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Innovation for Sustainability


Automotive News World Congress

The Role of Innovation in Industry Sustainability

January 20, 2009, 2:00 – 4:30 PM

Detroit Marriott Renaissance Center

*Dr. Andrew Brown, Jr., P.E., NAE
Executive Director & Chief Technologist
Delphi Corporation*



Is a Leading Automotive Supplier with Strategic Global Presence

U.S. & Canada

Manufacturing sites:	21
Employment:	21,200
Joint ventures:	5
Technical centers:	7

Europe & Middle East

Manufacturing sites:	52
Employment:	51,200
Joint ventures:	8
Technical centers:	14

Total Delphi

Manufacturing sites:	148
Employment:	155,000
Joint ventures:	35
Technical centers:	28

Mexico & South America

Manufacturing sites:	55
Employment:	69,200
Joint ventures:	5
Technical centers:	2

Asia Pacific

Manufacturing sites:	20
Employment:	13,400
Joint ventures:	17
Technical centers:	5

Businesses of the Transformed Delphi



Electrical / Electronic Architecture

- Electrical / Electronic Distribution Systems
- Electrical Centers
- Connection Systems

Electronics & Safety

- Entertainment & Communications
- Controls & Security
- Safety Systems
- Power Electronics



Powertrain Systems

- Gas Engine Management Systems
- Diesel Engine Management Systems
- Fuel Handling & Evaporative Canisters

Thermal Systems

- Thermal Automotive
- Thermal New Markets



Product & Service Solutions

- Independent Aftermarket
- Diesel Aftermarket
- Original Equipment Service
- Medical Systems

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Delphi

Harnesses Its Culture of Innovation to Create Real World Value

- Innovation is:
 - The creation and delivery of **new customer value** in the market place
 - An **ever-evolving** process
 - **Enterprise-wide responsibility**, as a creative process, that must include all business functions to be successful
- Technology advancement is fundamental to a successful company and Innovation is the differentiator
 - Invention alone is not enough
 - Innovation resides at the **intersection of invention and insight**
 - Innovation **creates new value**
 - Innovation transforms knowledge and technologies to **drive productivity and new growth**



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Is Focused on Providing Market-driven Solutions Addressing Global Megatrends

Megatrend	North America	Europe	Asia Pacific		South America	Global Trends
			developed economies	growing economies		
Natural growth: Population, economical, infrastructural						
People live longer - Larger, stronger elderly segment						
Generations X-Y: Echo boomers gain more influence, power						
Increased concern about safety, security, privacy						
Health care: Rising needs & cost						
8/5 > 12/6 > 24/7 - Less time, more stress						
Globalization - Socio-economic-political redistribution						
Higher cost of natural resources						
Increasing environmental awareness / regulations						
Information explosion. Increased flow, volume, and dependence on internet						
Wireless world						
Social change in Europe						
Increasing adoption of advanced technology						
Cost as a driver						

Key



Primary regional trend

Secondary regional trend

Global trend

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The Future is Safe, Green and Connected

MEGATRENDS

• People Megatrends

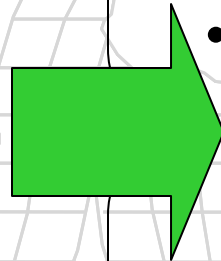
- Natural Growth
- People Live Longer
- Generations X & Y
- Increased Concern About Safety, Security and Privacy
- Health Care
- 8/5 > 12/6 > 24/7

• World Megatrends

- World Turmoil
- Globalization
- Higher Cost of Natural Resources
- Increasing Environmental Awareness/Regulations

• Technological Megatrends

- Information Explosion
- Wireless World



MEGATRENDS

• Safe

- Traffic congestion in major metro areas around the world becomes worse; more accidents; longer commute; higher stress level



• Green

- Fast growing economies: more fuel for mobile platforms
- Demand for electrical energy and related conventional resources far exceeds current capabilities



• Connected

- Global demand for broadband access will continue to grow



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Delphi Portfolio of Enhanced Safety Solutions

- **Active Safety Systems**

- 76 GHz Radar, IR, Vision Systems
- Sophisticated Algorithms and Controllers
- Automatic Vehicle Control of Throttle Braking and Steering
- Adaptive Cruise Control with Stop & Go
- Electronic Control of Braking Systems

