Robert Eller Associates, Inc.

CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES

OPPORTUNITIES FOR ADVANCED TECHNOLOGY POLYOLEFINS IN AN IMPLODING AUTO SUPPLY CHAIN

PRESENTED BY:

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PREPARED FOR:

POLYOLEFINS '06
HOUSTON, TX

FEBRUARY 27, 2006

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OUTLINE

- **OPERATING HYPOTHESES**
- **CURRENT STATE OF THE AUTO INDUSTRY**
- **INDUSTRY STRUCTURE SHIFTS**
- **THE IMPLODING SUPPLY CHAIN**
- **ADVANCED TECHNOLOGY POLYOLEFINS AND THEIR CURRENT/POTENTIAL ROLE**
- **ROLE OF FABRICATION TECHNOLOGY**
- **EUROPE AND N. AMERICA COMPARED**
- **FUTURE VIEW**

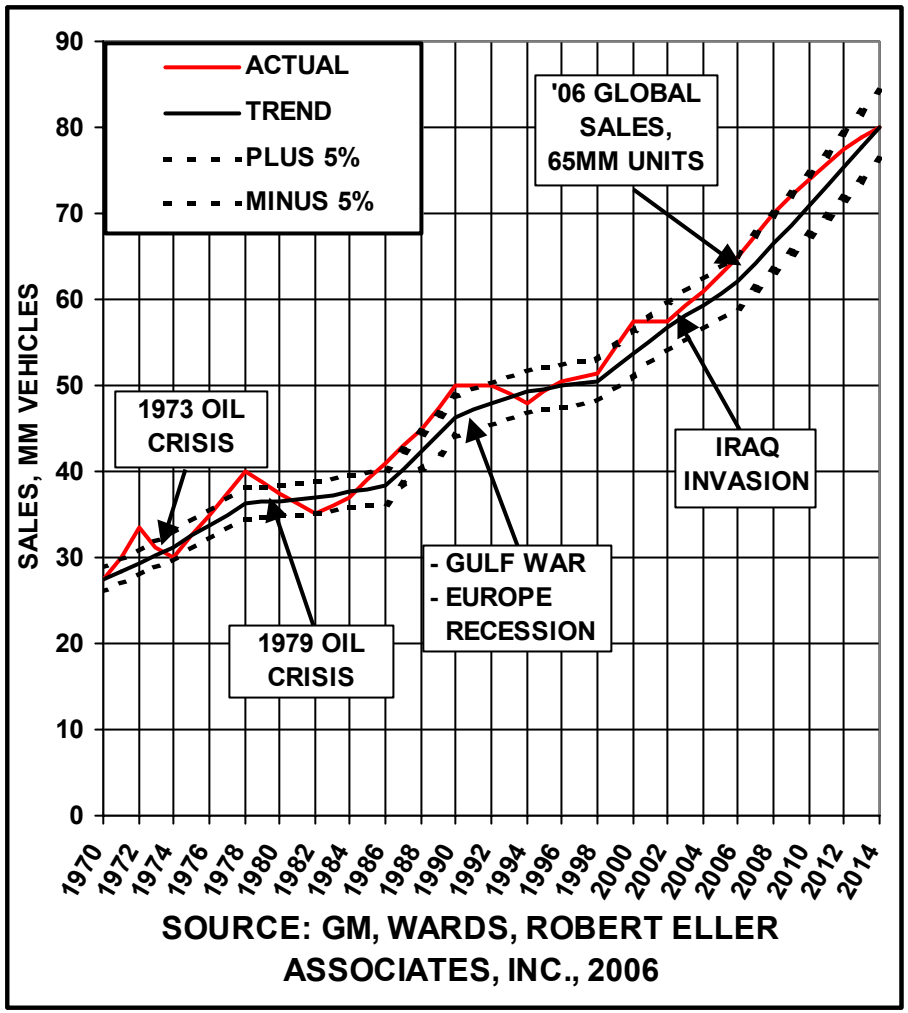
OPERATING HYPOTHESES

- **THE SUPPLY CHAIN WILL BE RESHAPED**
- **VEHICLE PRICE DECLINES CONTINUE**
- **“HIGH” N.A. FUEL PRICES CONTINUE**
- **NET TECHNICAL INFLOW TO U.S. CONTINUES**
- **MATERIALS/PROCESS TECHNOLOGY IS A PATH TO ADDING VALUE**
- **FLEET COMPOSITION ADAPTS TO ECONOMIC PRESSURES**
- **MANUFACTURING SHIFT TO ASIA**
- **GLOBAL QUALITY STANDARDIZATION**

CURRENT/FUTURE STATE OF THE AUTO INDUSTRY

- **GLOBAL PRODUCTION DEMAND GROWTH APPROX. 3%/YR. THROUGH 2012**
- **GLOBAL DEMAND HISTORY +/- 5% OFF TREND LINE SINCE 1970 DESPITE GLOBAL CRISES**
- **GLOBAL VEHICLE AND SUPPLIER OVERCAPACITY**
- **STAGNANT U.S./EUROPE DEMAND**
- **DEMAND GROWTH SHIFT TO ASIA PACIFIC**
- **MINI/SMALL CAR (B SEGMENT) SHARE GAIN GLOBAL AND U.S.**
- **GROWTH OF DOMESTIC ASIA PACIFIC OEMs**
- **SHARE LOSS BY U.S./EUROPEAN DOMESTIC OEMs**

GLOBAL LIGHT VEHICLE PRODUCTION TREND LINE



- **2011 GLOBAL SALES COULD REACH 75MM UNITS**
- **GLOBAL AAG = 3%/YR.**
- **ASIA PACIFIC GROWTH 5-6%/YR.?**
- **WESTERN GROWTH STAGNANT OR DECLINE**
- **GLOBAL FLEET SHIFT TOWARD SMALLER CARS**
- **VARIATIONS HAVE BEEN IN +/- 5% BAND SINCE 1970**

AUTO MANUFACTURING SHIFTS TO LOW COST REGIONS

THE CHINA EFFECT:

