



**LEMBAGA GETAH MALAYSIA**

Kreatif • Inovatif • Progresif

# **R&D for Rubber Industry**

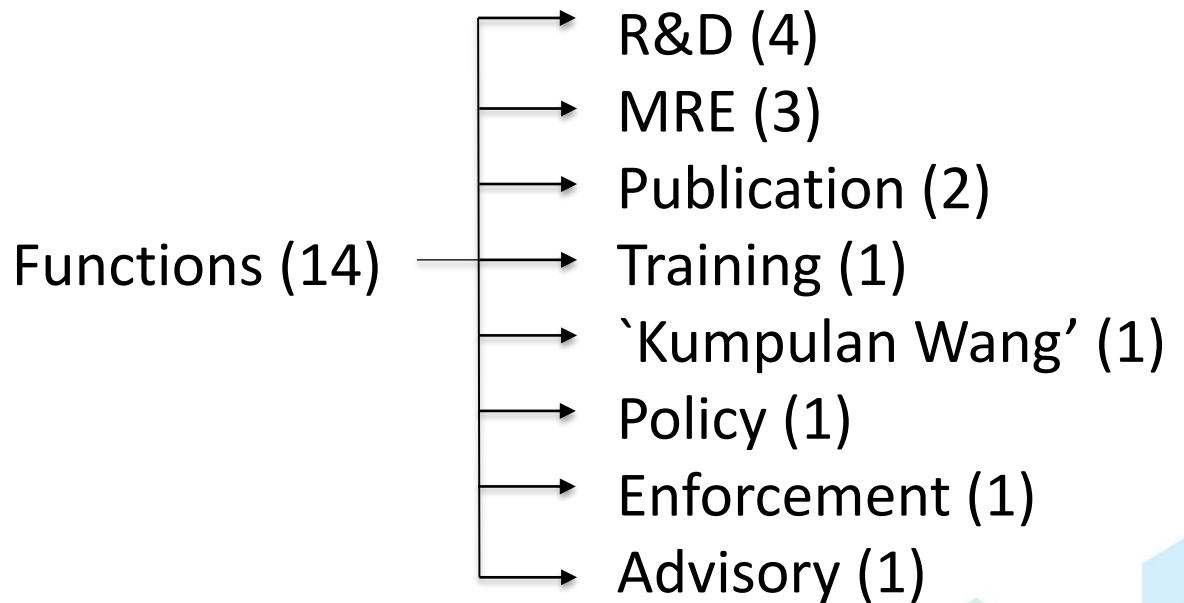
## **IPiCEX 2016**

**2 – 4 November, 2016**  
**Johor Bharu**

# MRB (Incorporation) Act 1996 (Act 551)



“Rubber industry” includes production of rubber and *heveawood*, processing and utilisation of rubber, manufacturing of rubber products and services related thereto;



# NR

# SR



## Upstream



Types of crop harvested



Petroleum

Latex

Cup lump

## Midstream (Raw Rubber Processing)



Latex Concentrate

(EPDM, SBR etc.)

Processed Rubber

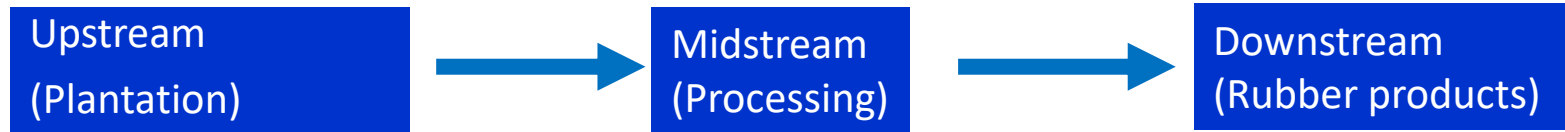


SMR

## Downstream Rubber products



# Sectors of Natural Rubber Industry



## Raw Materials

- latex
- cuplumps
- sheet rubbers (ribbed smoked, air dried)



## Processed Rubber

- Standard Malaysian Rubber
- latex concentrate
- specialty rubbers



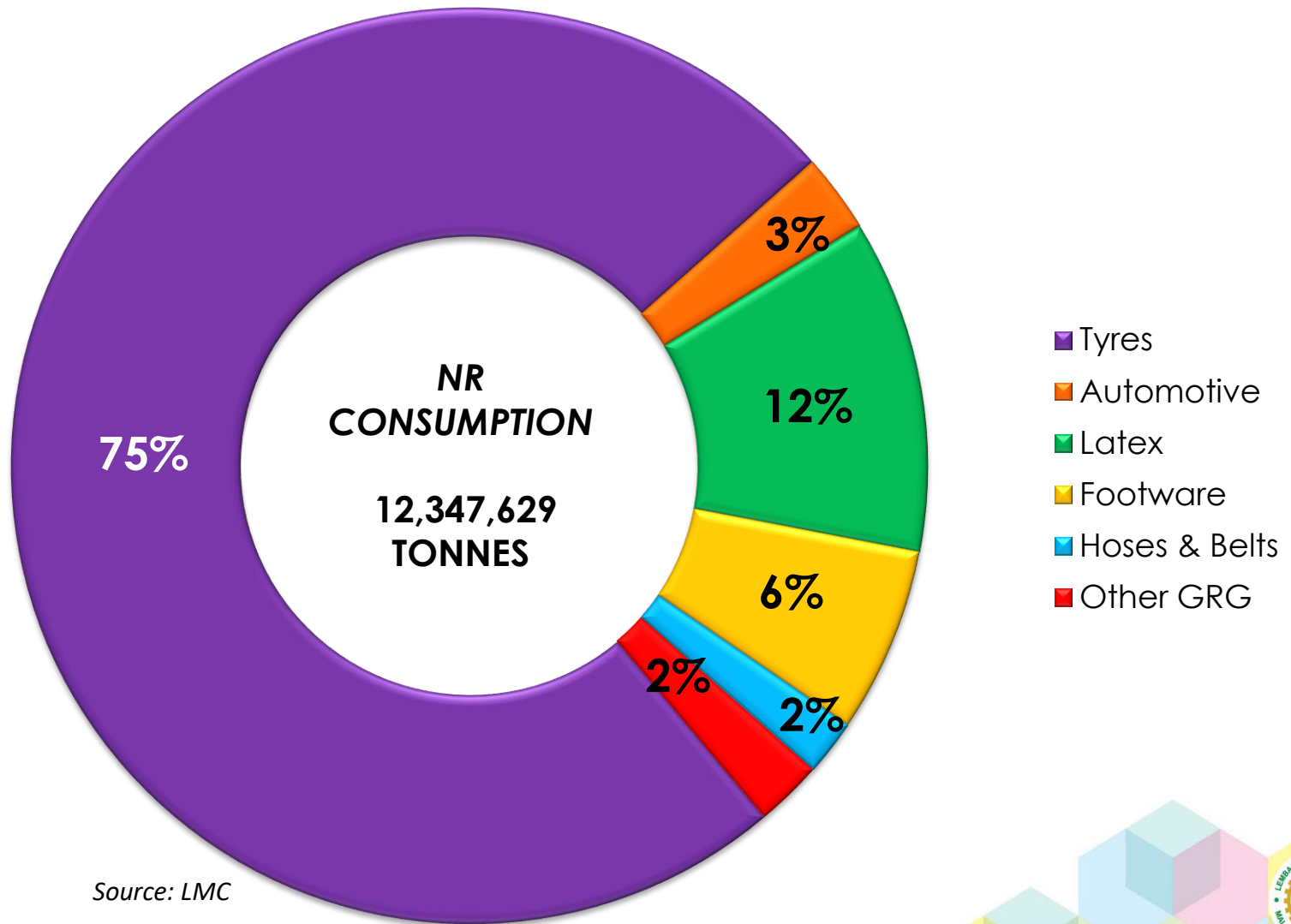
## Rubber & Rubber-based Products

- Gloves
- Tyres
- Automotive parts



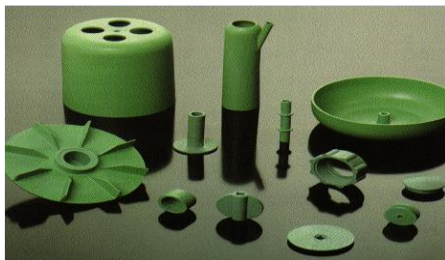
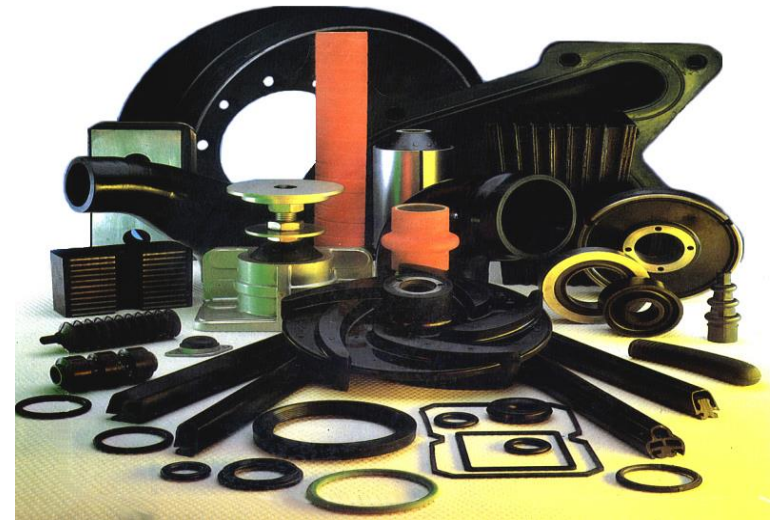