- **Driver State Alerts**

- Fatigue/Drowsiness
- Distraction

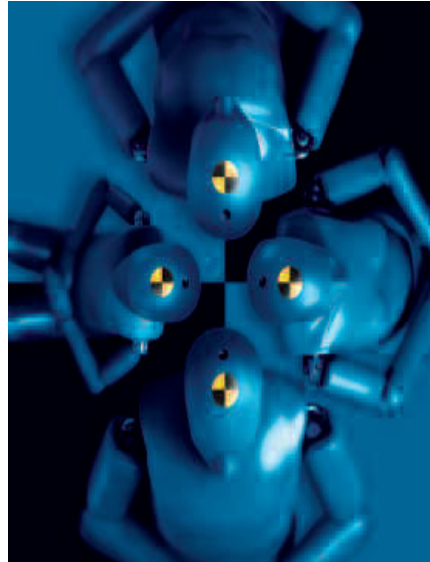
- **Rollover**

- Dynamic Rollover Propensity
- Yaw Stability
- Handling Responsiveness
- Trailer Towing Stability

- **Safety Electronics**

- **Lane Departure Warning and Feedback**

- **Collision Warning Systems**



- **Pedestrian Protection**

- **Road Sign Recognition**

- **Occupant Detection Systems**

- **Airbags, Seat Belts, Steering Wheels**

- **Battery Disconnects**

- **Battery Monitoring Device**

- **Telematics**

- Emergency Notification

- **HMI (Human Machine Interface)**

- Diagnostics
- Control Modules and Units
- Haptic Devices

- **Medical Systems**

- Infusion and Dialysis
- Vital Signs
- Respiratory and Mobility

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Delphi Portfolio of Green Solutions

- **Fuel Economy and Performance Technologies**
 - Cylinder Deactivation System
 - Two-step Valve Train with Dual Independent Cam Phasers
- **Reman ECM/PCM**
- **Universal Reflash Tool**
- **Alternative Fuel Systems/Components**
 - Fuel System for Dimethyl Ether
- **Evaporative Emissions Canisters**
- **Diesel Fuel Injection Systems and After-treatment**
- **Gasoline Direct Injection**
- **Next Generation Energy Efficient A/C**
- **HVAC Compressors**
- **HVAC Systems for Alternative Refrigerants**



- **Electric HVAC Systems**
- **Electronics Cooling**
- **Hybrid Electric Vehicle Technologies**
- **Hybrid Vehicle Electrical, Electronics, Components & Integration**
- **Power Conversion Products**
- **High Voltage Battery Pack System Ammonia, Planar Oxygen & Battery IVT Sensors**
- **Electronics Packaging**
- **Optimized Electrical/Electronic Architectures**
- **Navigation**
- **Ultra-light Radio**
- **Electric Power Steering Systems**

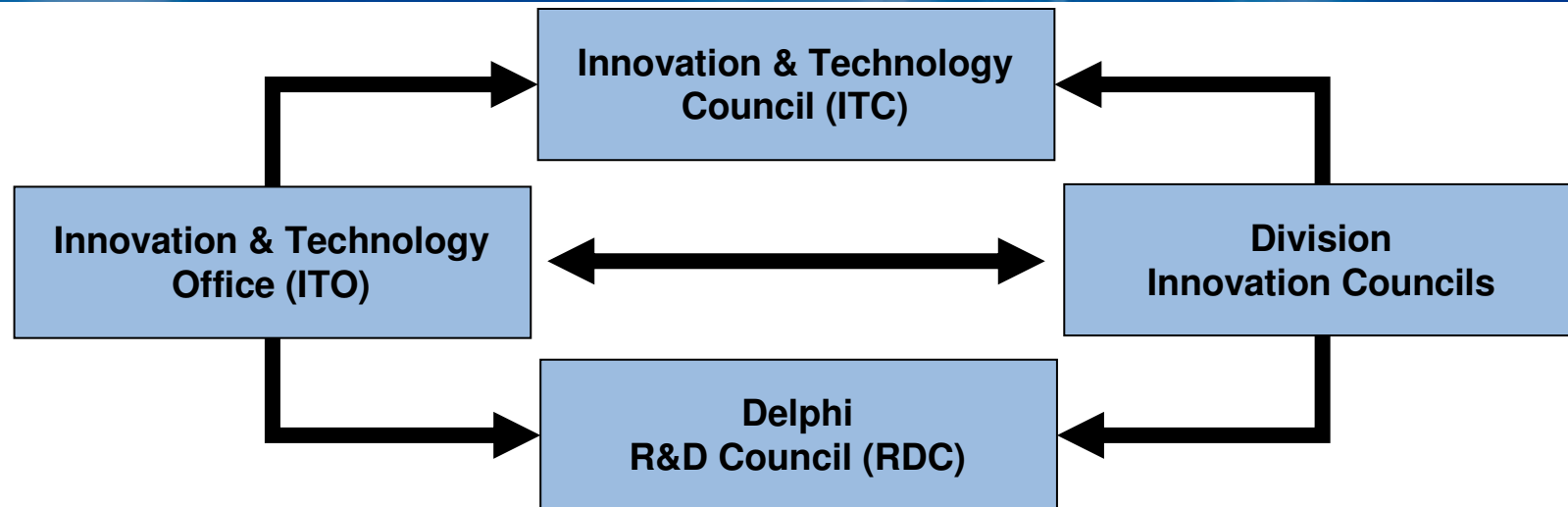
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Delphi Portfolio of Connectivity Solutions