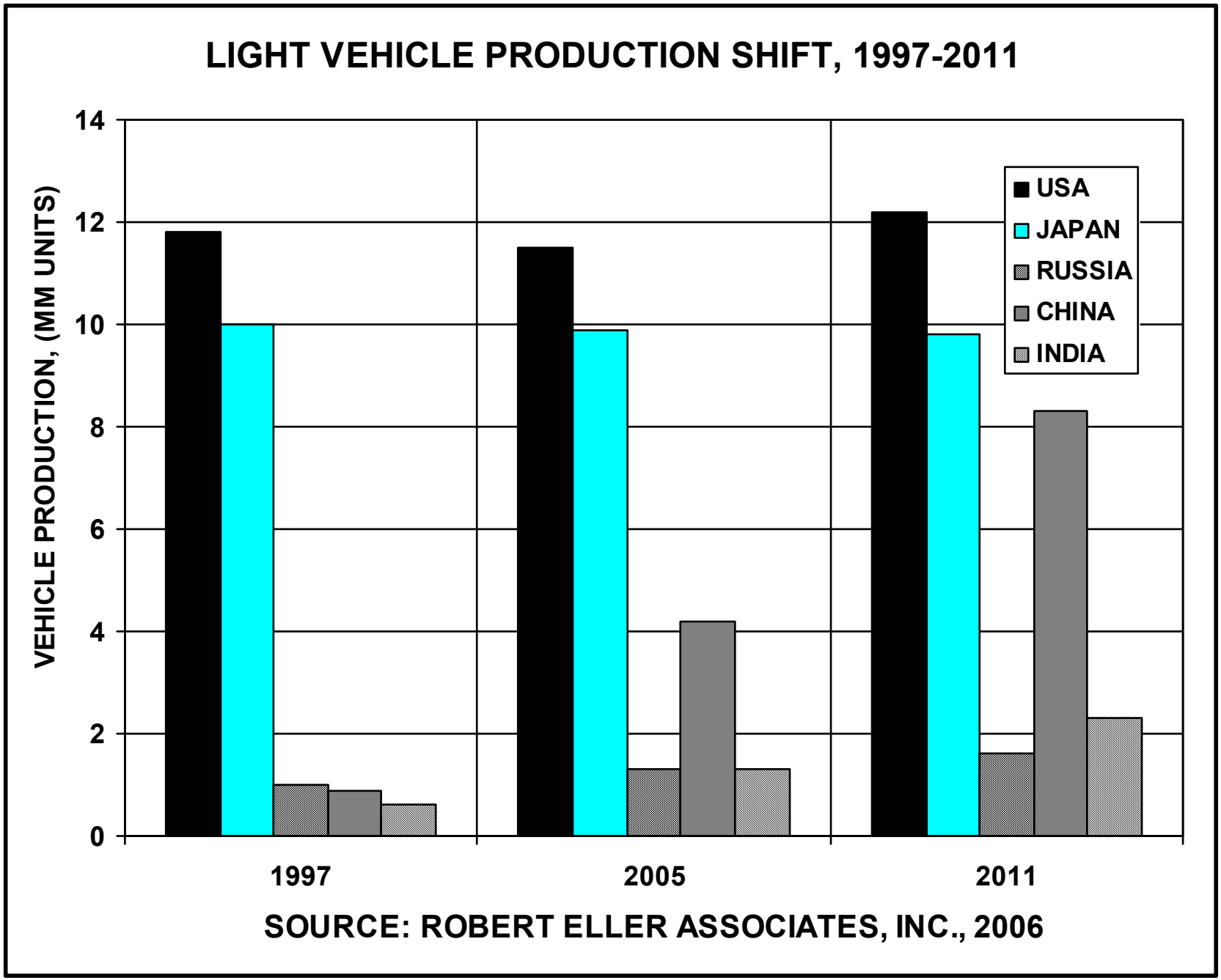
- MAJOR SHARE GAIN (2X FROM 2005-2010)
- GROWTH OF SMALL CAR PRODUCTION
  - INEXPENSIVE PEOPLE CARRIERS (SMALL VANS, BUSES) FOR EXPORT TO EMERGING DOMESTIC MARKETS
  - SYRIA CURRENTLY MAJOR EXPORT TARGET
  - $5,000 TARGET PRICE
- RESIN SUPPLIER, CMPD'R., TIER 1 SHIFT STARTED CAUTIOUSLY

(CONT'D.)

GROWTH OF AUTO MANUFACTURING SHIFTS TO LOW COST REGIONS

THE CHINA EFFECT:

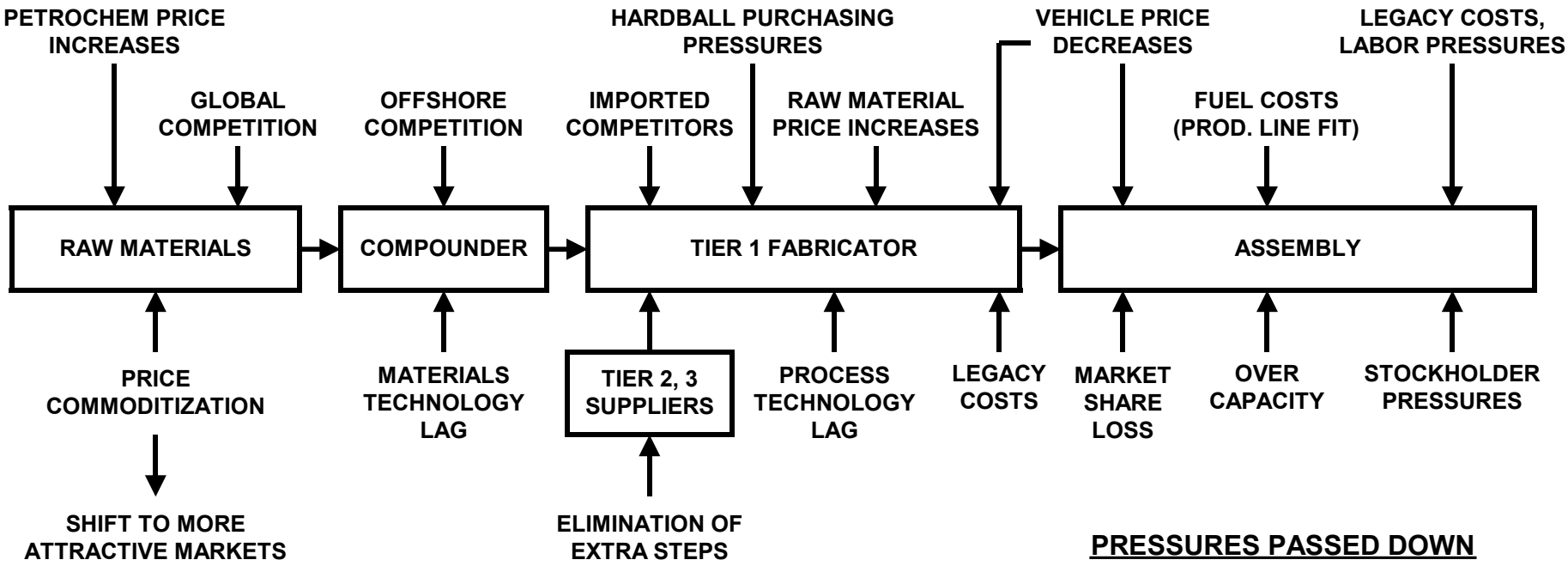
- CHINA POWER GAIN IN MIDDLE EAST?
- GEELY/CHERY IN U.S./EUROPE? IN 2008
- DOWNTURN OF CHINA DOMESTIC MKT. WILL STIMULATE VEHICLE EXPORTS
- KITS WILL HAVE SIGNIFICANT SHARE
- WULING (GM), CHANG'AN (FORD JV) ARE SMALL CAR LEADERS
- GOVERNMENT ROLE