# World Industry Application of NR, 2015

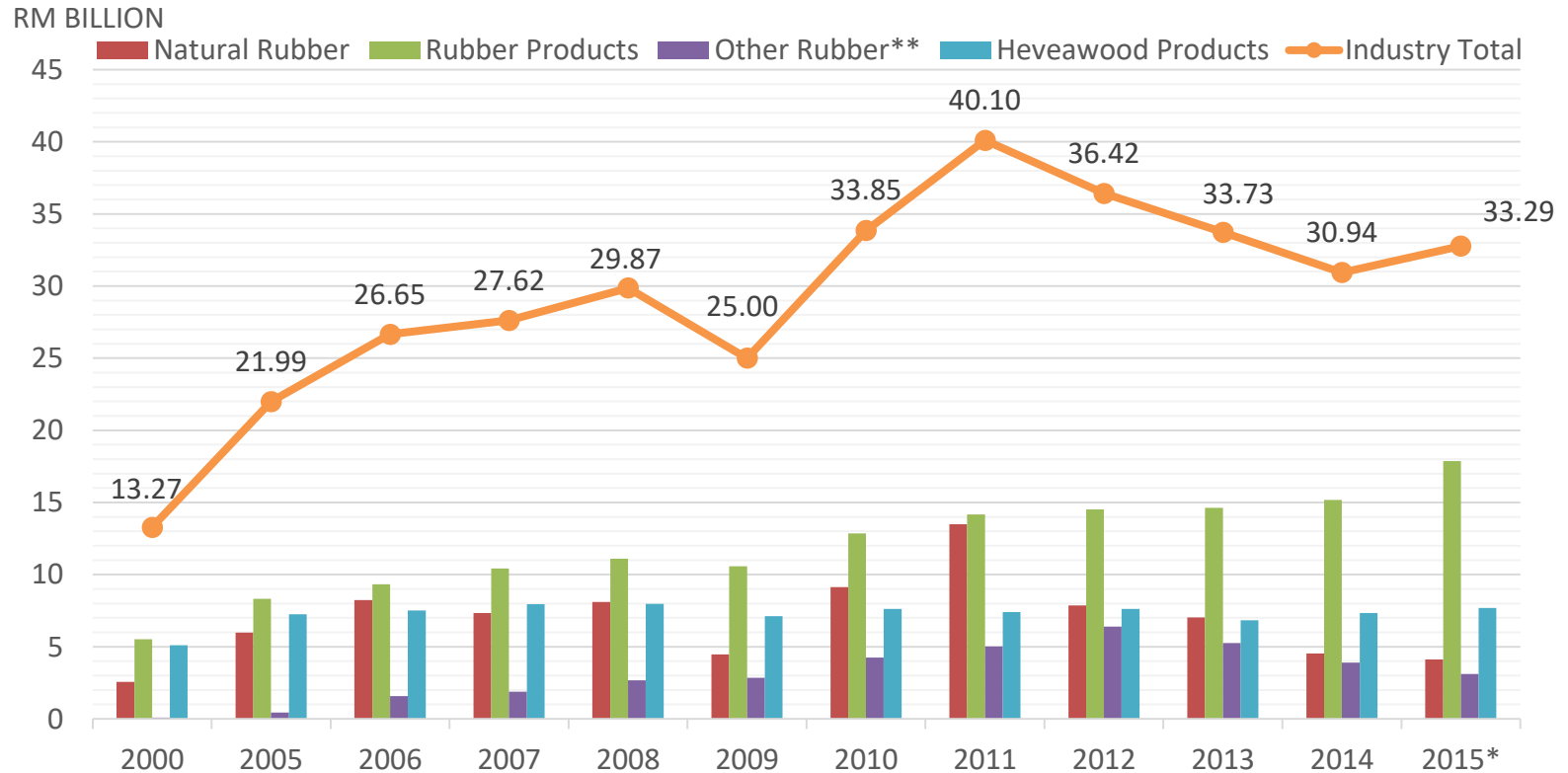


# Diversity of Rubber Products

*(Challenges and Opportunities for ISO/TC 45)*



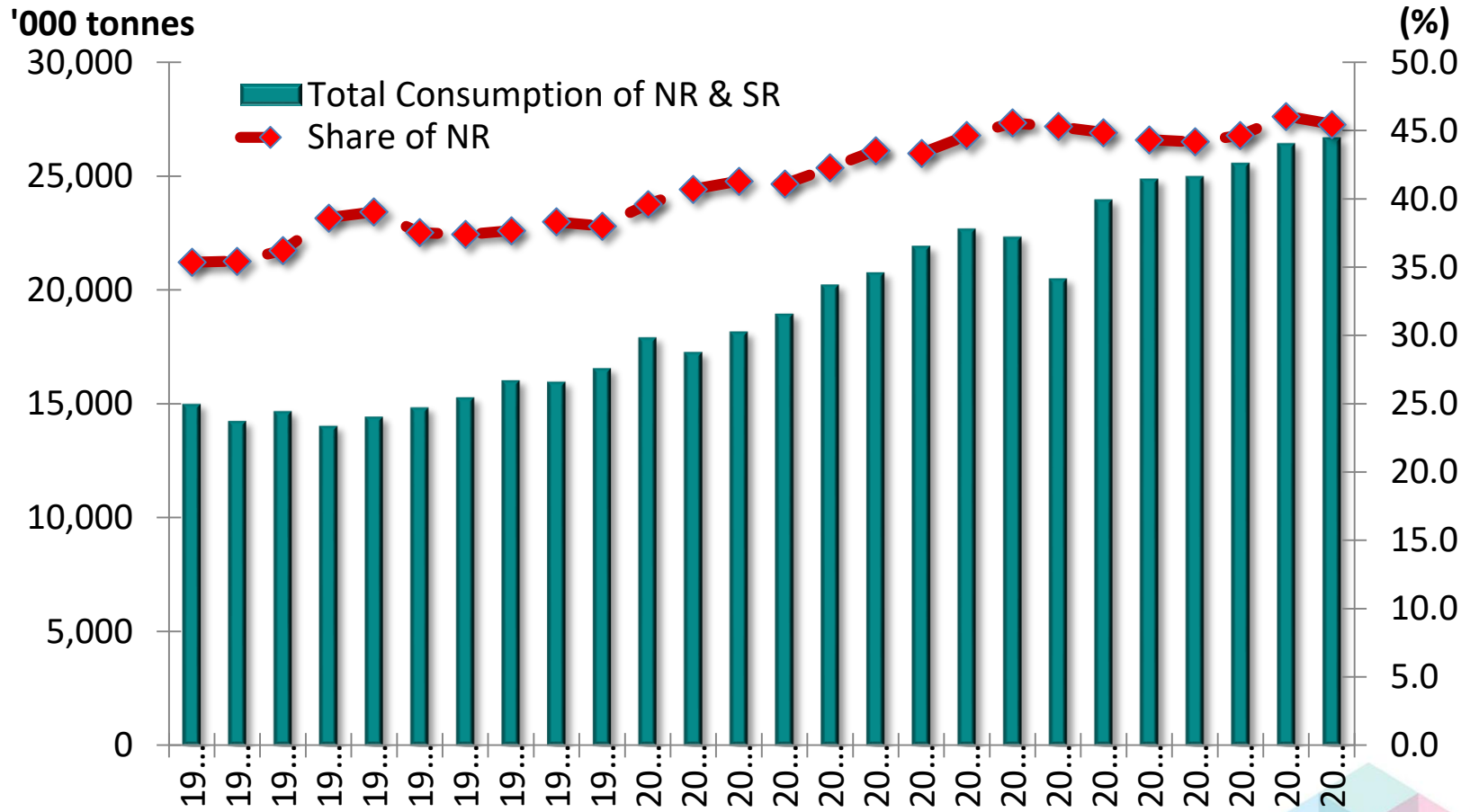
# Contribution of Rubber Industry to National Exports



Note: \*\* Other Rubber: Synthetic Rubber, Reclaimed Rubber, Waste Rubber, Compound Rubber and Unvulcanised Rubber (HS Code 4002-4006)

Source: Department of Statistics, Malaysia; Malaysian Timber Industry Board (MTIB)

