

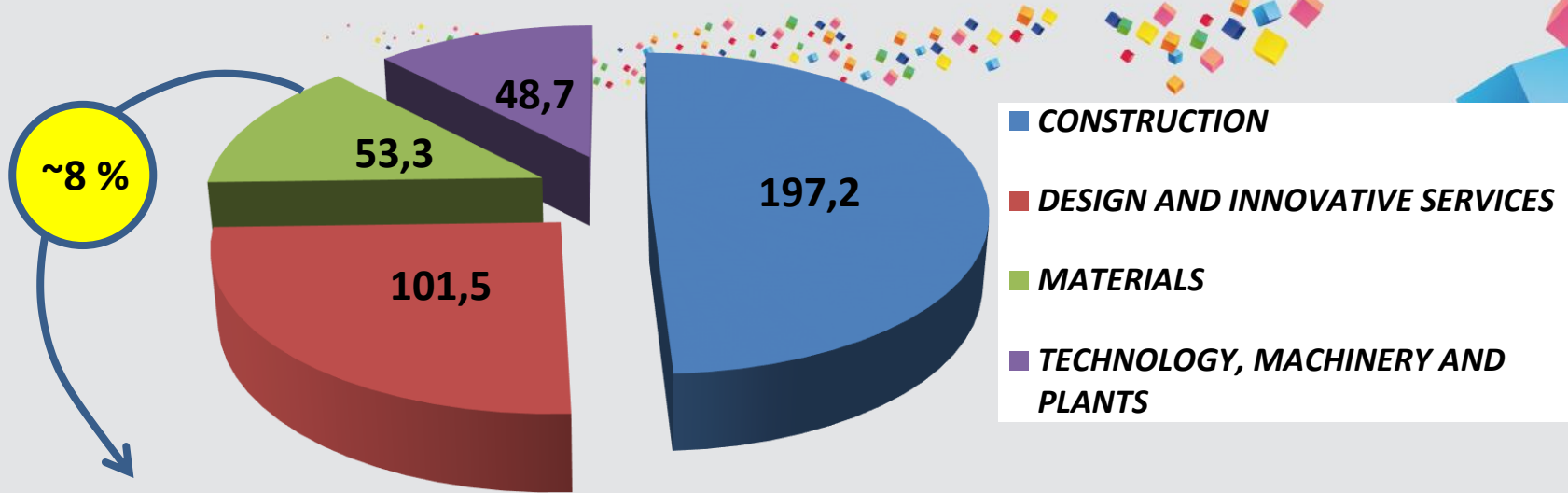


**Nano** Rome, 20-23 September  
**2016 Innovation**  
Conference & Exhibition

**INNOVATIVE PRODUCTS IN  
CONSTRUCTION INDUSTRY**

**Giorgio Ferrari – R&D Laboratories – Mapei S.p.A. - Milano**

# CHEMISTRY FOR CONSTRUCTION IN ITALY



**Adhesives**



**Paints & Pigments**



**Sealants**



**Concrete & Cement Admixtures**



**Repair & Restoration**



**Plastic & Fibers**



**Waterproof**

Source: 



**FEDERCHIMICA**  
Federazione Nazionale dell'Industria Chimica

# MAPEI's INNOVATION VISION STRATEGY

«Success means to grow on the global market»

**Sales turnover 2015 2.4 billion €**

«To grow means to be competitive»

**68 companies and 64 factories in 5 continents**

«To be competitive it is necessary to innovate»

«Innovation requires R&D investments»

**5% of turnover**

1. INCREMENTAL INNOVATION OF PRODUCTS
2. FROM PRODUCTS TO SYSTEMS
3. RADICAL INNOVATION
4. TECHNOLOGICAL DISCONTINUITY

# MAPEI's INNOVATION VISION STRATEGY

## 1. INCREMENTAL INNOVATION OF PRODUCTS

### DRIVING FORCE



- ***ELIMINATION OF SOLVENTS***
- ***REPLACEMENT OF HIGH CONCERN COMPONENTS IN FORMULATES***
- ***INCREASE OF RECYCLED MATERIALS***
- ***INCREASE OF LIFE CYCLE OF APPLIED PRODUCTS***