LIGHT VEHICLE PRODUCTION SHIFT, 1997-2011
VEHICLE PRODUCTION, (MM UNITS)
14
12
10
8
6
4
2
0
1997
2005
2011
USA
JAPAN
RUSSIA
CHINA
INDIA
SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006

AN INEFFICIENT INTERIOR SUPPLY CHAIN WILL:

- SEE INTENSIFIED GLOBAL COMPETITION
- FURTHER GLOBALIZE
- FURTHER CONSOLIDATE
- FLATTEN
- INCREASE ASIA PRESENCE (AND FACE PARALLEL SUPPLY CHAIN)
- ACCELERATE EUROPE/N. AMERICA TECHNICAL/STRUCTURAL CONVERGENCE
- SEEK TECHNOLOGY SOLUTIONS TO THE PROFIT SQUEEZE

AUTOPLASTIC SUPPLY CHAIN IMPLOSION



ELIMINATE/REDUCE THE INEFFICIENCIES:
- -MULTIPLE STEPS
- -EXCESSIVE LOGISTICS
- -SCRAP GENERATION
- -INEFFICIENT PROCESS TECHNOLOGIES
- -SALES/MARKETING COSTS
- -EXCESS LABOR COSTS
- -OVER-GLOBALIZATION?

PRESSURES PASSED DOWN THE SUPPLY CHAIN:

- ← PRICING PRESSURES
- ← SUPPLY CHAIN "MANAGEMENT"
- ← DEMAND SLOWDOWN
- ← REVISED SPECIFICATIONS
- ← GLOBALIZATION PRESSURES

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006

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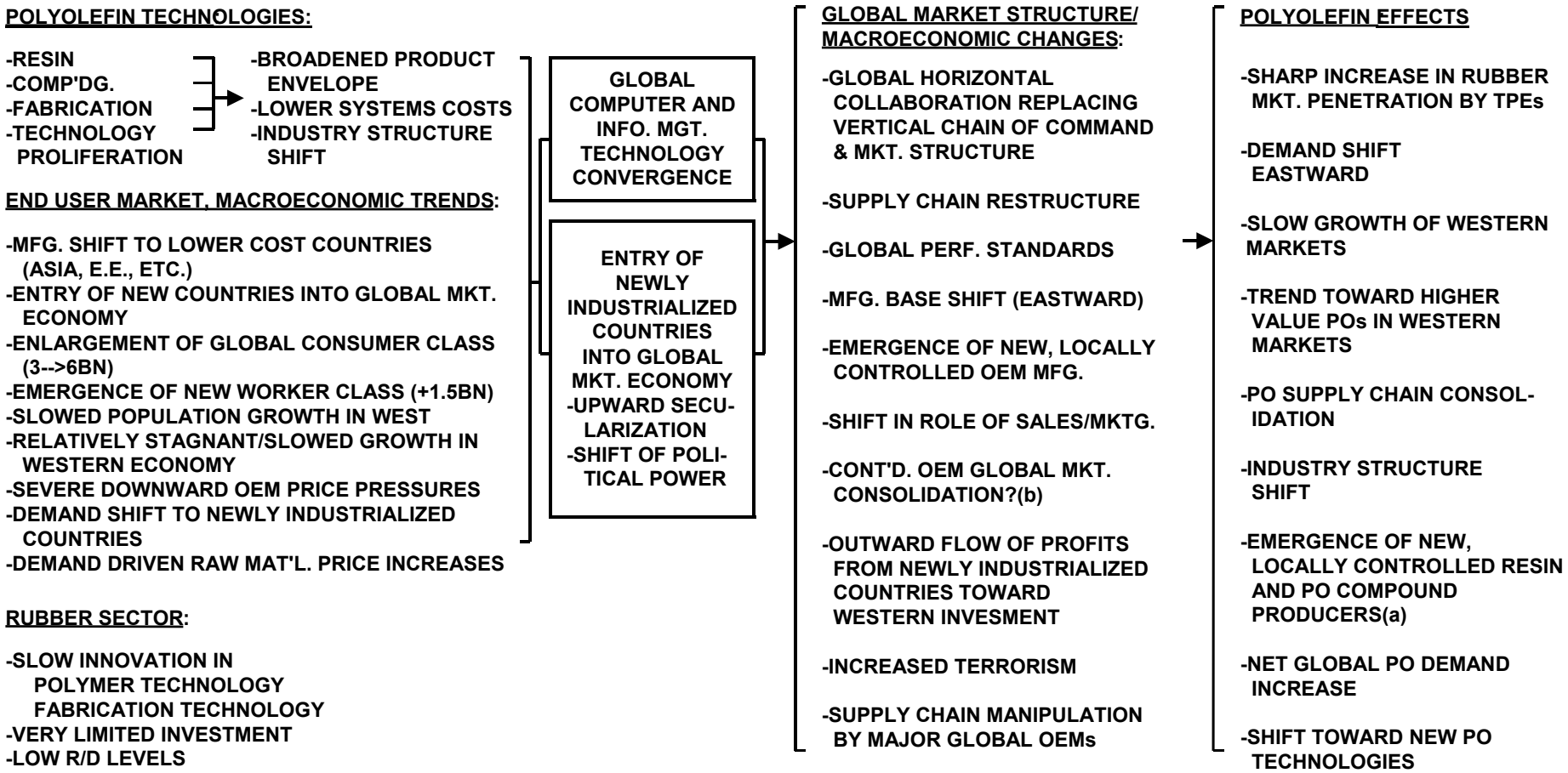
POLYMER TECHNOLOGY, INFORMATION TECHNOLOGY MACROECONOMIC INFLUENCES ON AUTOMOTIVE POLYOLEFINS



NOTES: (a) A NEW PARALLEL SUPPLY CHAIN CHALLENGING THE POSITION OF ESTABLISHED WESTERN POLYOLEFIN SUPPLIERS
(b) PARTIALLY OFFSET BY EMERGENCE OF NEW, LOCAL COMPETITION IN NEWLY INDUSTRIALIZED REGIONS

