

Natural Fiber-Reinforced Composites: Ascribing Global Economic Value to Unique Renewable Resources in Developing Countries

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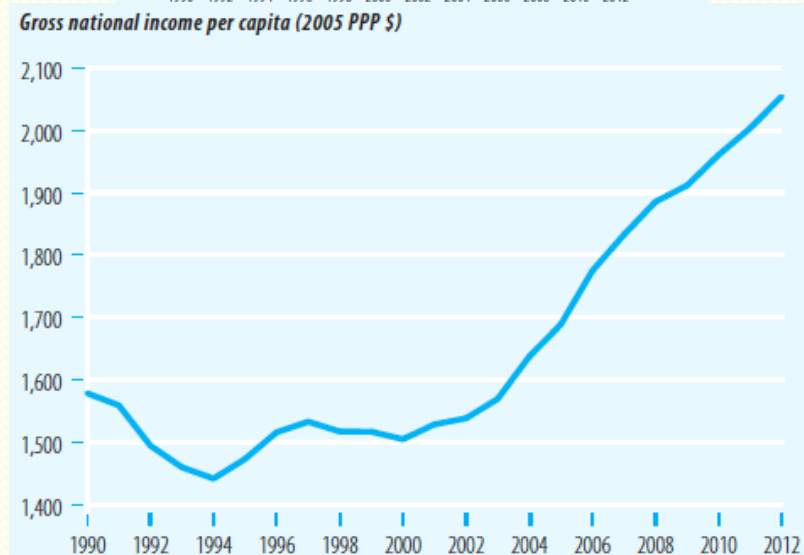
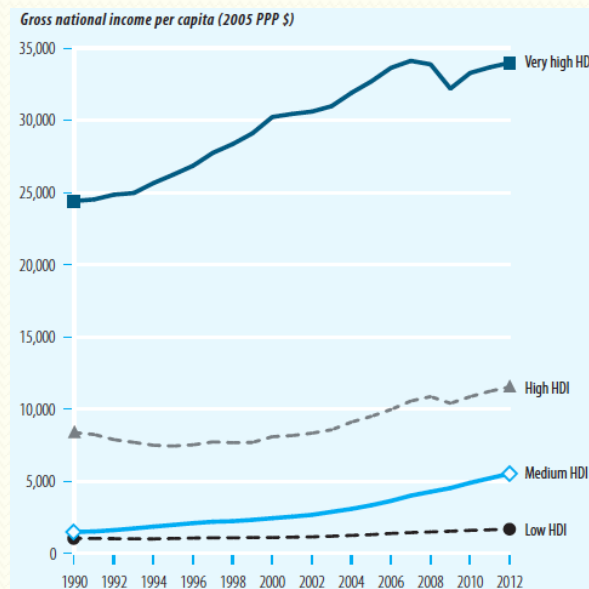
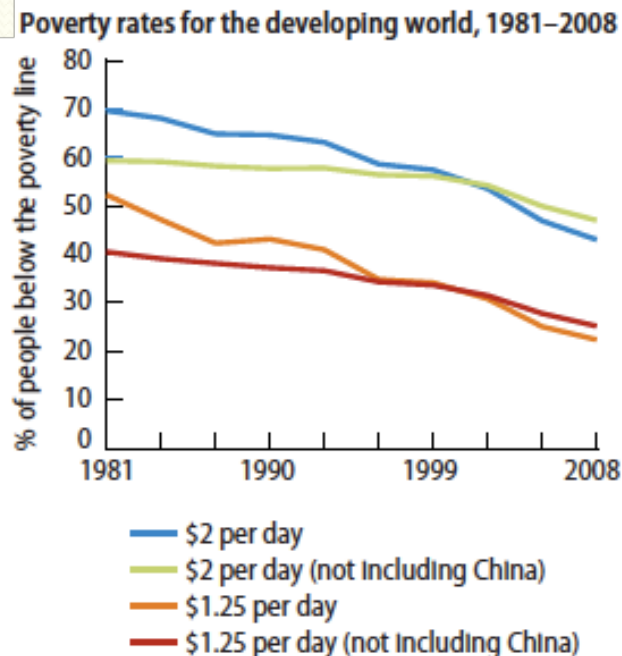
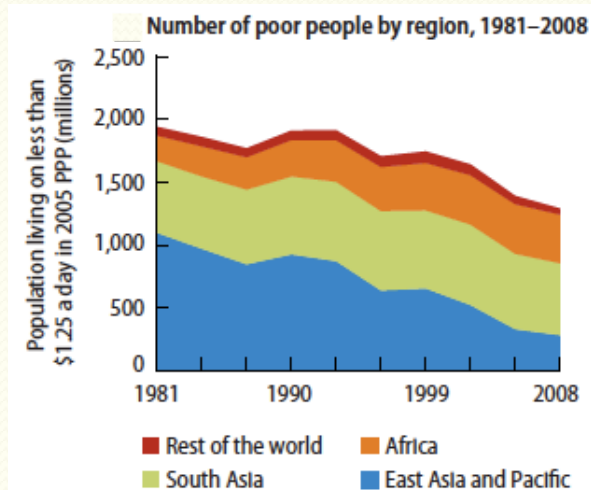
Advisor: Dr. William Jordan, Ph.D.