- **Connected Vehicle**
 - In-vehicle Communications and Entertainment
 - 3G/WiMax, WiFi, DSRC
- **Vehicle Infrastructure Interface (VII) and Vehicle-to-Vehicle Interface**
- **Satellite Audio, Video and Data Systems**
- **Digital Receivers**
- **Telematics**
- **Advanced Reception Systems**
- **Navigation Systems**
- **Portable Device Interfaces**
- **Rear Seat Entertainment**
- **Wireless Connectivity**
- **Security Systems**
- **Optimized Electrical/Electronic Architectures**
 - Electrical Centers
 - EED Systems
 - Connection Systems
- **HMI (Human Machine Interface)**
 - Diagnostics
 - Control Modules and Units
 - Haptic Devices
 - Displays
- **Medical Systems**
 - Infusion and Dialysis
 - Vital Signs
 - Respiratory and Mobility
- **Commercial Aviation and Electronics**
- **High-density, High-speed Interconnects**
- **Controls**

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Delphi Innovation & Technology Linkages with Divisions



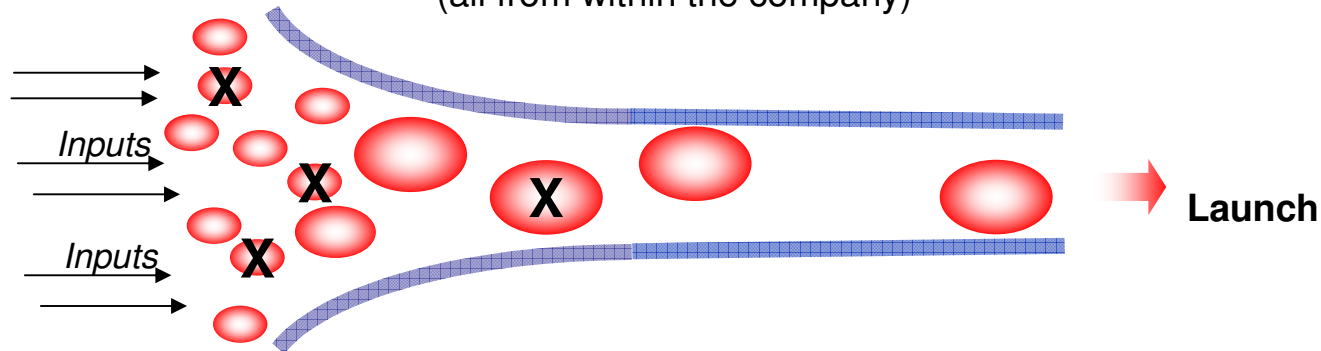
- The Innovation and Technology Council (ITC)
 - Comprised of the CEO, division presidents, select corporate officers, and the ITO's executive director.
 - Determines the future direction and strategy that best fits Delphi.
- Division Innovation Councils (one in each division)
 - Comprised of each division's president, engineering director, and advanced engineering director.
 - Responsible for the development of product/technologies which align with the ITC vision.
- The Delphi Research & Development Council (RDC)
 - Comprised of the advanced engineering director of each division with the ITO's executive director serving as chair.
 - Addresses matters of innovation policy and practices, identifies areas of synergy, and fosters collaborations aimed at improving Delphi's market position.
- The Innovation & Technology Office (ITO)
 - Interfaces with each of these councils to connect the vision, strategy, and future needs of Delphi across the divisions to ensure that the right products and technologies meet the market needs.
 - Manages any 'cross-divisional synergies' that arise as a result of this interface with the councils and divisions.