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006

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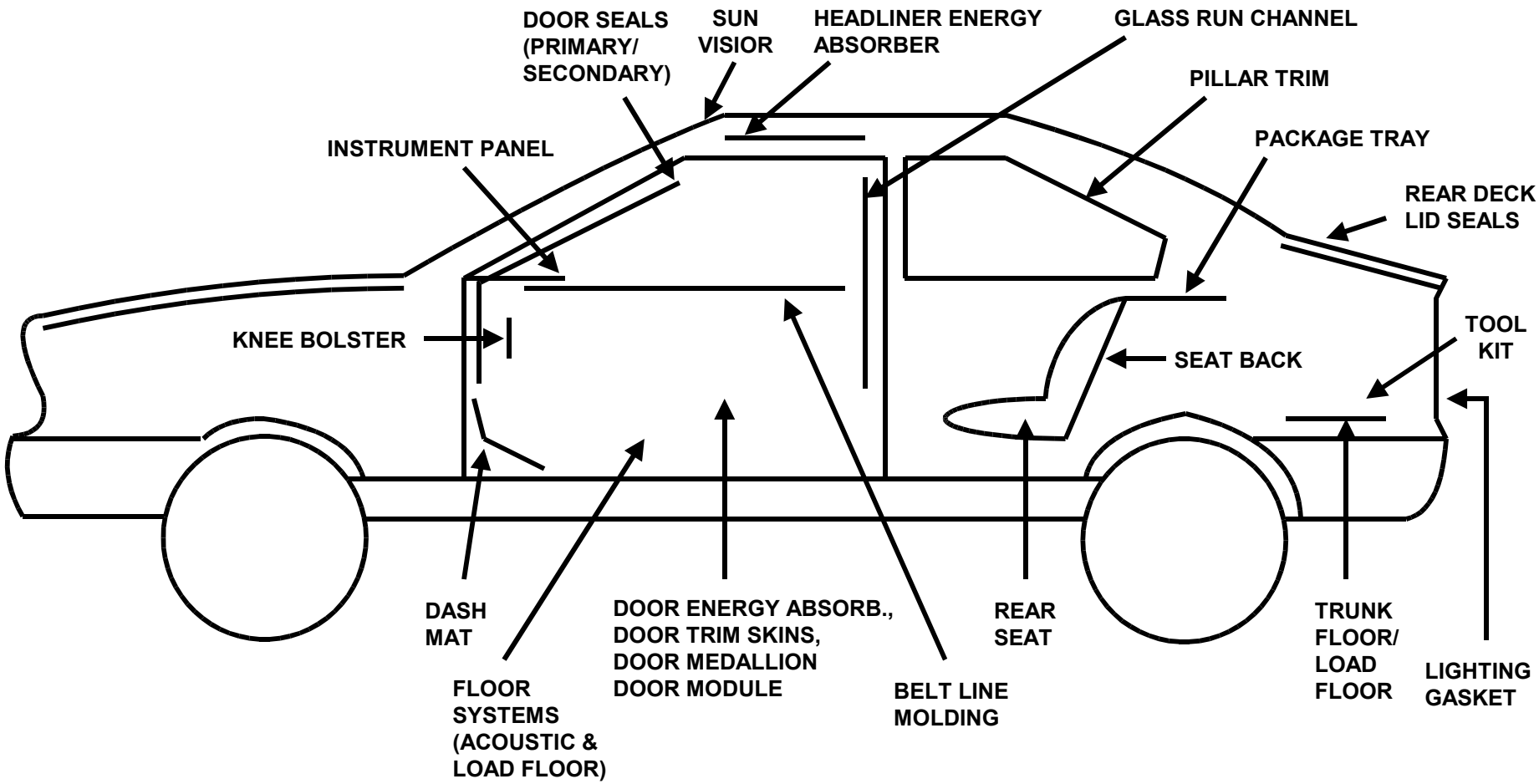
ROLE OF ECONOMIC PRESSURES

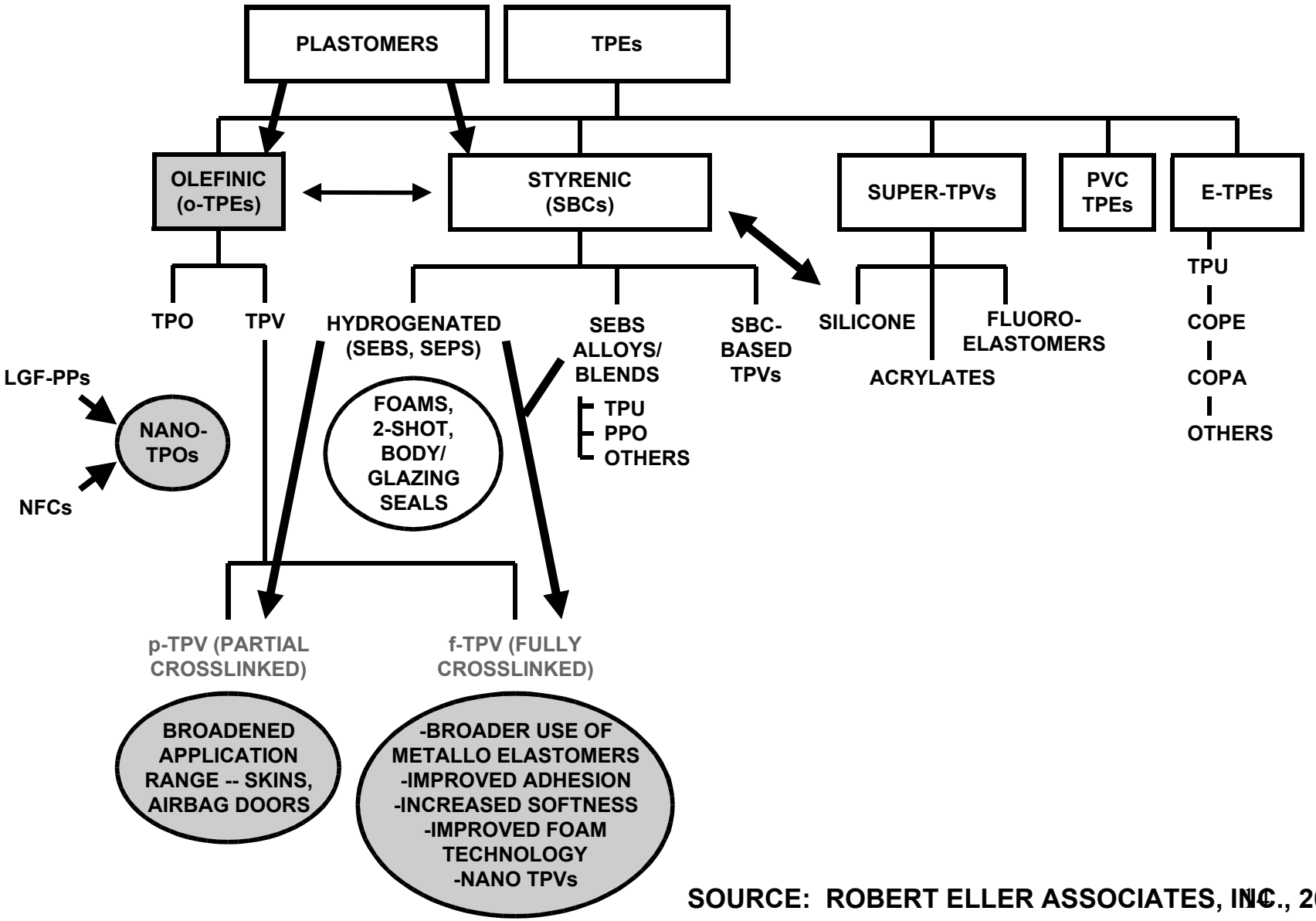
- **HIGH LABOR COSTS (N.A./EUROPE)**
- **RECENT RAW MATERIAL COST INCREASE SQUEEZE TIER 1s**
- **SHIFTS TOWARD MATERIALS AND TECHNOLOGIES CAPABLE OF MEETING REDUCED COST TARGETS**
- **EUROPEAN, N. AMERICAN AND JAPANESE INTERIOR TECHNOLOGY CONVERGENCE**
- **SUV PROFITABILITY LOSS IN N. AMERICA:**
  - **RENEWED WEIGHT SAVE INCENTIVE**
  - **PRESSURE FOR SMALLER VEHICLES**