“The Spirit of the Lord is on me, because he has anointed me to
proclaim good news to the poor. He has sent me to proclaim
freedom for the prisoners and recovery of sight for the blind, to set
the oppressed free, to proclaim the year of the Lord’s favor.”

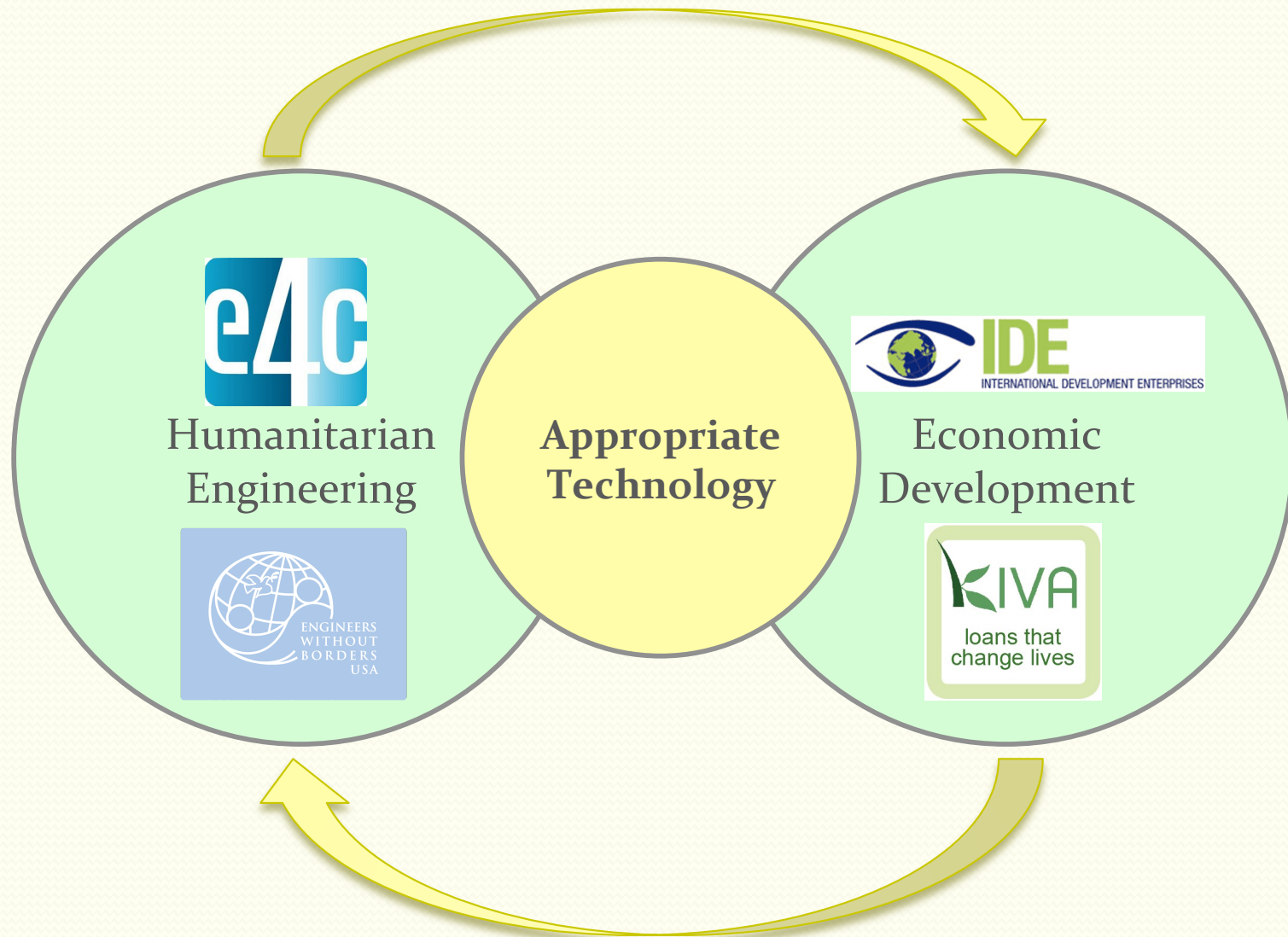
– Luke 4:18-19 (NIV)