# Share of Natural Rubber in World Rubber Consumption



Source: International Rubber Study Group, IRSG



# R&D: Contribution and Achievement





# From initial 22 trees to 500 million rubber trees?





# Upstream Sector



**First commercial planting in Malaya started in 1896**



# Latex Harvesting Technology





# Midstream Sector





# Downstream Sector

**SHOCK CELL FOR OFFSHORE APPLICATION**



**SEISMIC RUBBER BEARINGS**

**IRANIAN PROJECT**



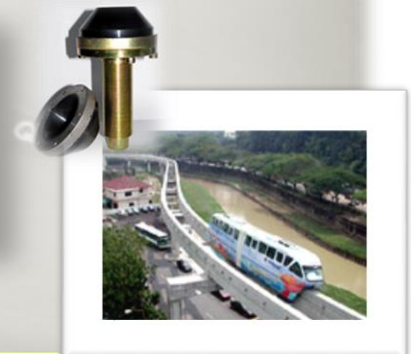
**PENANG BRIDGE II PROJECT**



**FLOATING SLAB TRACK BEARING**



**RUBBER BUFFER**



**RUBBER FENDERS**



**Automotive components**



**Rubber  
Gloves**



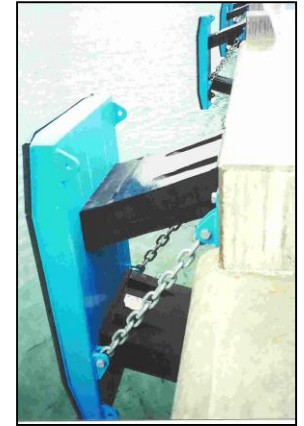




Flexible Traffic Guide Post



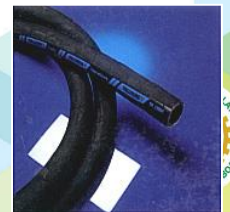
Dock Fenders for Ships



Buckling Fender

## Conveyer Belts and Hoses

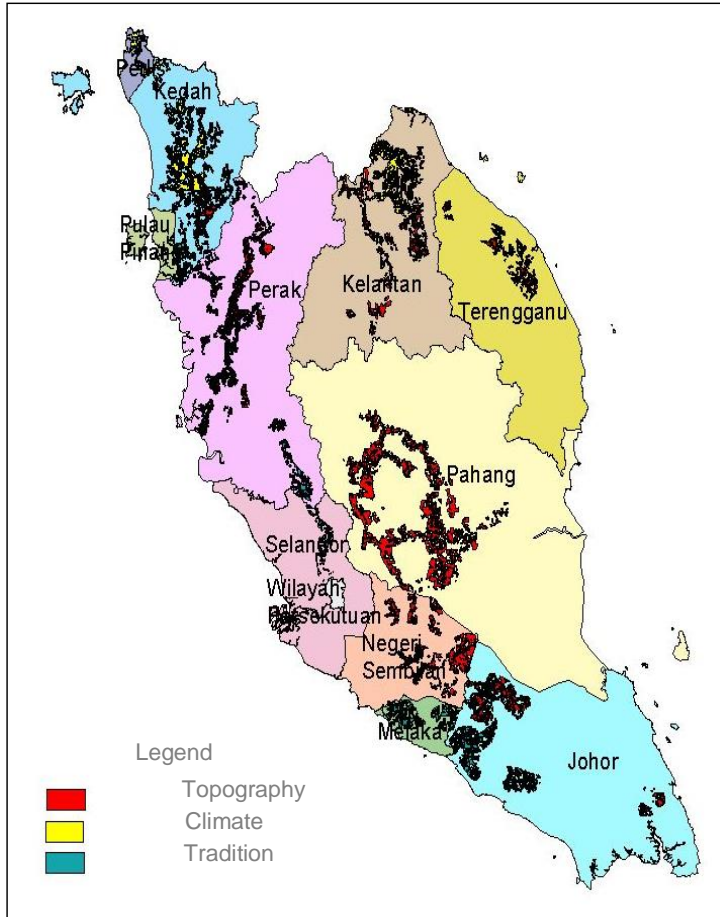
## Footwear and Components



# Current R&D&C



# Zon Getah Semenanjung Malaysia



Gambarajah 1

## Rubber Zone vs High Productivity

1. **Latex harvest technology**
  - a. **Stimulation**
    - i. Young *Hevea* trees – ethephon and EBF (MORTEX)
    - ii. Premium and older *Hevea* trees – ethephon, gaseous stimulation
  - b. **Method of latex extraction (conventional or short-cut system)**
  - c. **Tapping days**
2. **Clones**
3. **GAP based on precision agriculture concept, eg. stimulation, fertilizer application, soil-moisture.**



# Breeding of New Rubber Clones



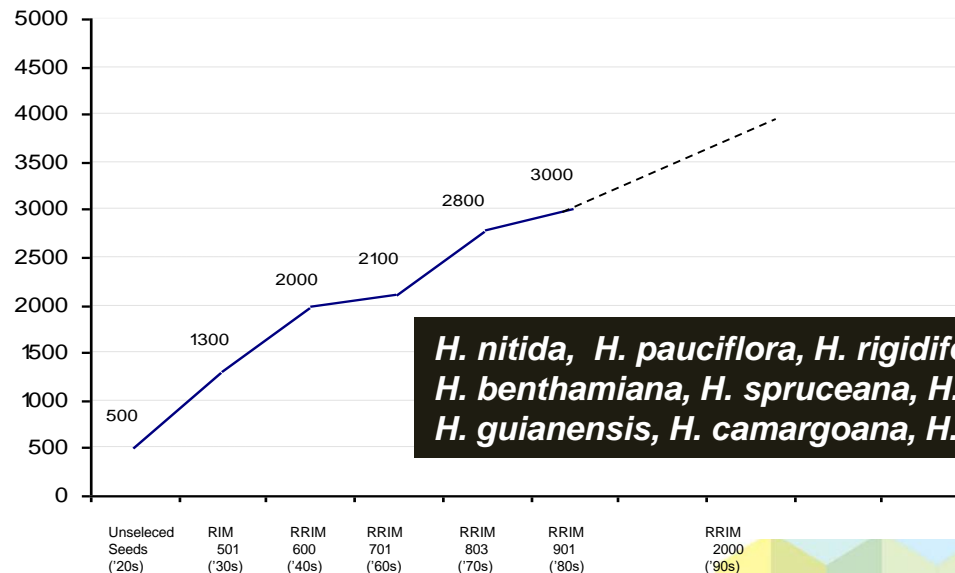
**1981 & 1995  
Expeditions  
to Amazon**



**Hand Pollination**



**Germplasm**



*H. nitida, H. pauciflora, H. rigidifolia, H. benthamiana, H. spruceana, H. microphylla, H. guianensis, H. camargoana, H. camporum,*





# Breeding and Production of Quality Planting Material



Bush nursery



Ground Nursery



Quality planting material



RRIM 2000 Series Clones: RRIM 2001 to RRIM 3001



# Mechanisation - Production of Planting Material

Approach : Fully Mechanised Nursery System (1 million capacity/year)



## Activities

### Rubber seeds

Quantity (Seeds)

±60 million

±30 million

Tonnes/year

300

150

Ratio (2WPb:seeds)

1:3

1:1.5

Flowering season

Limited

Not limited

Collection technique

Mixed

Fresh



### Root stocks

Germination rate

Low (<30%)

High (>70%).

**Production of planting material** – seed tray for production of germinated seeds and soil filling machine for filling-up soil in polybags (mechanization).



Soil filling machine :

Filling rate ie # polybags/day

**Mechanisation**

2,500-3000

**Conventional**

300-500

Wages (RM/worker/day)

40

40

# or workers (RM/day)

2 (80)

6 (240)

# of working days/month

24

24

∑ RM/Month

1920

5760

Polybag cost (RM/polybag)

0.004

0.10



# Mechanisation – Field Mechanisation : Fertilizer Application

Objective : to increase efficiency by increasing land:man ratio and reducing quantity of fertilizer applied

gm/tree/year : 1000 gm (1 kg/tree/year)

@ 350 tappable trees/ha 350 kg @ 25 kg/bag → 14 bags of 25 kg/bag

If 2 workers @ 7 bags/worker @ RM7.00/bag = RM49/ha/worker (∑ RM98/ha)

Fertilizer machine - 'pocketing system'

- Land:man ratio ( $\pm$  20 sec/hole, 180 trees/hr, 1260 trees/7 hr, 3.6ha/machine with 2 operators @ 500 gm/tree



# Main Focus

1. New economic model for smallholders
2. Increasing latex production
3. Rubberised road based on cuplumps
4. Integration of agricultural activities in rubber ecosystem
5. Green tyres

# New Economic Model for Smallholders: Empowering smallholders into supply chain in the rubber industry



## Concept

1. Vertical integration
2. Clustering of rubber smallholdings
3. Rubber processing centre (PMG) as vendor rubber processing factory

## Instrument

1. Cooperative (cluster concept e.g. 200 smallholdings  $\pm$  600 ha/cluster)
2. Rubber processing Centre (PMG) @ 10 tonnes cuplumps/day to produce 7 tonnes crepe rubber (70% DRC)
3. Rubber processing factory e.g. SMR' @ 100 tonnes/day, clusters 14 PMG @ 7 tonnes/day