AUTOMOTIVE INTERIOR APPLICATIONS



SOURCE:ROBERT ELLER ASSOCIATES,INC.,2006

NEW TPE COMPETITORS, TECHNOLOGIES, AND TARGETS



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006

VALUE CREATION VIA MATERIALS

- IMPROVED REACTOR-TPOs
- POLYOLEFIN SUBSTITUTION FOR ETPs
- COATINGS ELIMINATION
  - IMPROVED MOLDED-IN COLOR
  - IMPROVED SCRATCH/MAR RESISTANCE
- PLASTOMER/HMS-PP COMBINATIONS
- FOAM QUALITY IMPROVEMENT
- SKIN/FOAM COEXTRUSION
- EPP & EPE/PS BEAD FOAMS
  - SEATING,DOOR TRIM,FLOOR
  - TEXTILE/FOAM COMBINATIONS
- GROWTH ROLE FOR HMS-PP

MAT'LS TECHNOLOGY (CONT'D.)

- **ADVANCED TECHNOLOGY NONWOVENS POISED FOR GROWTH**

  -MICRODENIER, BICOMPONENT
- **ENHANCED ROLE FOR PLASTOMERS:**

  -EPDM SUBSTITUTION (TPO)

  -LCB EAOs/HMS PP COMBINATIONS

  CHALLENGE p-TPVs

  -FIBERS (MICRO-DENIER, ELASTIC)

  -FILMS?,FOAMS
- **FOAM QUALITY IMPROVEMENT**
- **SKIN/FOAM COMBINATIONS**
- **EPP BEAD FOAMS (SEATING, TEXTILE/FOAM)**
- **SBC-TPVs ENTERING(CHALLENGE O-TPVs)**
- **MONO-MATERIALS CONSTRUCTIONS**

INCREASED PLASTOMER ROLE

- **LONG CHAIN BRANCHING:**
  - **POOR MAN'S CROSSLINKING**
  - **SKINS/THERMOFORMED APPLICATIONS**
- **TPO BUMPER FASCIA**
- **HIGH PROPYLENE PLASTOMER GRADES:**
  - **HIGH ELASTICITY TPO APPLICATIONS**
  - **COATED FABRICS?**
  - **FOAMS?**
  - **ELASTIC NONWOVENS**

VALUE CREATION : FABRICATION TECH.

- **2 SHOT MOLDING**
- **RIGID/FLEXIBLE COMBINATIONS**
- **DIRECT COMPD'G (GF, FILLED, TPO?)**
- **CO-PROCESSING:**

  -CO-BLOW

  -CO-INJECTION

  -COEXTRUSION

  -PROFILE EXTRUSION
- **ON-BOARD FUNCTIONS (ACOUSTIC, ENERGY ABSORB)**
- **MONO-MATERIALS CONSTRUCTIONS**
- **THERMOFORMING**

SOME INTERIOR COMPETITIONS

MODULE	COMPETITORS
FLOOR, HEADLINER	-FOAM VS. FIBER -LT. WT. COMPOSITES VS. FOAM -PET VS. PP NONWOVENS
HEADLINER "A" SURFACE	-NW VS. KNIT
HEADLINER SUBSTRATE	-PU FOAM VS. NW, PO FOAM -PU FOAM VS. LT. WT. COMPOSITES
SKIN	-THERMOFORM VS. 2-SHOT -SLUSH VS. SPRAY
ACOUSTICS	-FOAM VS. FIBER
ENERGY MGT.	-FOAM VS. R-TPO -R-TPO VS. C-TPO

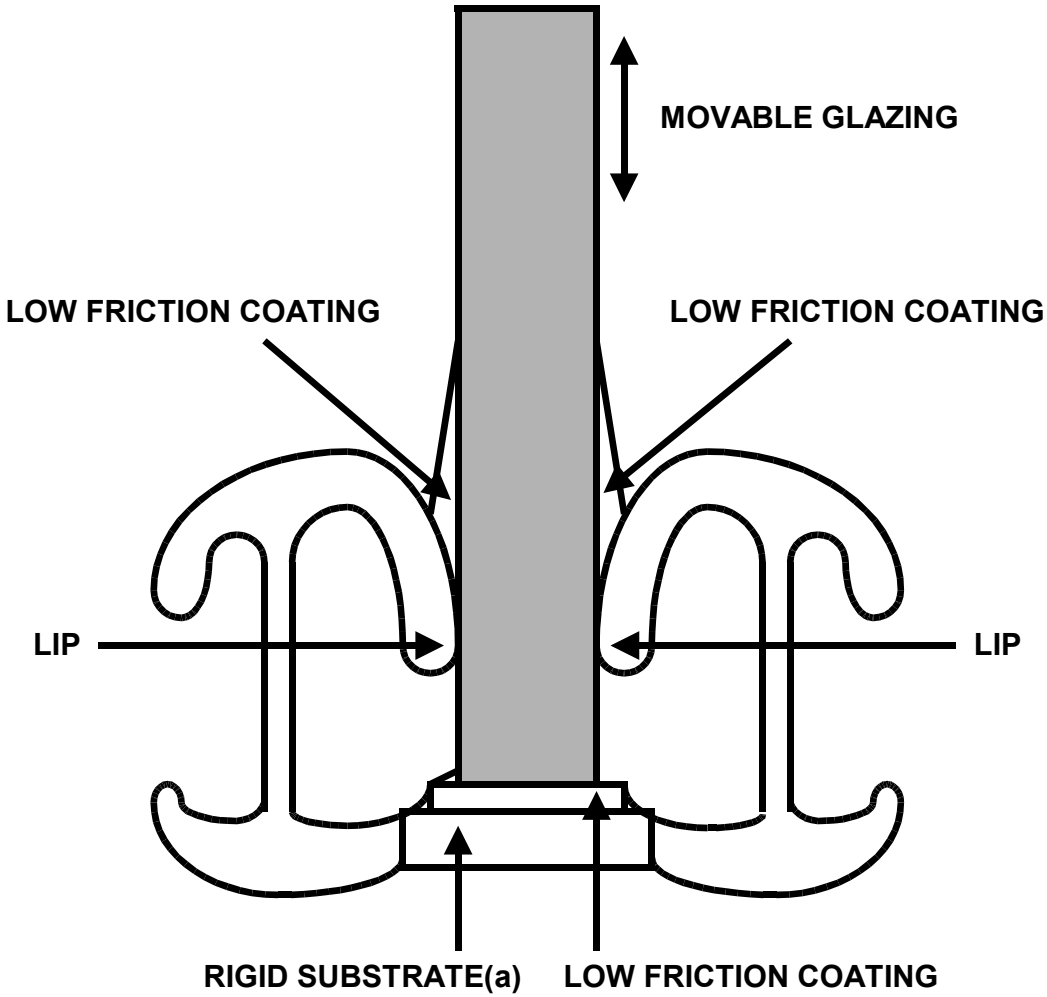
(CONT'D.)