The Encouraging News of Poverty Reduction

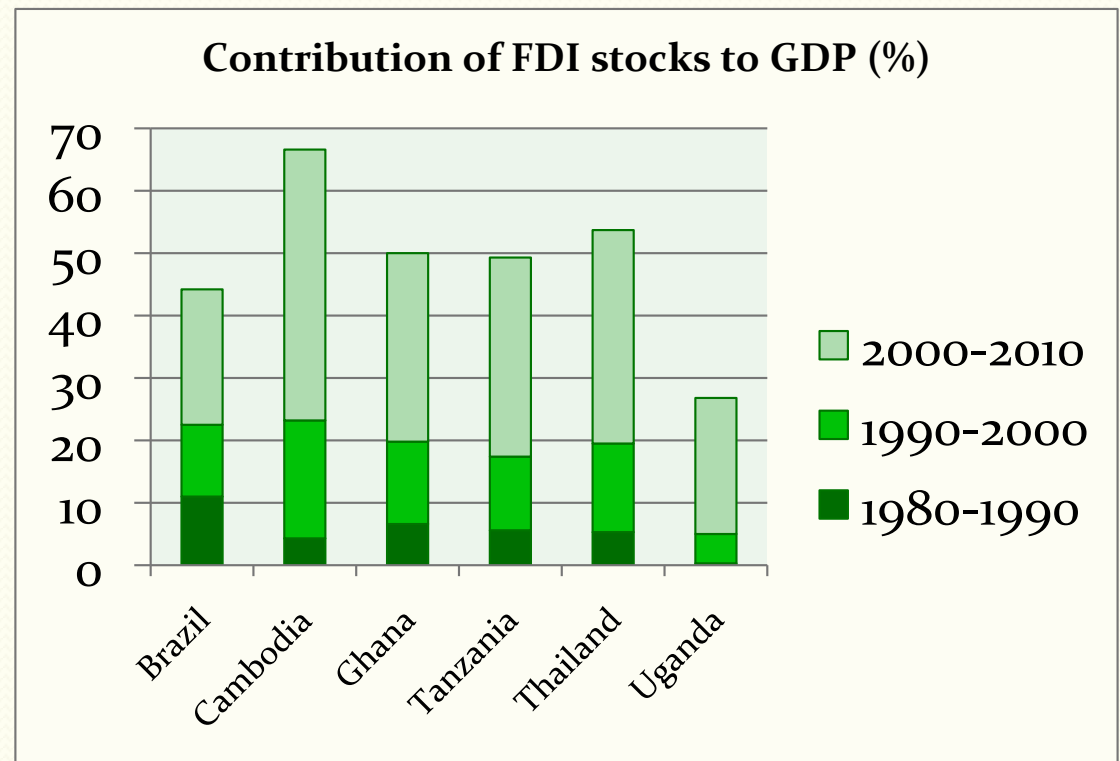
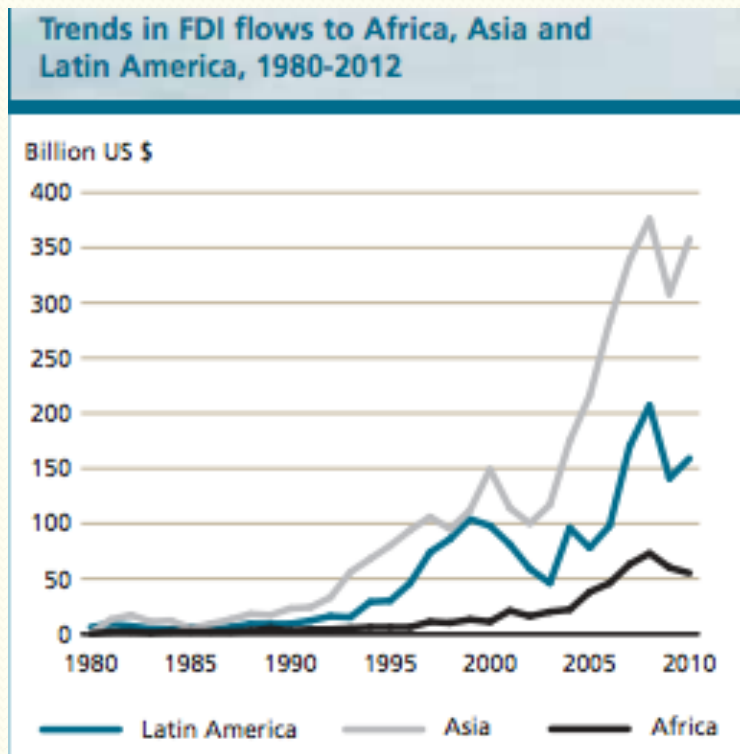


