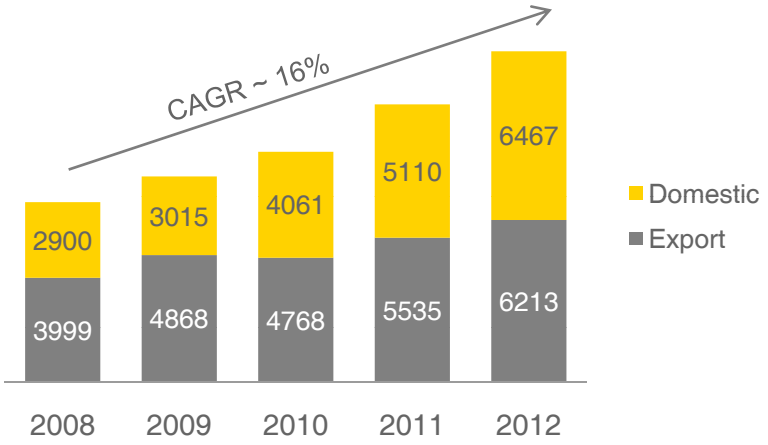
Biopharma represents a major segment of overall biotechnology industry in India

- According to Vision 2020: A Bio Pharma Strategy for India , a report by ABLE and PWC in the next decade 48 biologics with current sales of $73 billion are due to come off patent.
- Given the challenges of producing biosimilars in comparison to small molecule generics the existing strengths of Indian firms in biopharmaceutical manufacturing will make a positive difference
- Biopharma market includes:-
  - Vaccines
  - Therapeutic proteins
  - Stem cells
  - Diagnostics & devices
    - There is a 70% cost advantage that Indian labs offer for manufacturing of devices and diagnostic kits

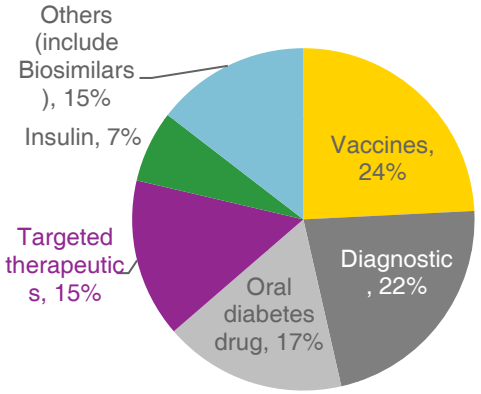
Vaccines

- India is the biggest global supplier of traditional vaccines
- India exports vaccines to over 150 countries
- Serum Institute of India is the world's 5th largest vaccine producer and supplies almost 50% of all vaccines to UNICEF/WHO
- Indian vaccines are innovative & affordable
  - Shantha's Hep B Vaccine: Price reduced from $15 to $0.5 per dose
  - Serum Institute of India launched Nasovac in 2010 at INR 160 (approx $3.5/dose) which is 50% cheaper than current prevailing prices)
- In vaccines human vaccines are almost 80% of market by revenue

Indian Biopharma industry revenue (in INR Cr)