SOME INTERIOR COMPETITIONS

MODULE	COMPETITORS
AIRBAG DOORS	-SEBS VS. TPO -r-TPO VS. SEBS, c-TPO -SINGLE VS. 2-SHOT
TRIM	-PAINT VS. IN-MOLD DECORATION -PAINT VS. MOLDED-IN COLOR
DOOR TRIM	-INJECTION VS. THERMOFORM -WOOD FIBER FILLED VS. TALC
SEATING	-LEATHER VS. TEXTILE -LEATHER VS. LUX. COATED FABRICS
COATED FABRIC	NO OLEFINIC SUCCESS VS. PVC YET

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006

TYPICAL GLASS RUN CHANNEL CROSS-SECTION



NOTE:
(a) USUALLY FILLED PP

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006

Body Seal Example:Rear tailgate seal

Model: Jeep Cherokee

Manufacturer: Major Body Seal Tier 1

Material Type: EPDM Compound

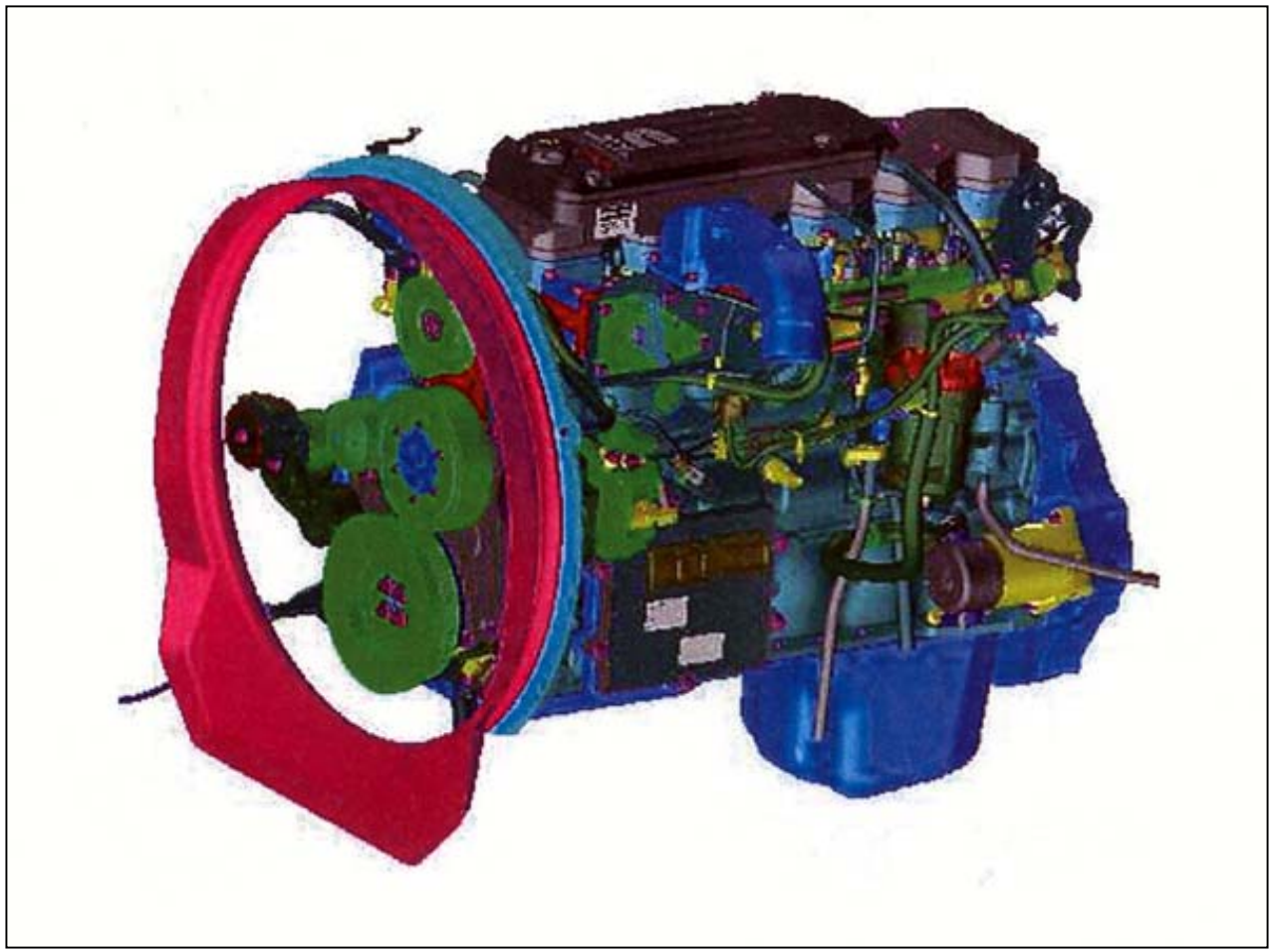
Note: Foamed (sponge)/Solid (dense) Combination

RUBBER SUBSTITUTION STATUS

APPLICATION	STATUS
BODY/ GLAZING SEALS	-STARTED WILL GROW -HIGH POTENTIAL
HOSE	-NO SIGNIFICANT PENETRATION YET
BELTS	-UNLIKELY PENETRATION
BOOTS/ BELLOWS/ DUCTING	- SUBSTANTIAL PENETRATION - SHIFT TO HIGHER PERF. TPEs?
GROMMETS, BUMPERS, GASKETS	- STARTED

Manufacturer: Valeo
TPV Type: TPV
Manufacturer Location: Europe
Note: Example of boots/bellows and EPDM replacement.