Stewardship Model for Developing Countries

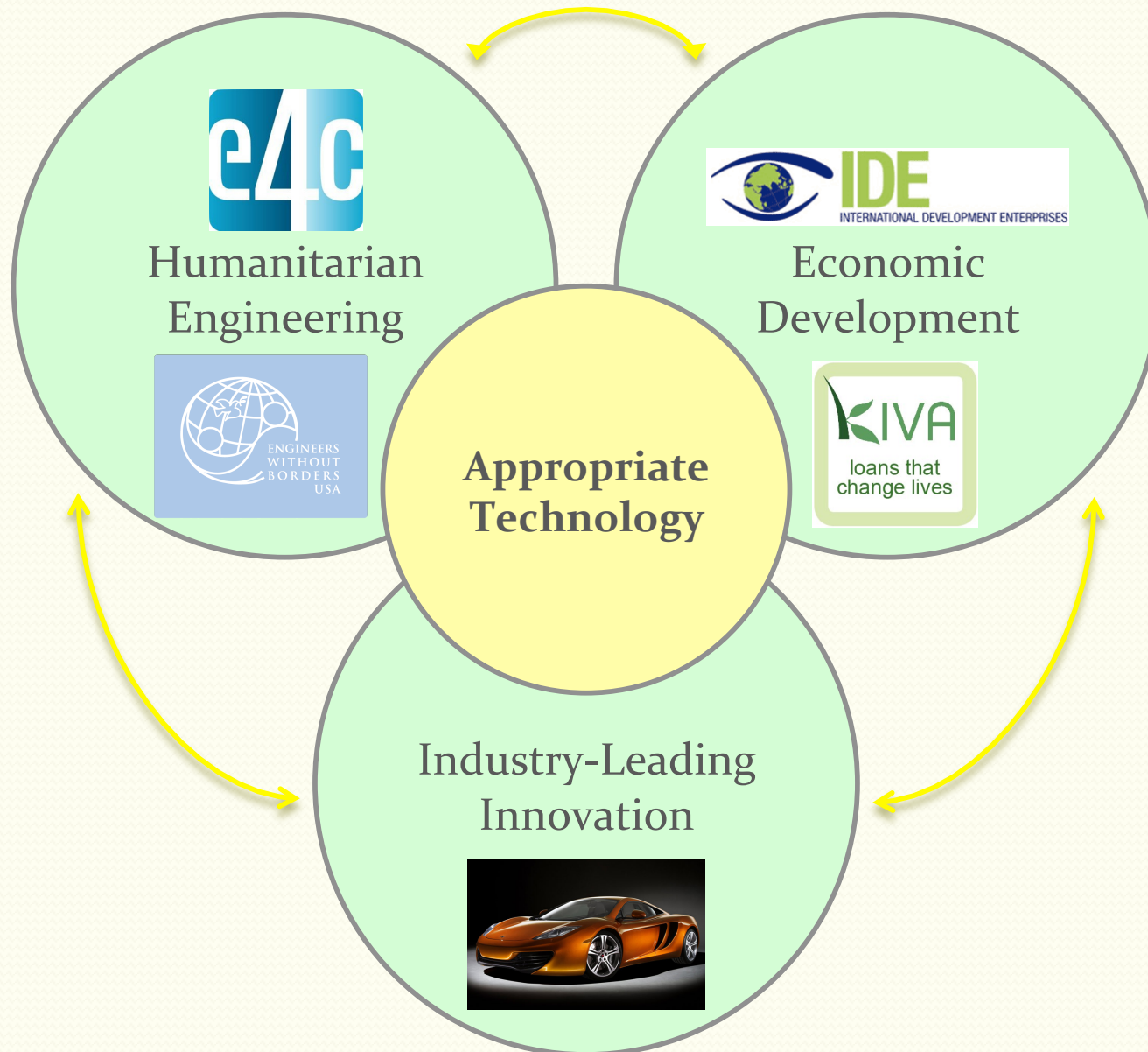


Foreign Investment Plays a Critical Role

It has also been shown that FDI works as a means of integrating developing countries into the global market place and increasing the capital available for investment, thus leading to increased economic growth needed to reduce poverty and raise living standards. – FAO 2012