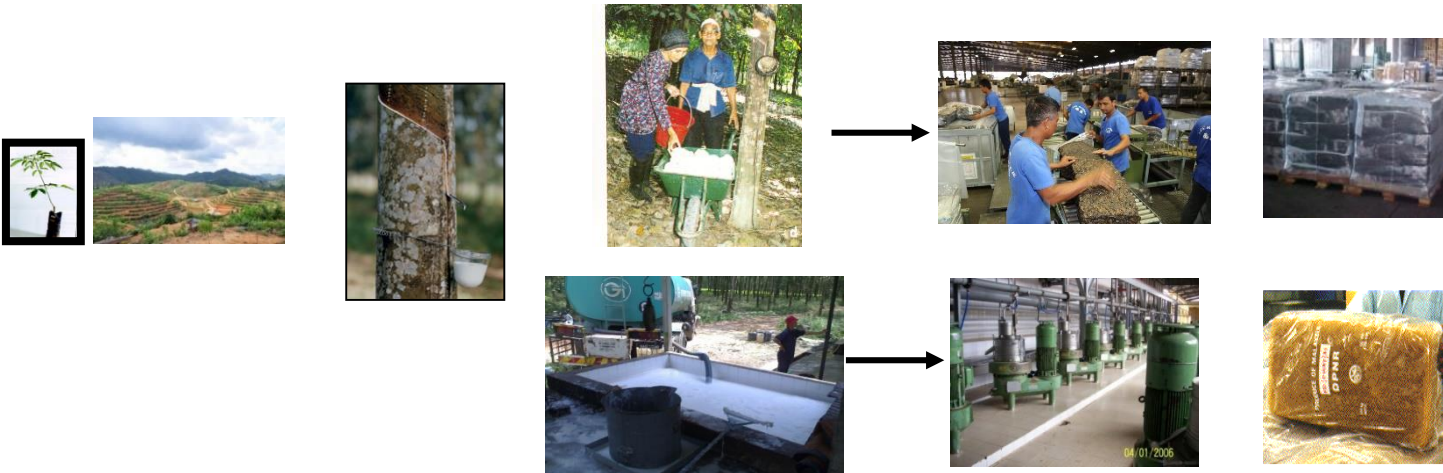


## VERTICAL INTEGRATION APPROACH

Upstream  
Supply of raw materials  
Latex or cuplump

+

Midstream  
Rubber processing  
SMR, Latex concentrate



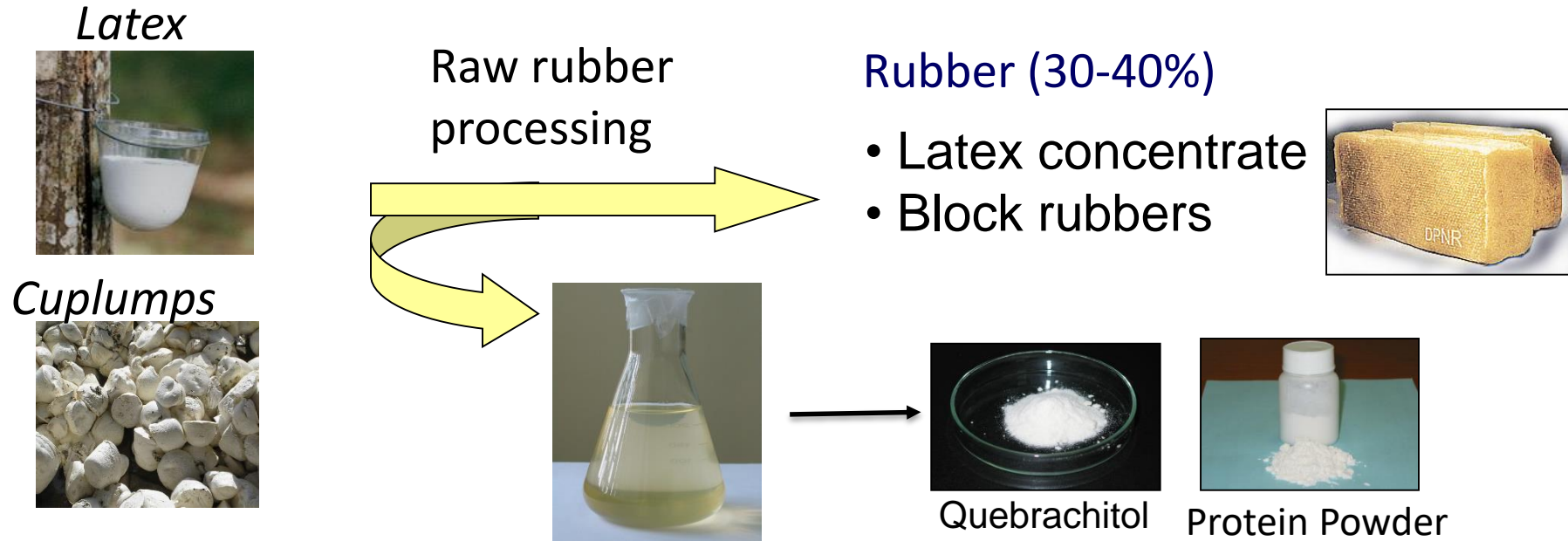
Vertical integration – a combination of upstream (rubber plantation) and midstream sectors (rubber processing).

Land development, planting and field maintenance : USD 4,000/ha/5 year and USD 200/ha/year from 6<sup>th</sup> to year 25<sup>th</sup> year (field maintenance)

SMR plant – 30 tonnes/day to 200 tonnes/day which require between 3,000 ha to 6,700 ha @ 30/kg (fresh cup lump)/ha/tapping.



# Natural Rubber Serum Products with Commercial Applications from Bioprocessing Technology



## Natural rubber serum (60-70%)

- Clear liquid byproduct (solid content = 3-5%)
- Disposed of as effluent
- Main source of pollutant from raw rubber processing



## Natural rubber serum (60-70%)

- Liquid Protein solution (20%)
- Protein powder
- Additional income to s/holders

# Quebrachitol



- Sugar fraction
- Applications
  - ✓ Alternative source of carbohydrate
  - ✓ Antibiotics and Enzyme Inhibitors
  - ✓ Inositol derivatives

# Serum Protein



- Applications
  - Industrial proteins and enzymes
  - Culture growth media
  - Food additives
  - Animal feed supplements

# INCREASING LATEX PRODUCTION



# Latex Production in Malaysia

Domestic  
Production

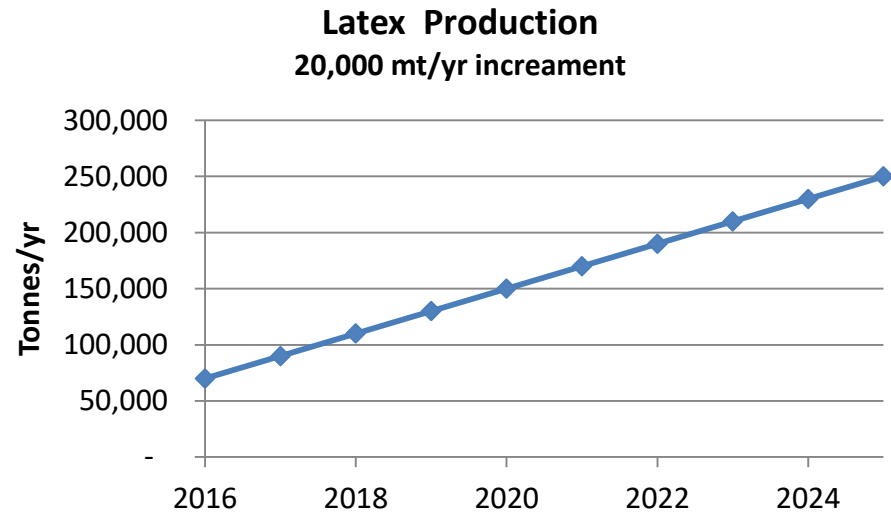
- 70,000 tonnes/yr

Import

- 400,000 tonnes/yr

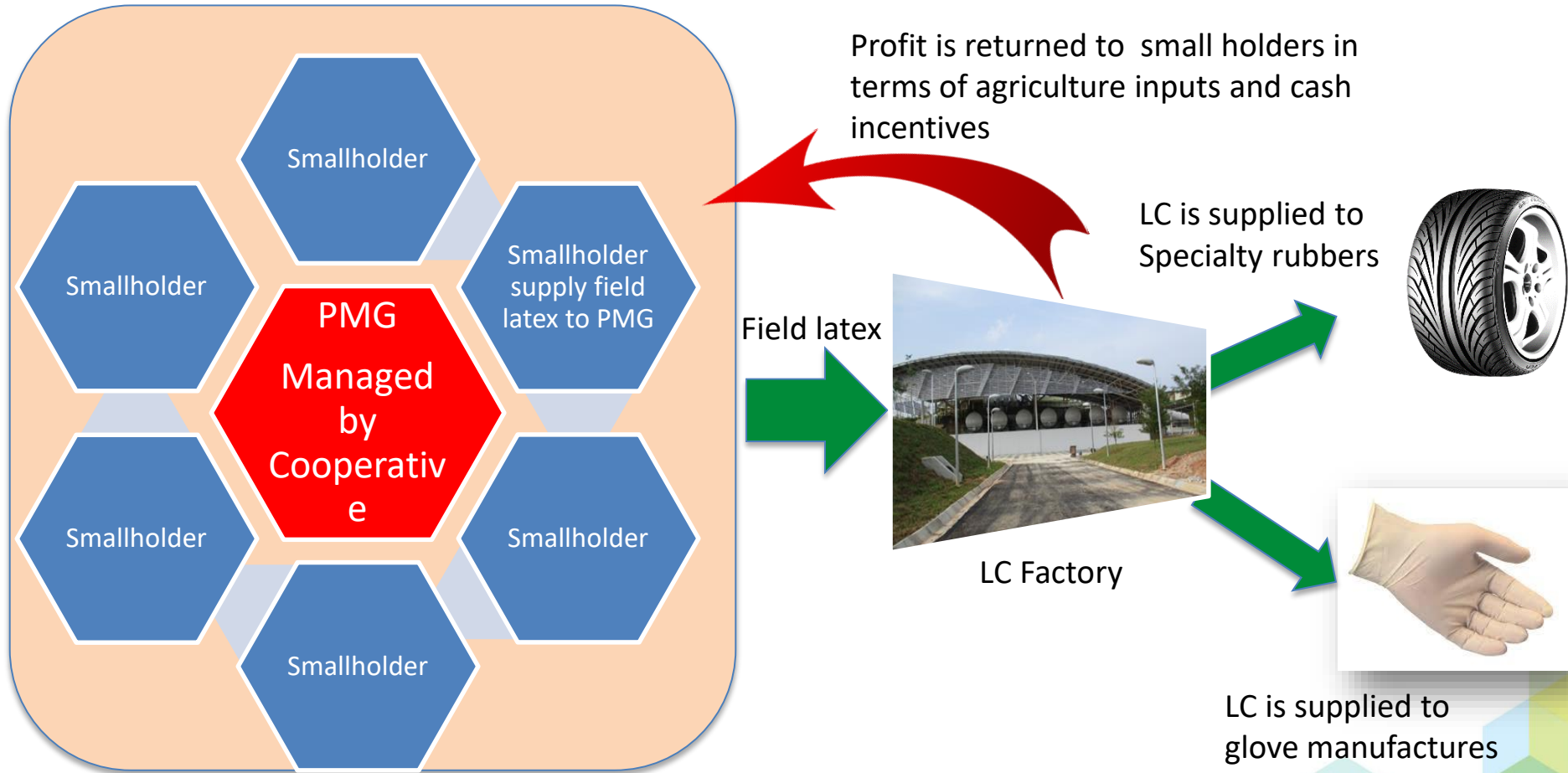
Target by  
2020 -700,000  
mt/yr

- 400,000 mt for Glove Ind.
- 300,000 mt for Specialty rubber





# Involvement of Smallholder in Rubber Processing



Cooperative is managed by small holders-  
Small holder will get better latex price, avoid middle –man,  
direct to factory