Product: Airbag door
Material Type: TPO (non-crosslinked)
Note: Front and rear views



Product: Fan shroud
Manufacturer: Sur-Flo
Material Type: TPV (Nexprene)
TPE Supplier: Solvay Engineering Polymers
Note: Used in Dodge Ram HD pickup

Product: Crank case ventilation hose
TPE Grade Name: DuPont™ ETPV
Material Type: s-TPV
Process: Coextrusion
Status: Concept
Key Features: Blow-by gas resistance

Product: Current TSR air brake hose
Application: Class 6,7, & 8 heavy truck
Manufacturer: Paccar/Goodyear
Note: Fiber reinforced

Product: Seamless passenger airbag lid
Vehicle: Honda Civic 2006
Material Type: Mitsubishi Chemical AP15 TPO
Process: Injection molding directly into soft thermoformed TPO skin, no paint, all plastic
Fabricator: Visteon

HOW TO CAPTURE VALUE

- **TARGET SYSTEMS COST SAVINGS**
- **AVOID REGIONAL PERSPECTIVE LIMITATIONS**
- **TAKE FROM E/E, EXTERIORS**
- **SHORTEN THE SUPPLY CHAIN(RESIN SUPPLIER ROLE?)**
- **LOWER COST MATERIALS**
  - **R-TPOs CREATING OPPORTUNITIES**
  - **METALLOCENE/HMS PP COMBINATIONS**
  - **NONWOVENS**
  - **FOAMS**

CAPTURING VALUE(CONT'D)

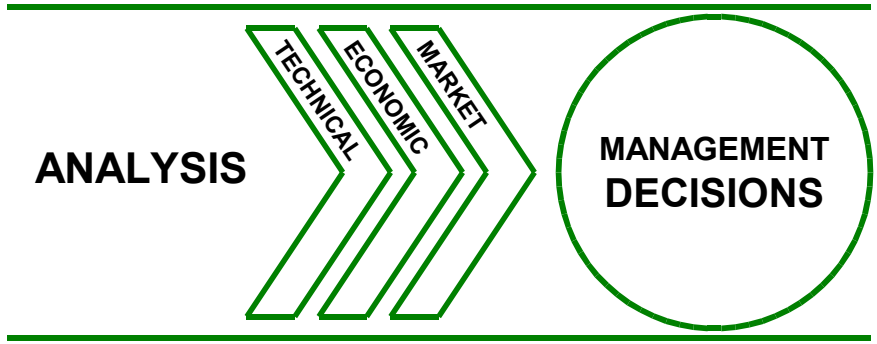
- **FABRICATION TECHNOLOGIES**
  - **2-SHOT MOLDING/LOW PRESSURE MOLDING**
  - **MONOMATERIALS CONSTRUCTIONS**
  - **ON-BOARD FUNCTIONS (ACOUSTIC, ENERGY ABSORPTION,STRUCTURE)**
  - **DIRECT COMPOUNDING/FABRICATION**
  - **THERMOFORMING**
- **ADVANCED TECHNOLOGY NONWOVENS POISED FOR GROWTH IN:**