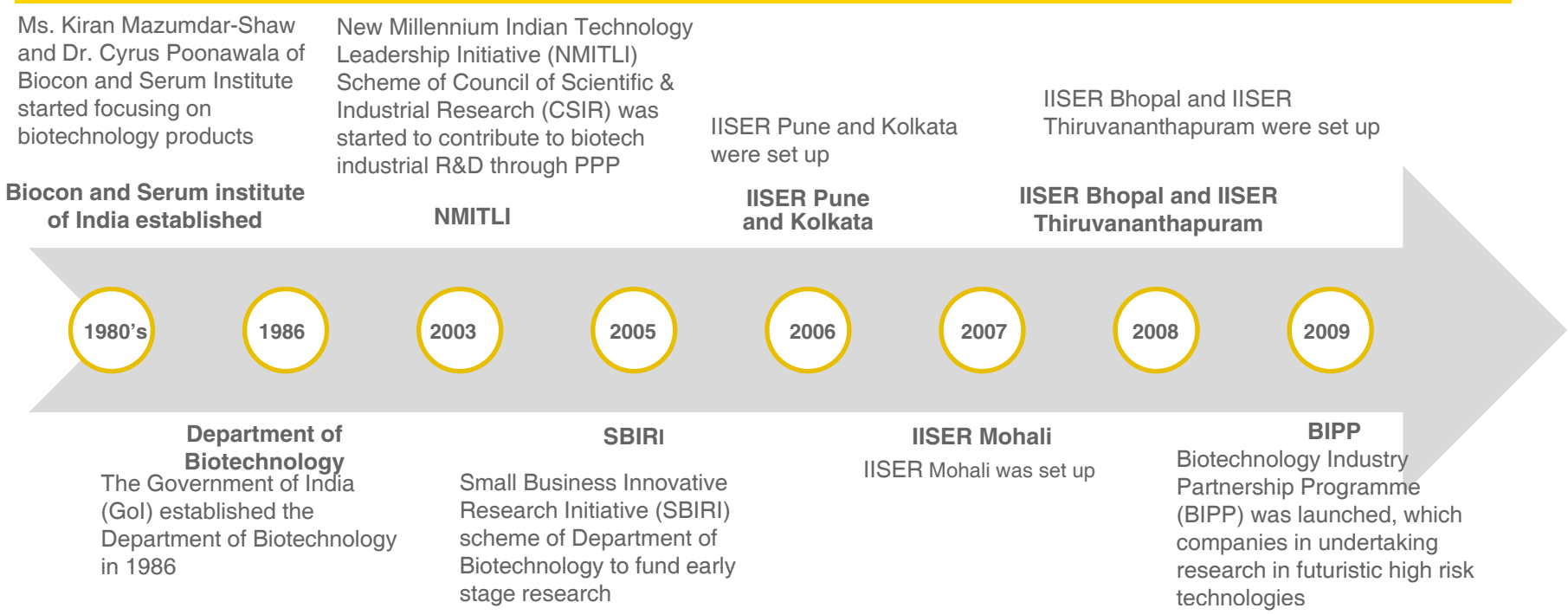


Indian Biopharma market split (FY 2010)



Source: Secondary Research, EY Analysis

Triggers that helped in growth of biotech industry in the country



Other factors that worked in favor of India

- Early Stage Funding–DBT has launched Biotechnology Industry Research Assistance Programme (BIRAP), Ignition Grant Scheme
- Exemptions for claiming weighted tax deduction @ 200% (enhanced from 150% to 200% during 2009-10) , extended till 2017
- According to data released by the Department of Industrial Policy and Promotion (DIPP), the drugs and pharmaceuticals sector has attracted foreign direct investment (FDI) worth US$ 1.67 billion between April 2000 and March 2010
- Department of Biotechnology (DBT) spends 30 % of its budget on public-private partnership (PPP) programs
- Besides the central government initiatives, individual states are also doing their bit to promote the biotechnology industry. Karnataka takes the lead and the state's revised biotech policy offers many fiscal incentives and concession to prospective investors in the industry

Source: Secondary Research, EY Analysis

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ACMA

Automotive Component Manufacturers Association of India

About ACMA

The Automotive Component Manufacturers Association of India (ACMA) is the apex body representing the interest of the Indian Auto Component Industry.

Its active involvement in trade promotion, technology up-gradation, quality enhancement and collection and dissemination of information has made it a vital catalyst for this industry's development. Its other activities include participation in international trade fairs, sending trade delegations overseas and bringing out publications on various subjects related to the automotive industry.

ACMA's charter is to develop a globally competitive Indian Auto Component Industry and strengthen its role in national economic development as also promote business through international alliances.

ACMA is represented on a number of panels, committees and councils of the Government of India through which it helps in the formulation of policies pertaining to the Indian automotive industry.

For Exchange of Information and especially for co-operation in trade matters, ACMA has signed Memoranda of Understanding with its counterparts in Australia, Brazil, Canada, Egypt, France, Germany, Iran, Italy, Japan, Malaysia, Pakistan, South Africa, South Korea, Spain, Sweden, Thailand, Tunisia, Turkey, UK, USA and Uzbekistan.

ACMA represents over 670 companies, which contributes more than 85% of the total auto component output in the organised sector. In the domestic market, they supply components to vehicle manufacturers as original equipment, to tier-one suppliers, to state transport undertakings, defence establishments, railways and even to the replacement market. A variety of components are being exported to OEM's and after-markets world-wide.

ACMA is inseparably linked with the auto component sector and hence forms the channel through which business contacts are established with the Indian Automotive Industry.

ACMA is an ISO 9001:2008 Certified Association

Further information and data on the Indian automotive industry is available on the ACMA Website: www.acma.in

For more information, please contact:

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