Stewardship Model for Developing Countries



Agricultural Growth is Influential in Poverty Reduction

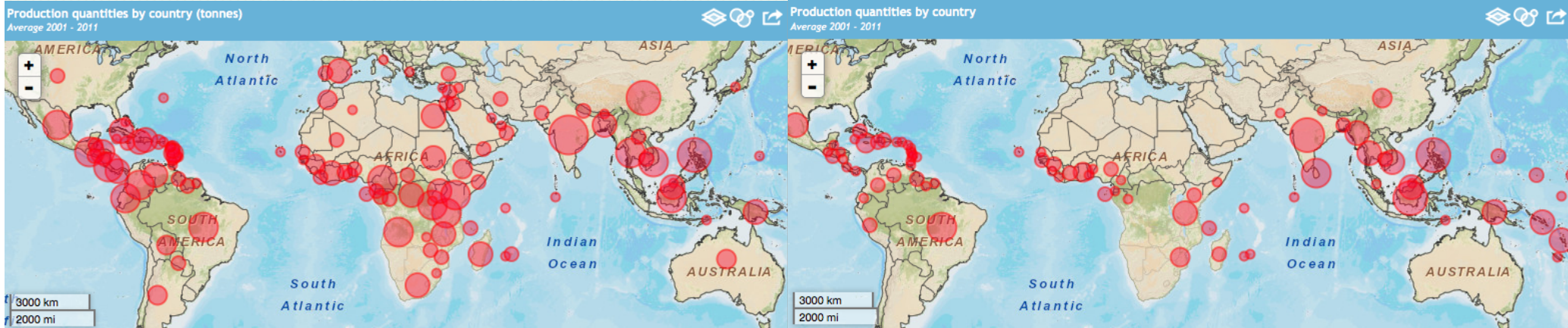
Overall GDP growth [in Africa] coming from agriculture is 2.7 times more effective in reducing 1\$/day poverty in the poorest quarter of countries... and 2 times more effective in the richest quarter of countries, than growth coming from non-agriculture.