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Closed vs. Open Innovation Models

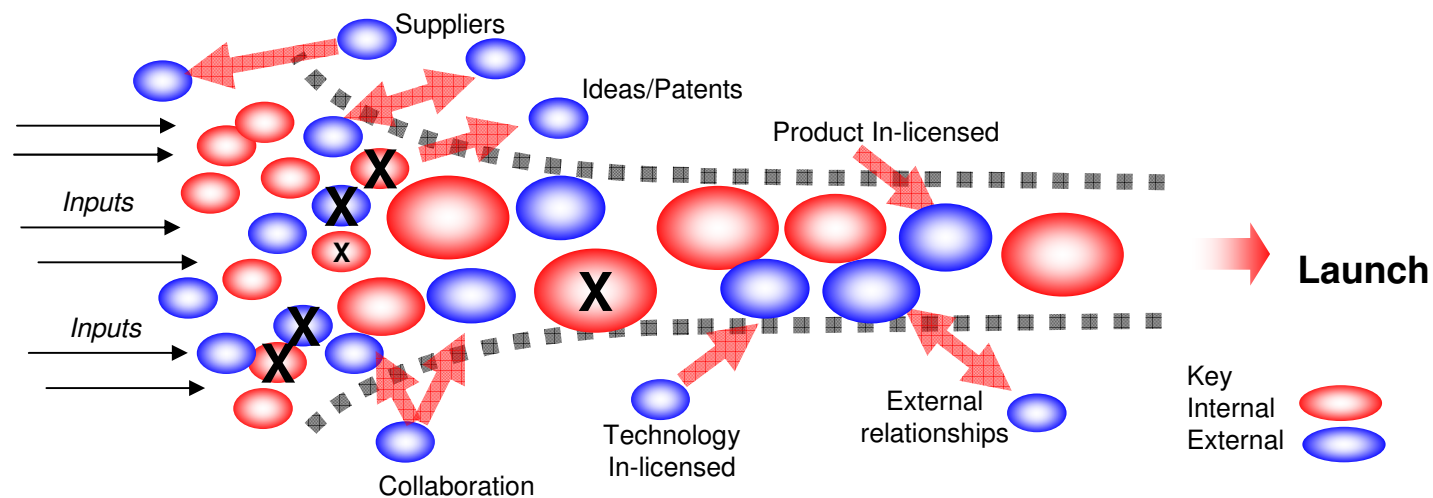
Product Development Pipeline in a Closed Innovation Model

(all from within the company)



Product Development Pipeline in an Open Innovation Model

(Both inside and outside of the company)