# LOW VOC EMISSION GRADE PRODUCTS

- **SELF LEVELLING**
- **CERAMIC TILES ADHESIVES**
- **JOINT GROUTS**



# MAPEI's INNOVATION VISION STRATEGY

## 2. FROM PRODUCTS TO SYSTEMS

MORE PRODUCTS ARE APPLIED TOGETHER TO IMPROVE THE FINAL PERFORMANCE

### DRIVING FORCE

- **DURABLE PERFORMANCES**
- **SUSTAINABLE SOLUTION OF A PROBLEM**
- **CUSTOMER WARRANTY**
- **HIGHER ADDED VALUE**



- **Acoustic insulation**
- **Structural strengthening**
- **Masonry restoration**
- **Finishing walls**
- **Waterproofing**
- **Thermal insulation**



# MAPEI's INNOVATION VISION STRATEGY

## 3. RADICAL INNOVATION

*«Invention which destroys or supplants existing models of business»*

### DRIVING FORCE

- **NEW MARKETS**
- **NEW CUSTOMERS**
- **REMAIN COMPETITIVE**
- **TECHNICAL RISK**
- **BUSINESS RISK**



# ISSUES OF CONCRETE SUSTAINABILITY



Concrete is the second most used material, after water

RETURNED CONCRETE is the unused concrete not placed at the jobsite and returned to the mixing plant (2% on global scale)



**RE-CONzero** used  
in the mixer to  
absorb free water of  
returned concrete



In few minutes,  
returned concrete is  
transformed into a  
granular material



**RE-CONzero**

**Returned Concrete  
with Zero Impact**



The new aggregates  
can be used at the  
RMC plant to produce  
new concrete

**CIRCULAR  
ECONOMY**

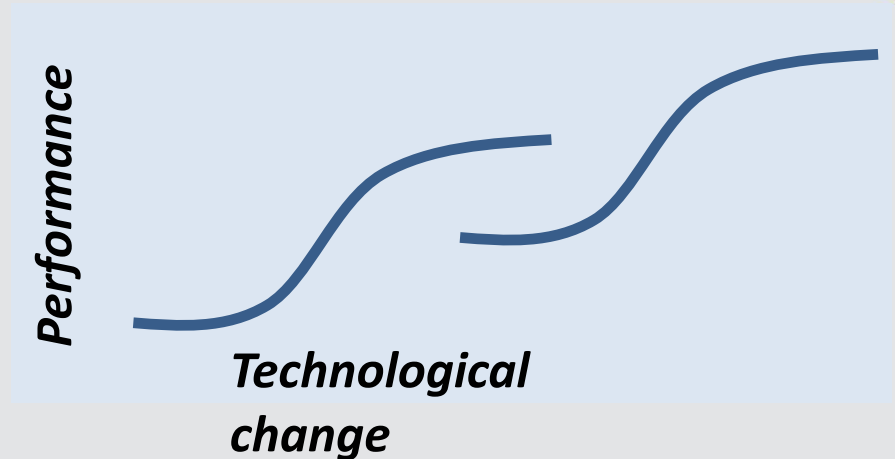
New aggregates  
are produced at  
RMC plant without  
any waste



# MAPEI's INNOVATION VISION STRATEGY

## 4. TECHNOLOGICAL DISCONTINUITY

“Process derived from emerging technology with the capacity to take value/performance to at least one order of magnitude compared to existing technology”



- **ADVANCEMENT OF SCIENTIFIC KNOWLEDGE**
- **TECHNOLOGIES DEVELOPED IN OTHER SECTORS**
- **COOPERATION WITH THE SCIENTIFIC COMMUNITY**