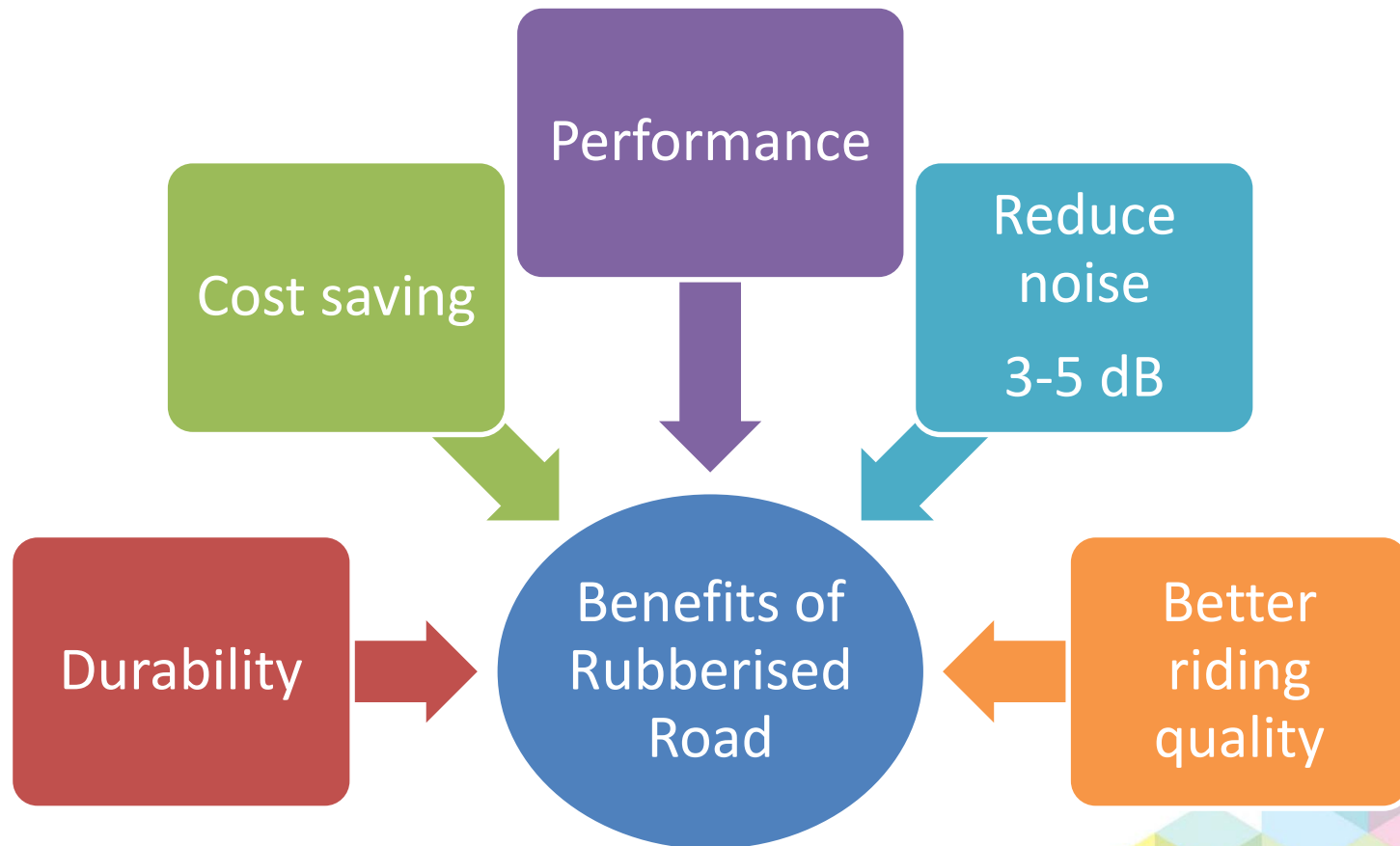
# Rubberised Road based on Cuplumps



# Rubberised Road based on Cuplumps

What is rubberised-bitumen?

A mixture of rubber (crumb or latex concentrate) and bitumen mixed at elevated temperature for a duration of time





# Sources of rubber as Additive to Rubberized Bitumen

Rubber Additive



Bitumen 80/100



Rubber modified bitumen

Current sources

Alternate Sources



Crumb rubber - tire



Cup Lump



Field Latex



Latex Concentrate



# **INTEGRATION OF CASH CROPS/LIVESTOCK/AQUACULTURE IN RUBBER ECO-SYSTEM**



# INTEGRATION OF CASH CROPS/LIVESTOCK/AQUACULTURE IN RUBBER ECO-SYSTEM Optimization of Land Use

1. Cash crop (vegetables, cereals, banana, pineapple)
2. Perennial trees (fruit trees, OP)
3. Livestock (chicken, goat, cattle)
4. Pasture eg napier grass (grazing or feedlot)
5. Aquaculture
6. Herbs (Tongkat Ali)
7. Moringa



# INTEGRATION OF CASH CROPS/LIVESTOCK/AQUACULTURE IN RUBBER ECO-SYSTEM



# WAY FORWARD FOR RETREADS INDUSTRY



# COMMERCIALIZATION





# Industrial Rubber Goods (IRG)

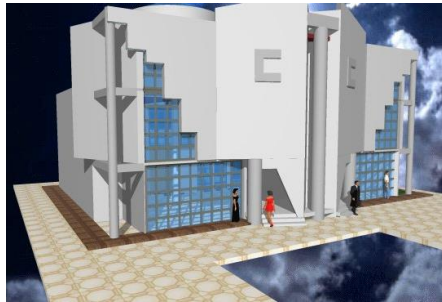


- Seismic Bearings



LNG tanks in China

San Bernadino USA



World largest single base Isolated project in Iran

First base isolated building in Algeria

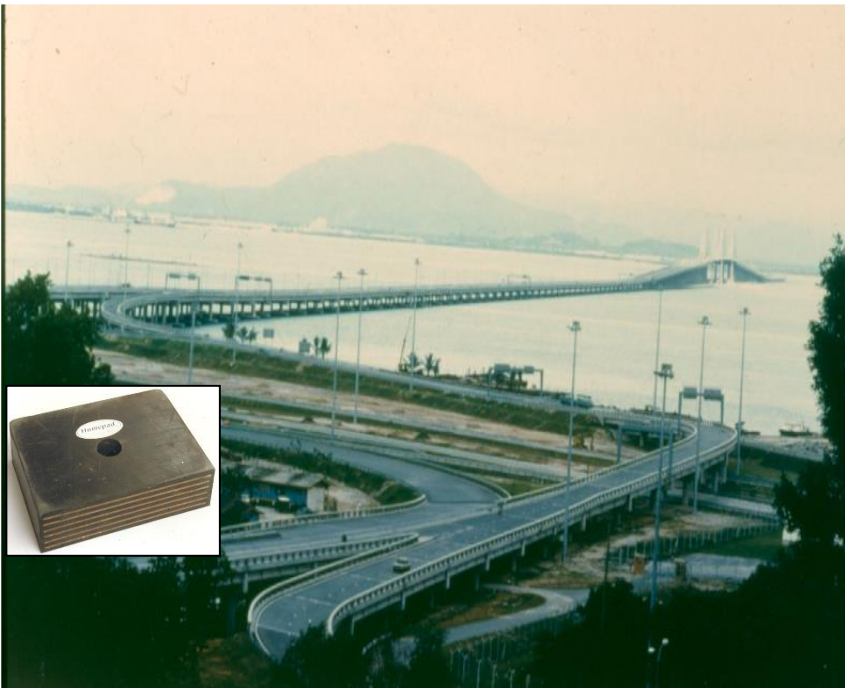


Indonesia



# IRG

- Seismic rubber bearings
- Rubber for offshore applications
- Base isolation – bridge bearings



Penang Bridge fitted with 9000 pcs  
of bridge bearing



**110-year old viaduct bridge in  
Melbourne Australia - still heavily  
trafficked structure**

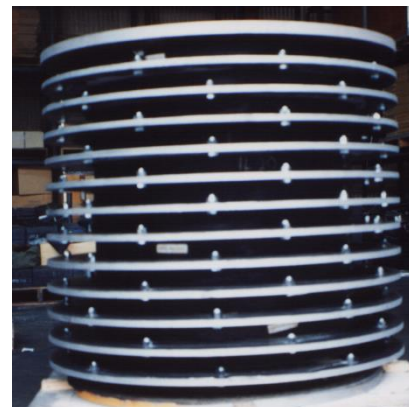
# IRG



- Seismic Bearings
- Rubber for Offshore



**Oil & Gas Offshore  
Production  
Application  
( Sarawak Shell -  
1995 - 1996)**



**Oil & Gas Offshore  
Production Application  
( Carigali Triton Project -  
2000-2001)**

**Oil & Gas Offshore  
Production Application  
(Nippon Oil Exploration  
Project 2002-2003)**





# IRG



- Seismic bearings
- Rubber for offshore
- Base isolation – bridge bearing
- Rubber for railways