  -FACE FABRICS

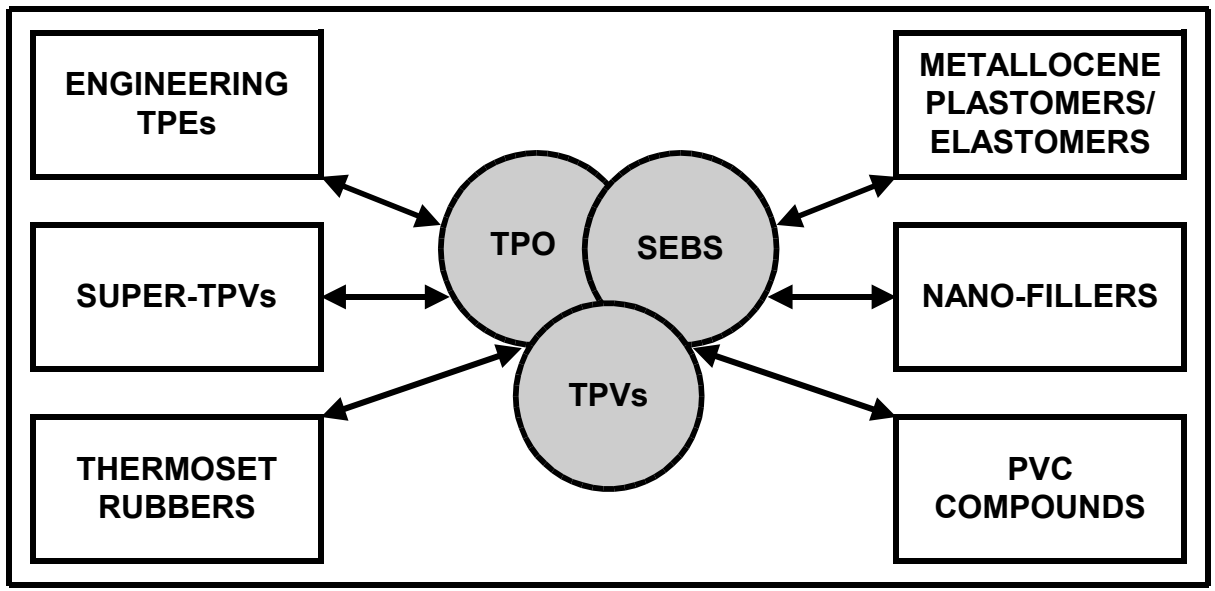
  -FABRIC/FOAM COMBINATIONS

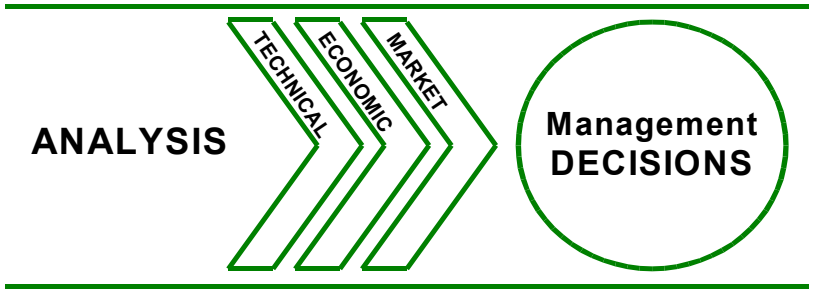
  -ACOUSTICS

  -SEMI-STRUCTURAL COMPOSITES



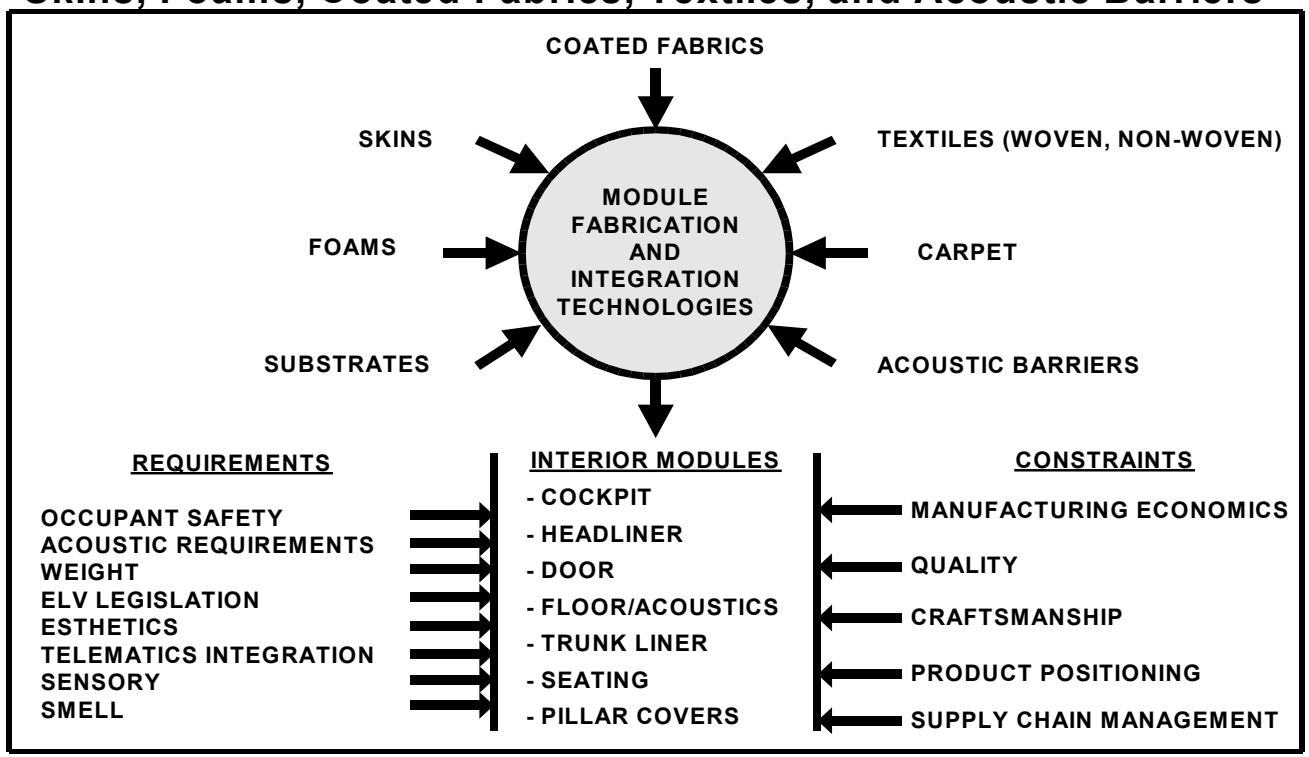
Specialty Thermoplastic Elastomers . . . Markets, Economics, Technology, Intermaterials Competition





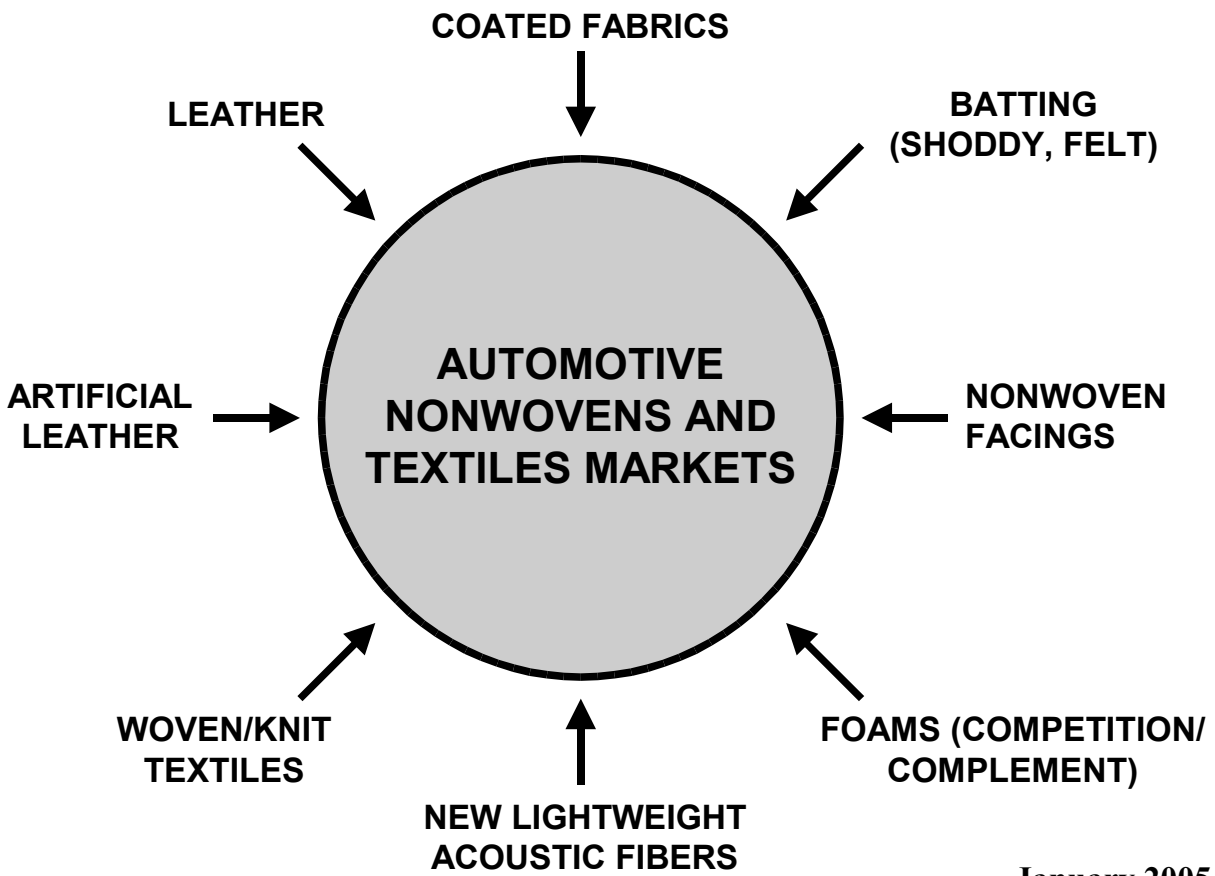
Automotive Interior Soft Trim:

Skins, Foams, Coated Fabrics, Textiles, and Acoustic Barriers



Opportunities for Advanced Technology Nonwovens for Automotive Surface and Construction Applications in N. America and Europe

A Multiclient Study



January 2005

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