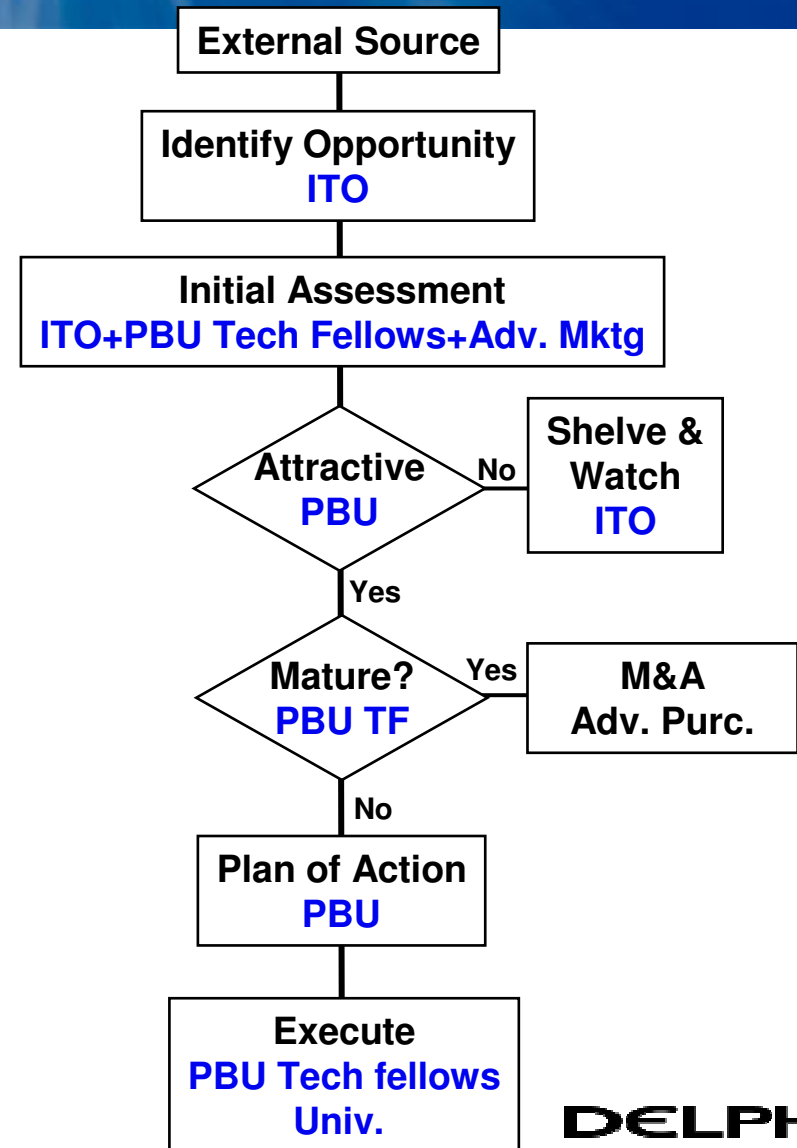
Open Innovation Fundamentals

- In-Sourcing Creativity NOT Out-Sourcing R&D
- Technology Advancement is Fundamental to a successful company and Innovation is the Differentiator
 - Invention alone is not enough
 - Innovation resides at the intersection of invention and insight
 - Innovation creates new value
 - Transforming knowledge and technologies to drive productivity and new growth
- Invention May Belong to R&D, but Innovation Does Not
 - Innovation is a creative process that must include all business functions to be successful
 - Innovation is an ever evolving process
- Success Depends On
 - Active Leadership
 - “Right” projects
 - Strong execution
 - Customer and market insight (critical)
 - Delivering exceptional value to the “most important customer” in the value chain (Value Innovation)
- Innovation is Everyone’s Responsibility...Anyone Can Do It!

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Example: New Alternative After-treatment for Diesel Engines

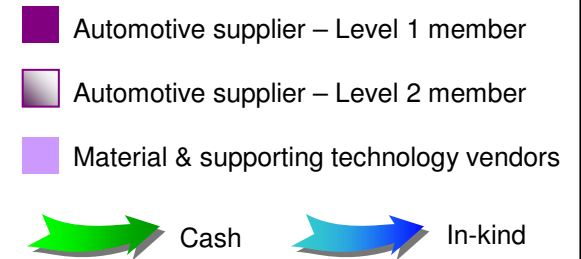
- **Opportunity:**
 - A Danish firm has developed an ammonia storage and dispensing method that may replace urea for cleaning the exhaust of future diesel engines. Unlike urea that needs frequent replenishment, this approach will store 3 times the ammonia compared to urea.
- **Benefits**
 - No additional infrastructure required for urea
 - » Offers a low-cost solution to the current, more expensive solution
 - » More convenient for consumer
 - Avoids operation without urea which causes increased pollution
- **Action Plan**
 - Explore how best to use this technology
 - Determine if engine modifications that generate some ammonia on board may extend the range for the life of the vehicle without requiring a refill



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Partnership Model & Funding Flow

Private



Member FTE researchers assigned to consortium as in-kind contribution

Membership fees (cash)

Supporting research; research management

ORNL and other DOE National Laboratories

Program funds

DOE

Direct support for research (via Other Transaction Authority)

TARDEC

Automation Alley

Economic development grants

Admin. & facility management; state and local support

State and Local Support

Innovation management; new business creation

NextEnergy

Wayne State and other universities

Faculty and student research support

Revenue from non-member sources (services, licensing sub-leased space)