Lateral suspension for KL Monorail

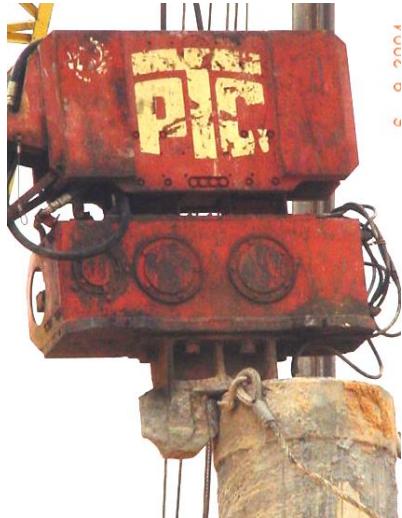


FST bearings for a  
Taiwan and Hong Kong project



# IRG

- Seismic Bearings
- Rubber for Offshore
- Rubber for Railways
- Vibrohammers Isolators for Construction Industries



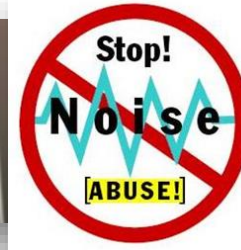


# RUBBERISED BITUMEN



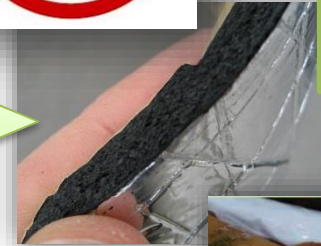
# Green Rubber Sound Insulator

ACT AS...



A sound wave barrier

CONSISTS OF...

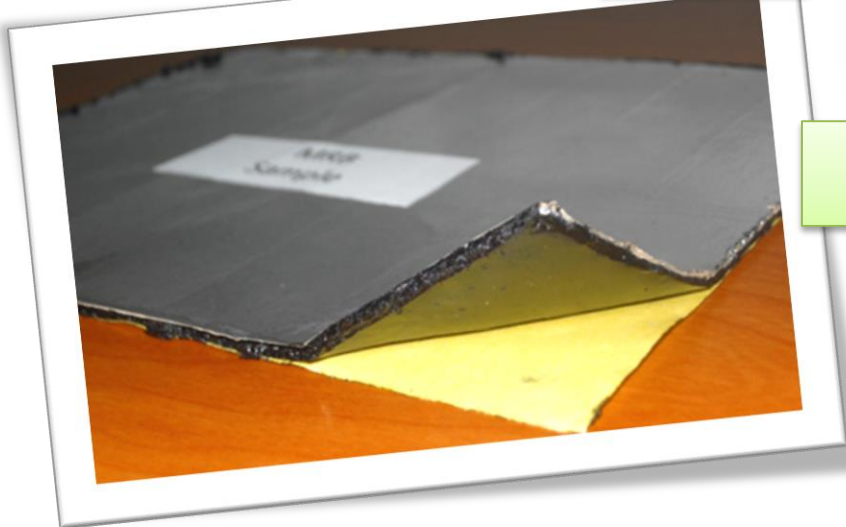


Rubber & Aluminum

MADE FROM...



Ekoprena



Potential Application

Automotive



Electrical Appliances



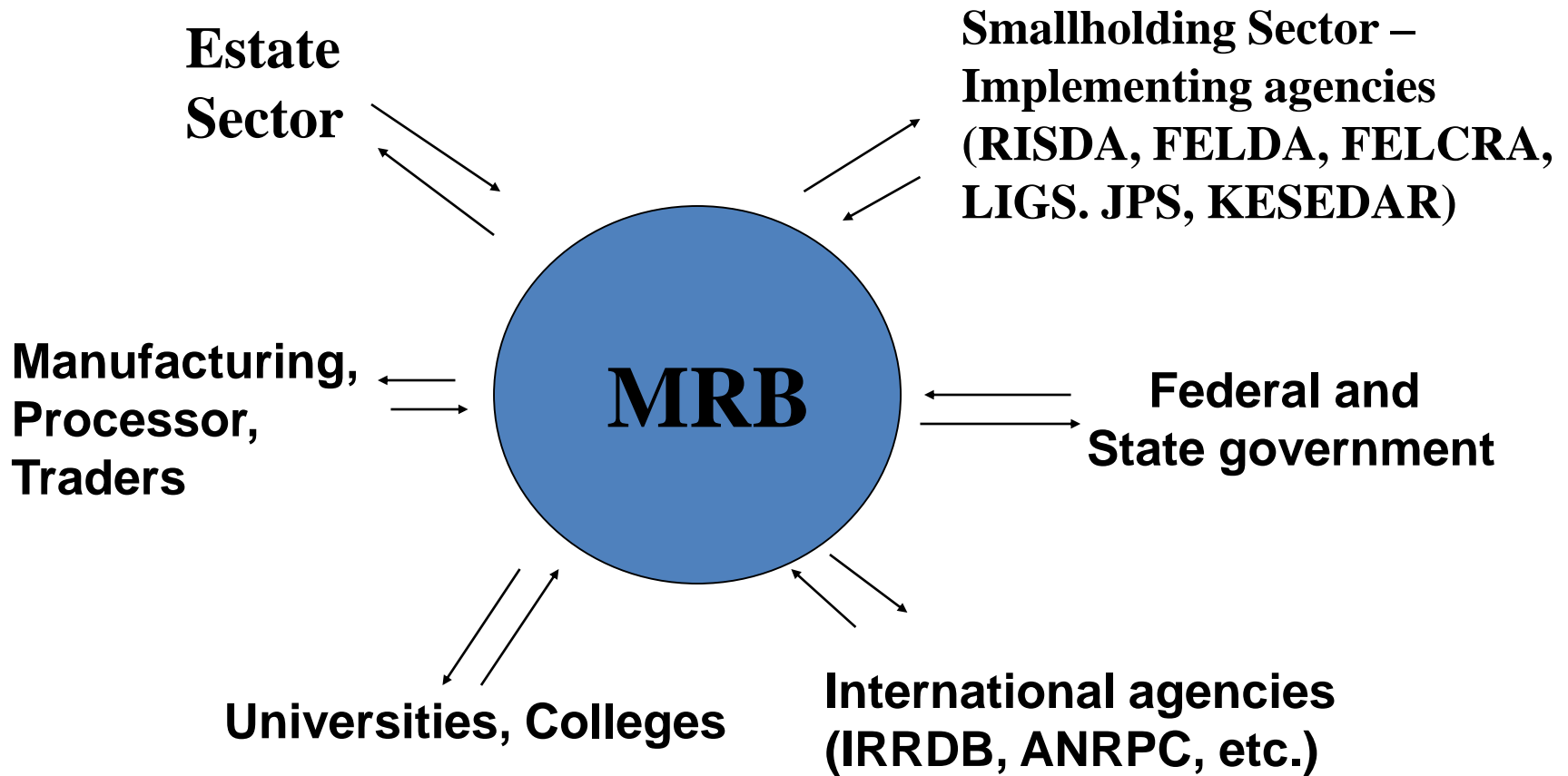
Building



# CHALLENGES



# Challenges?





# Challenges?

**Critical : R&D → Clients**

## **R&D**

- Improvement of technology
- Technical support

## **TOT**

- Awareness
- Training
- Participatory approach

## **Management of technology**

- Latex harvest technology
- Agronomic inputs

Marketing

Credit facility?

**Sosio-economy/Culture?**

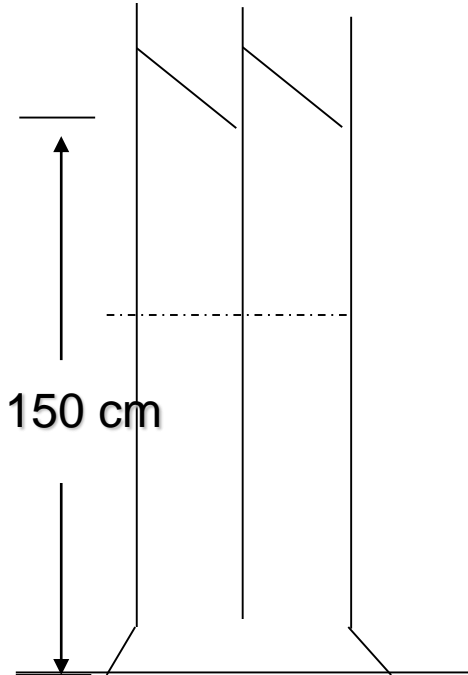
**ADOPTION OF TECHNOLOGY**

# CHALLENGES IN RELATION TO UPTAKE OF UPSTREAM TECHNOLOGIES

- **YPH and rubber production < potential**  
Target 2020 : 1800 kg/ha/year  
2015 : 1490 kg/ha/year
- **Labour shortage?**
- **Poor adoption of technologies – conventional system with high requirement of tappers is better than LITS concept? Less tapper, less rubber production?**
- **Transfer of technology (TOT)**
- **Inefficient field management**
- **Reduction in rubber planted areas**
- **Competition from low cost rubber producing countries**

# LABOUR SHORTAGE

## Impact of Tapping Frequency on the Economic Life of Rubber Tree



	cm/month	cm/yr	yr/panel	$\Sigma$ yr
d/2	2.5 (100%)	30.0	4.7	9.3
d/3	2.3 ( 90%)	27.6	5.0	10.0
d/4	2.0 ( 80%)	24.0	5,8	11.7
d/6	1.8 ( 70%)	21.6	6.5	13.0