- Alain de Janvry & Elisabeth Sadoulet
The World Bank Research Observer, vol 25 no. 1 (Feb 2010)

Unique Renewable Resources

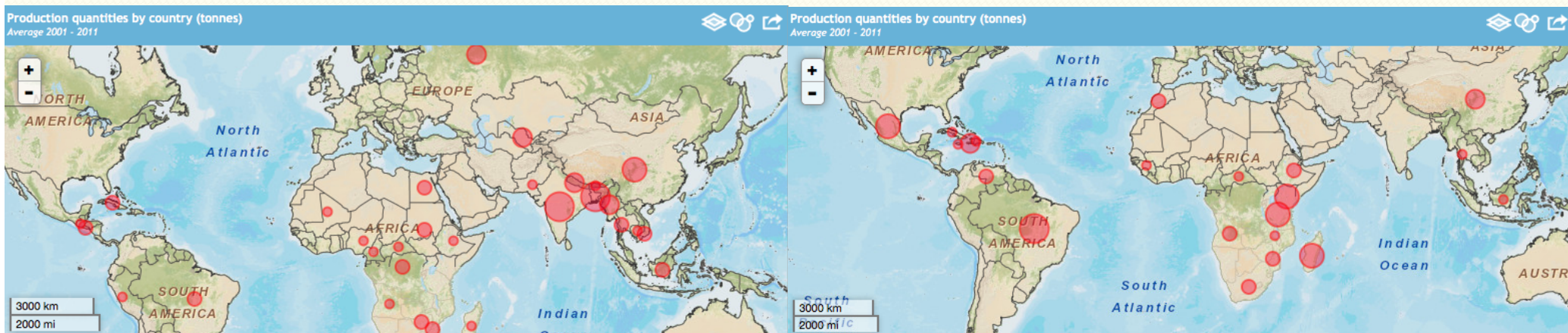
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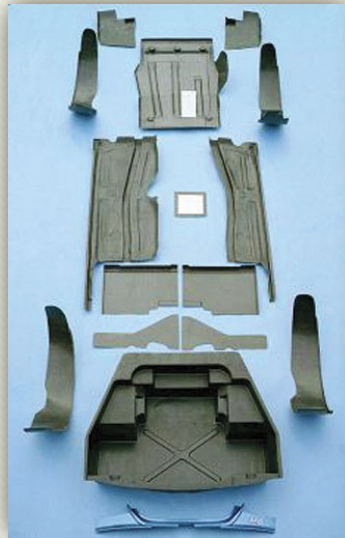
JUTE

SISAL



Fiber-Reinforced Thermoplastic Composites

- What are thermoplastic composites?



- Why fiber-reinforced?
 - High strength to weight ratio
 - Increased stiffness
 - Low cost
 - Adjustable mechanical properties