Public

Light Weight Materials

Thermal Management

Engine Combustion and Emission After-Treatment

USAUTOPARTs

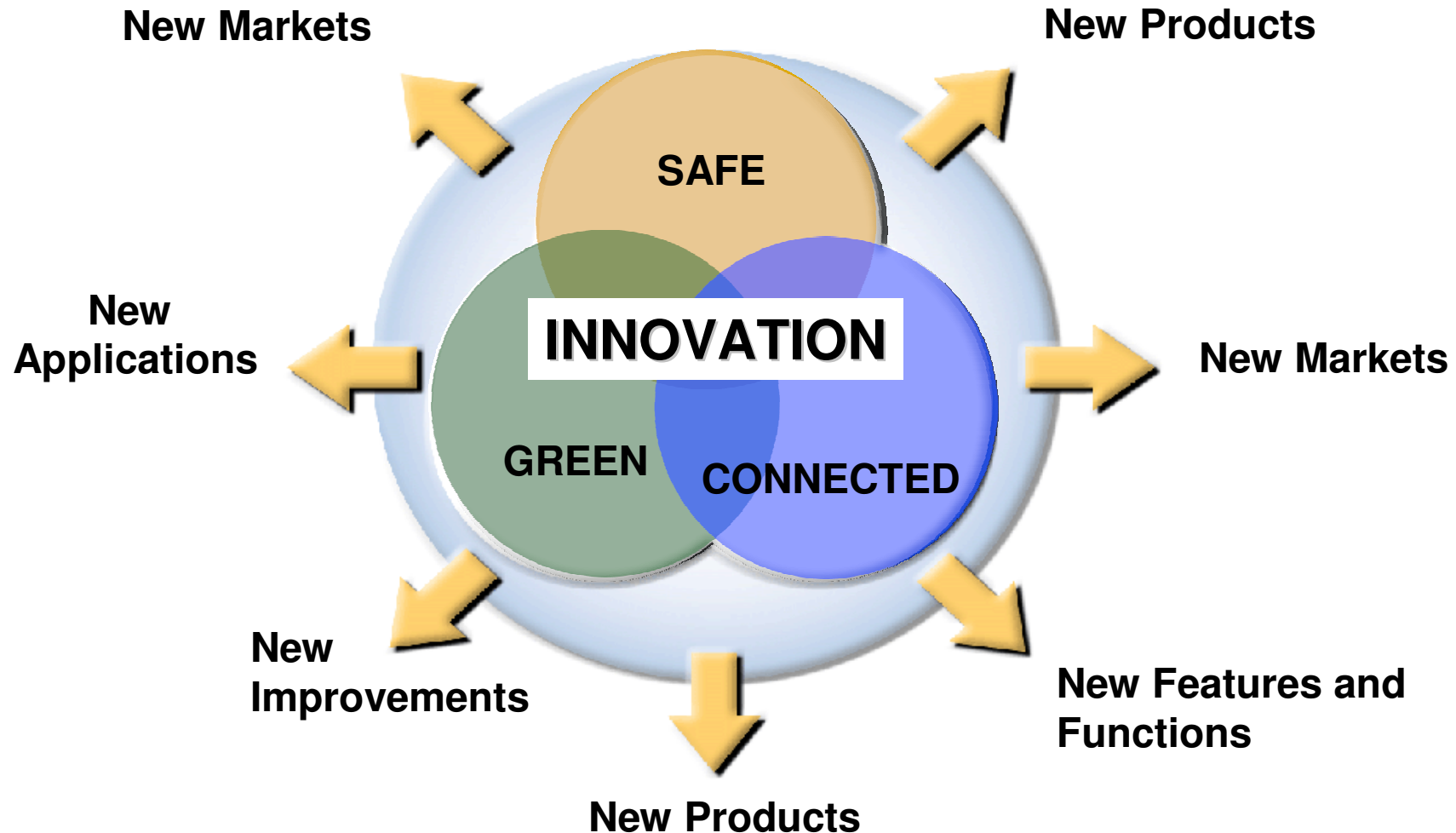
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Delphi and Autonet Mobile Collaboration

- Both companies recognized that new applications and new ways to communicate would form around the car.
- They agreed to develop and market Internet-connectivity technology products for original equipment manufacturers (OEMs).
 - Provide Internet for the car and change the face of in-car entertainment products and services.
 - Allows automotive manufacturers to enter the lucrative market of downloadable content and Internet media services.
- Focused on keeping passengers connected in a moving vehicle with minimal interruption.
 - Vehicle passengers stay connected to the Internet with any WiFi device while on the road.
 - Adult passengers can access weather reports and traffic conditions, make dinner or movie reservations, shop online, or engage in other internet based activities.
 - Children can complete homework or play online games.

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Delphi Competencies Innovate and Deliver Real World Value to the Marketplace



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