## Impact of Tapping Frequency on Requirement of Tappers

1.43 ha/task  
350 trees/ha  
500 trees/task

	# of task	Ha/tapper	# of tapper/ 100 ha
d/2	2	2.86	35 (100%)
d/3	3	4.29	23 ( 66%)
d/4	4	5.72	17 ( 48%)
d/6	6	8.58	12 ( 34%)

# LATEX EXTRACTION METHODS in the 19<sup>th</sup> CENTURY



## Survey in 2010/2011







Ethephon  
(1969)



Mortex  
(2004)

← BO-1/BO-2 →

# CHALLENGES: 4% using latex stimulant (Survey 2010/2014)



67.25 tonnes MORTEX  
67,250,000 gm

4x/yr 16,750,000 trees  
6x/yr 11,166,666 trees

@350 trees (TSPH)

4x/yr 47,857 ha  
6x/yr 31,904 ha

M'sia 18k to 27k ha  
(2.5% to 3.8%)



Bark renewal

TPD

Growth  
Softer bark

Moisture content in bark

Productivity

DRC

Sucrose in latex



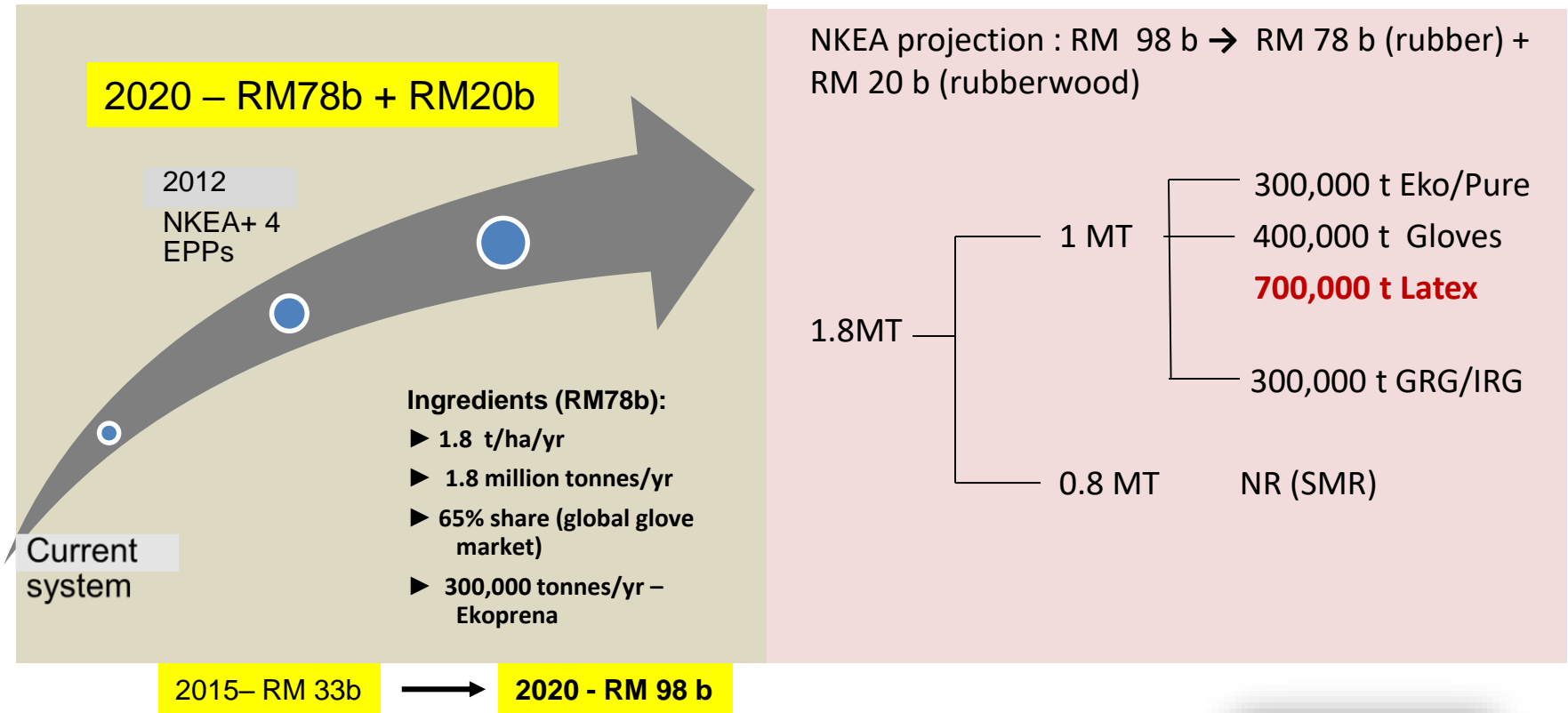
# Issues & Challenges in Rubber Downstream Sector

- Decreasing competitiveness of SMR
- Lack of new rubbers and value-additions in raw rubber processing
- Continued dominance & dependence on latex-based products
- Competition under liberalized trade
- Non-trade barriers
- Growing imports -1999 (RM1b) 2006 (RM 2.3b)
- Inadequate local raw material supply – latex & rubber wood
- Dependence on foreign labour
- Need more indigenous trained technical manpower in process and product development

# R&D – Next Step?



# Way forward ..... 2020 (Export value)





# STRATEGIES TO INCREASE PRODUCTION

- Increase replanting area to 40,000 hectare per year
- To expand rubber area (Sabah and Sarawak)
- Accelerate replanting to high yielding clones – Clone 1Malaysia (RRIM 3001)
- Promote mechanization and automation
- Enhance adoption in the appropriate technology in latex harvesting