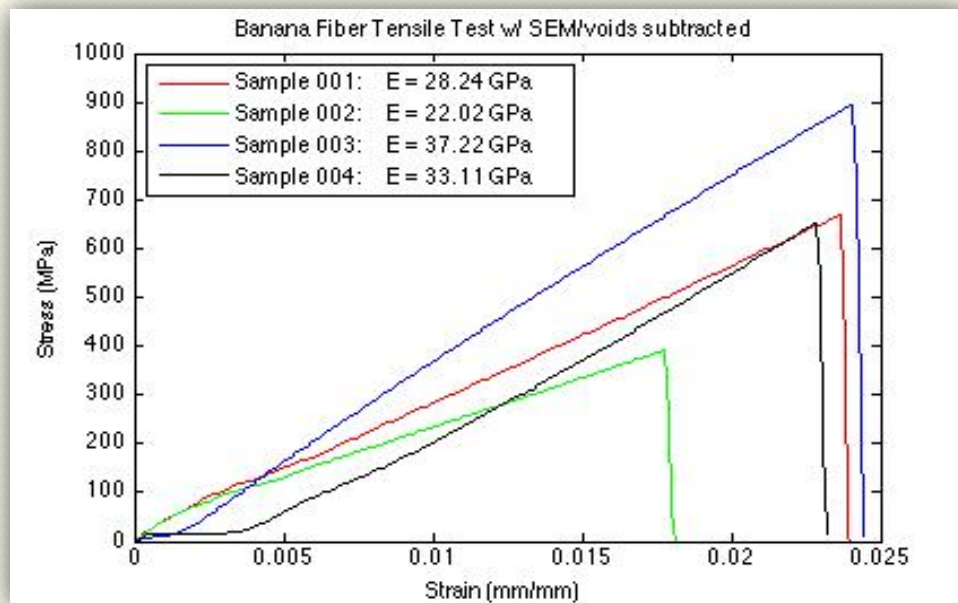
Thermoplastic Polymer

- Polymer Matrix: Low-density polyethylene (LDPE)
 - Supplied by McCann Plastics® in pellet form
 - Melt Flow Index (MFI) = 18.66 g/10 min
 - Density = 0.916 g/cm³
 - Melting Point = 110°C
 - Tensile Strength = 17.96 MPa
 - Tensile Modulus = 276.95 MPa



Fiber Reinforcement

- Fiber: Banana fiber extracted from the bast (inner bark) of the tree.



Mechanical properties of banana fibers of different diameters.			
Diameter of fiber (μm)	Initial Young's modulus (GPa)	Tensile strength (MPa)	% strain
50	32.7	779.0	2.75
100	30.5	711.7	2.47
123	30.15	651.54	2.25
150	29.7	773.0	3.58
200	27.7	789.3	3.34
250	29.9	766.6	3.24



Raw Material Processing



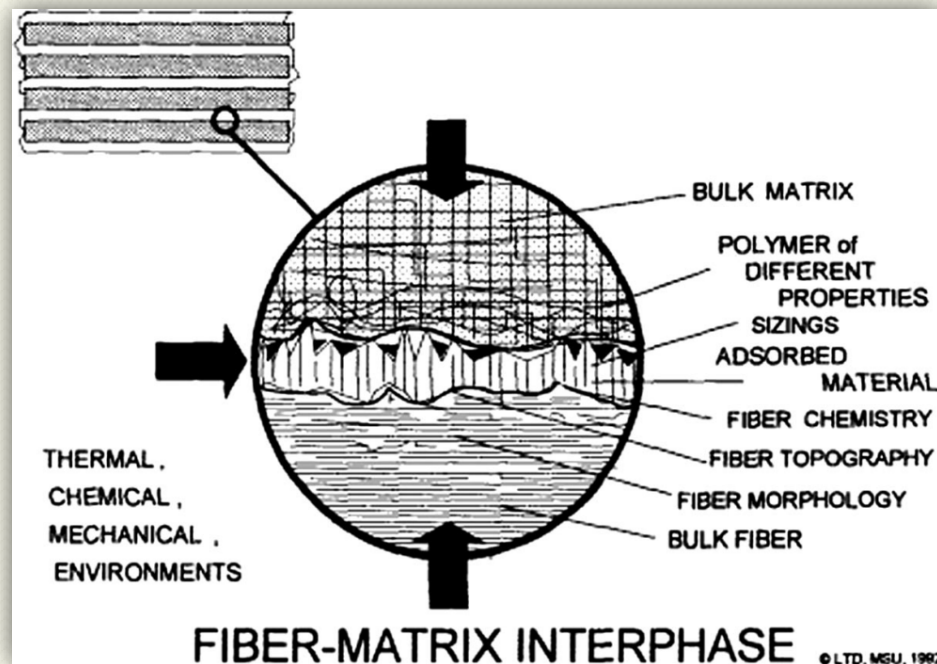
Part Manufacture/Production

Consumer



Thesis Research: Processing Issues

- Fiber-Polymer Matrix Interfacial Bonding
 - Lignocellulosic fibers (typical plant fibers) are inherently polar and hydrophilic.
 - Majority of thermoplastic polymers are non-polar and hydrophobic.
 - The absorbed moisture in the fibers is rejected by the thermoplastic polymer matrix, and poor interfacial bonding results.
 - Poor adhesion dilutes the composite and greatly reduces the mechanical strength.



Questions?