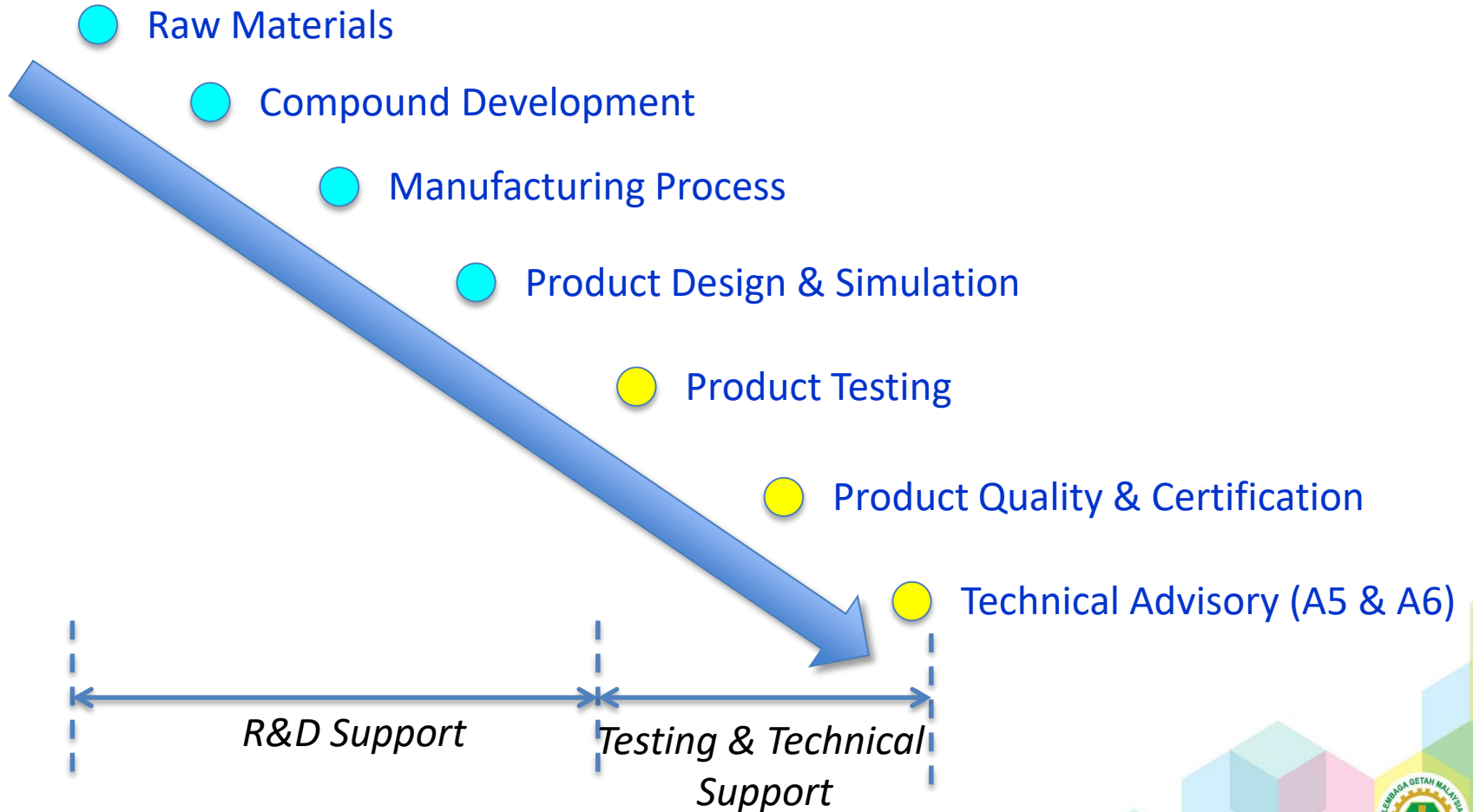
**LITS**



**Clone RRIM3001**



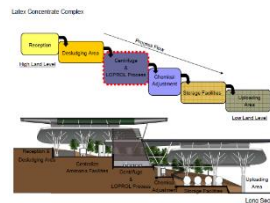
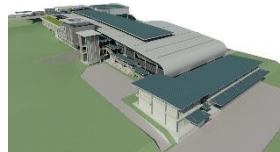
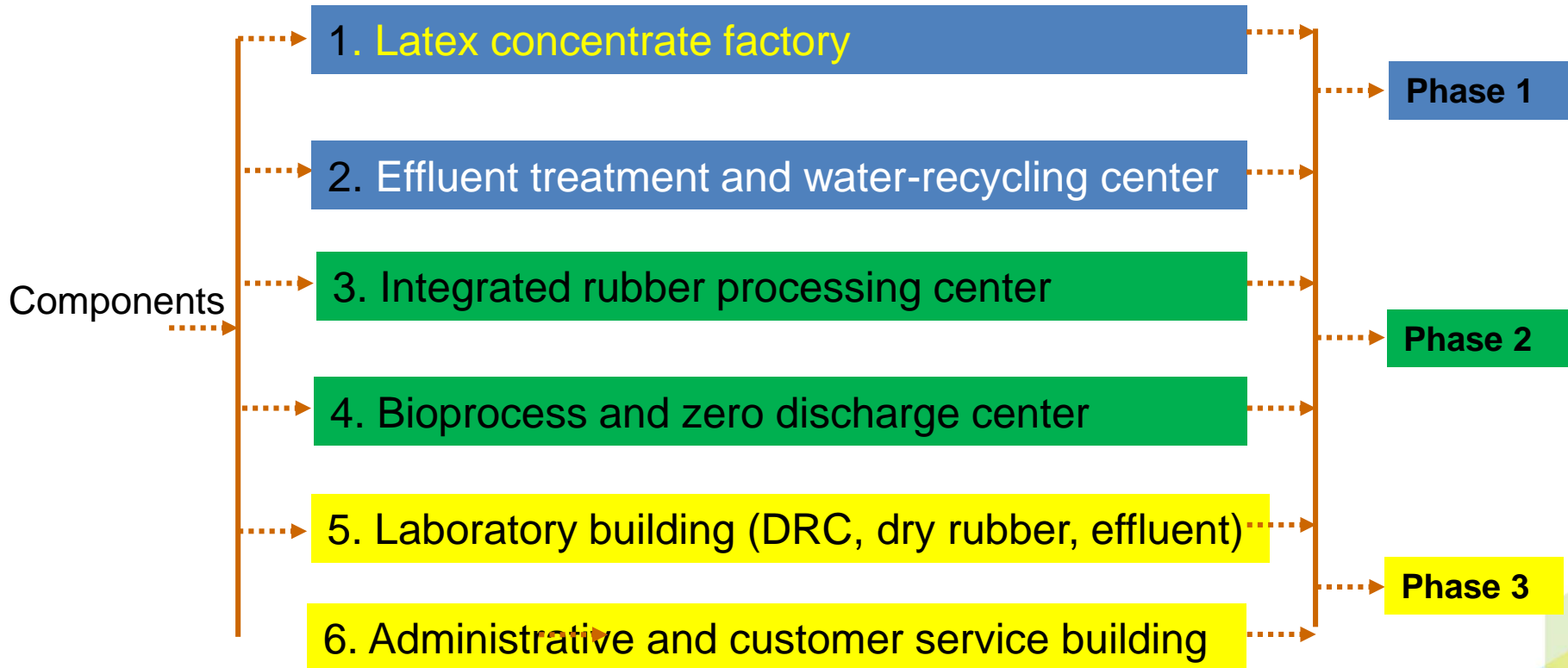
# MRB Supports for all Stages of Rubber Processing and Product Manufacturing



# Emerging Fields and Opportunities in Rubber Downstream Sector

- a. New rubber materials particularly for tyre applications
- b. Advanced/engineering materials and biomaterials in rubber
- c. Green rubber & rubber products
- d. Applications of rubbers in infrastructure, transport, military and automotive
- e. Environmentally-friendly and sustainable rubber industry
- f. Alternative sources of energy
- g. Broadening product base and strengthening edge in latex product with a focus on health and environment
- h. Developing Malaysia as the premier rubber product testing and certification centre for ASEAN
- i. Meeting challenges of globalization and liberalized trade

# Integrated Environmentally-Friendly Rubber Processing Complex (IPC)





# Latex Processing Centre



Purpose : LC (30 tonnes/day of field latex)  
2016 – installation of equipment, test and  
commissioning

## Specialty Rubber Processing Centre (SRF)





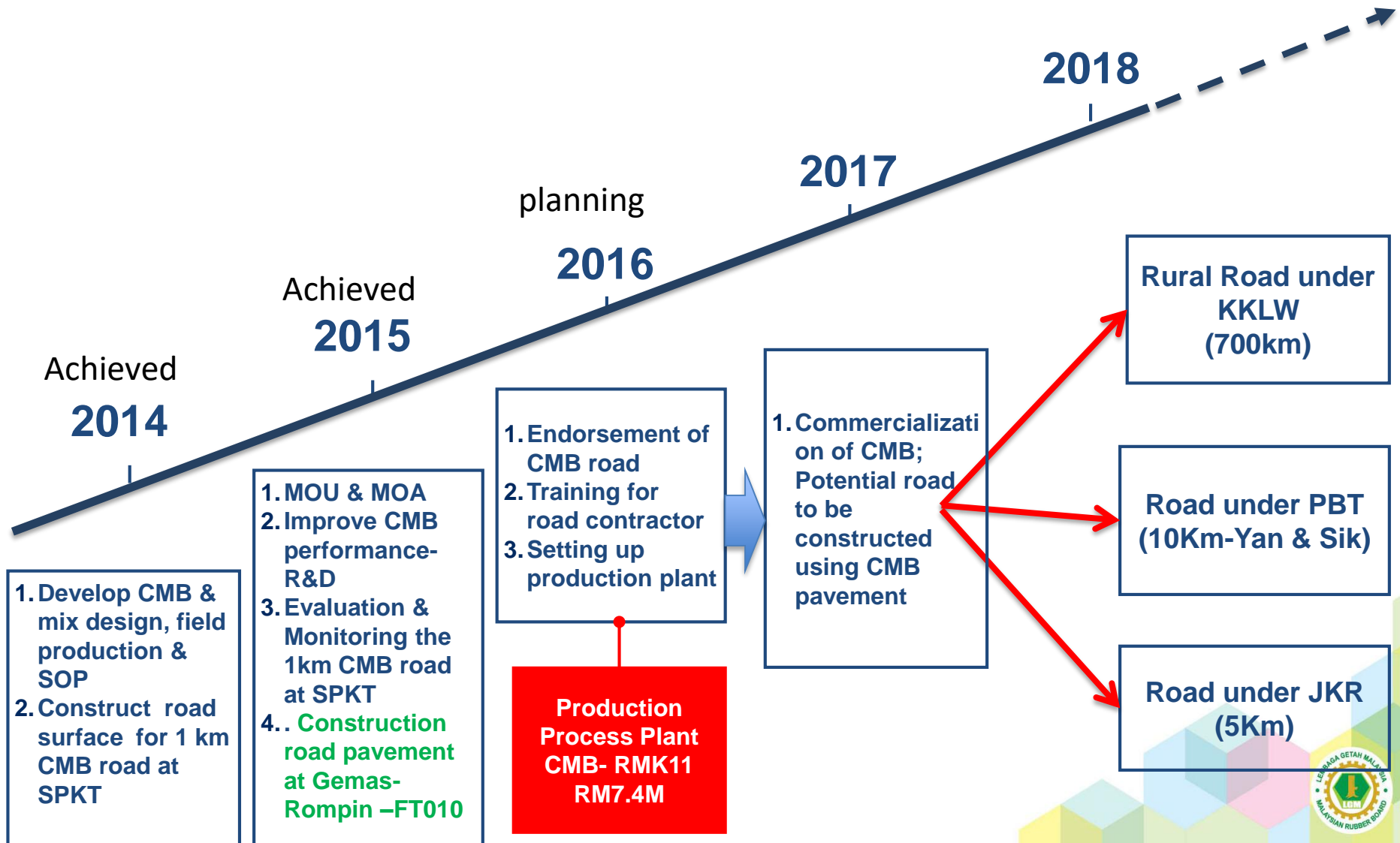
# APPLICATION OF GREEN RETREADS IN PUBLIC TRANSPORT

- 1 COLLABORATION RESEARCH ACTIVITIES
- 2 FUNDAMENTAL RESEARCH



# Cuplumps Modified Bitumen (CMB)

## Activities for CMB road pavement



# Technical and Industrial Support Services



Enhancing testing and support services to rubber industry by establishing Global Testing and Consultancy for Rubber (G-TAC<sub>R</sub>)



*One Stop Centre for Rubber Testing and Consultancy*



MS ISO/IEC 17025  
TESTING/CALIBRATION  
SAMM NO. 008





# MRB Centers of Research

1. Colloids and Interface Science
2. Advanced Materials and Analytical Chemistry
3. Advanced Processing and Product Technology
4. Engineering Design and Prototype

## 5. Advanced Imaging

6. Wood Science and Technology
7. Advanced Physiology and Agronomy
8. Tissue Culture
9. Genomics and Bioinformatics

## 10. Global Testing and Consultancy for Rubber (G-TAC<sub>R</sub>)



*Proposed COE Complex*



# Summary

- **Home-grown Technology**
  - Significant contribution to export revenue
  - High per unit area contribution
  - Spin-off and multiplier effect of rubber industry
- **Strategic Crop**
  - Supports downstream sector
  - Supports smallholders families
  - Helps eradicate poverty
- **Increasing domestic rubber consumption (ITRC)**
- **R&D vs Government procurement**

Transportation sector : Green rubber for tyre + NR for road construction?  
Other sectors: Engineering/Infra sector; Military/defence; Household; Sports sector



**Thank you**