# MAPEI's INNOVATION VISION STRATEGY

## 4. TECHNOLOGICAL DISCONTINUITY

### NANOTECHNOLOGY PROJECT

- FOCUSED ON CEMENT SYSTEMS

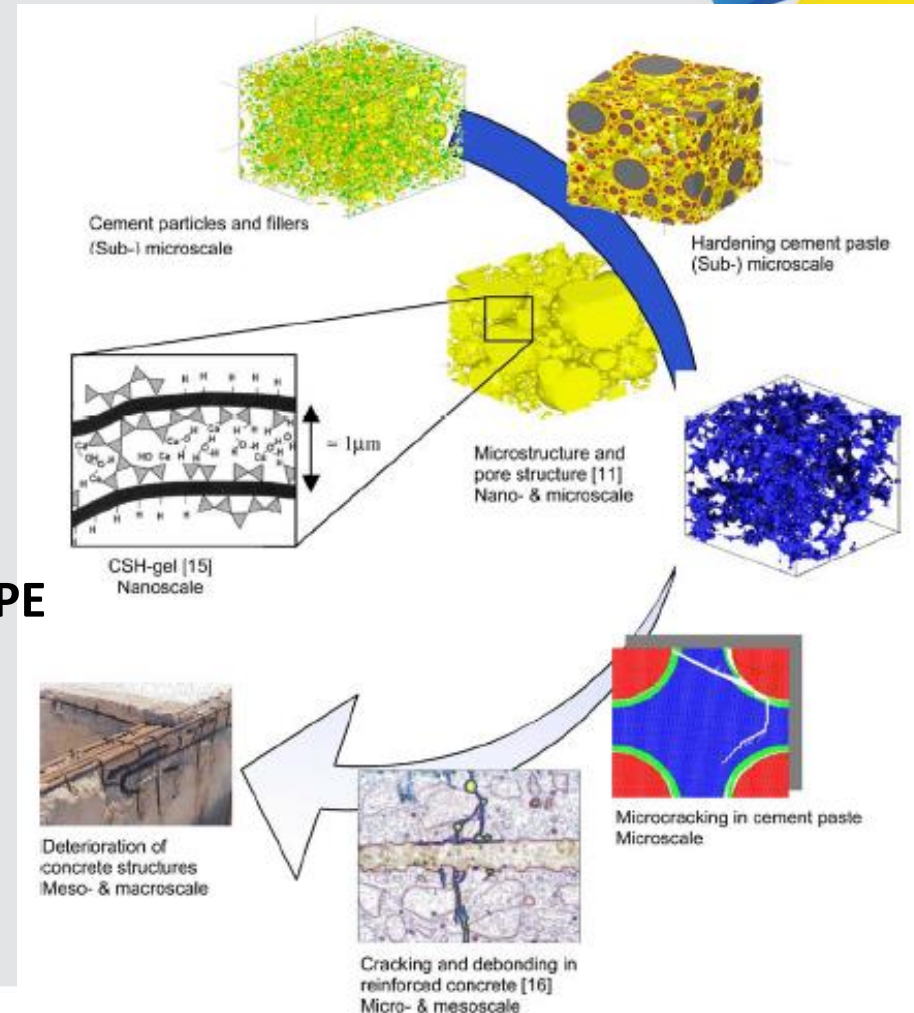
- STRUCTURE
  - RHEOLOGY
  - DURABILITY

- CHARACTERIZATION OF MICRO AND NANO STRUCTURE

- XRD
- SYNCHROTRON BEAM
  - FORCE ATOMIC MICROSCOPE
  - MICROTOMOGRAPHY

- CORRELATION BETWEEN NANO-STRUCTURE AND PERFORMANCE BY MODELLING

- MOLECULAR DYNAMIC
- VCCTL (NIST)



# MAPEI's INNOVATION VISION STRATEGY

## 4. TECHNOLOGICAL DISCONTINUITY

### NANOTECHNOLOGY PROJECT

MAPEI FINANCES THE PROJECT WITH PADUA UNIVERSITY –  
DEPARTMENT OF GEOSCIENCES

- *1 Full Professor*
- *1 Assistant Professor*
- *3 PhDs*
- *Program of visiting professors*
- *Operating costs*

MAPEI DIRECTLY PARTICIPATES  
THE PROJECT WITH

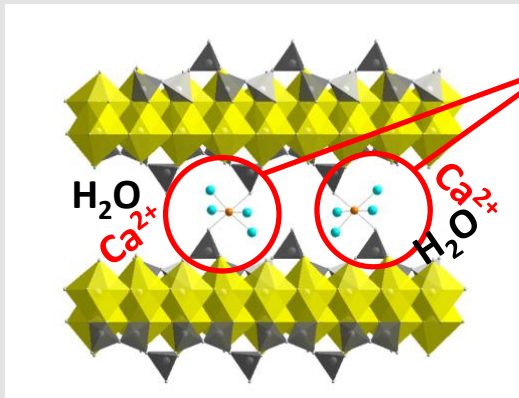
- *2 Graduates*
- *2 PhDs*
- *The analytical support of its central corporate laboratory*





# NANOTECHNOLOGY PROJECT

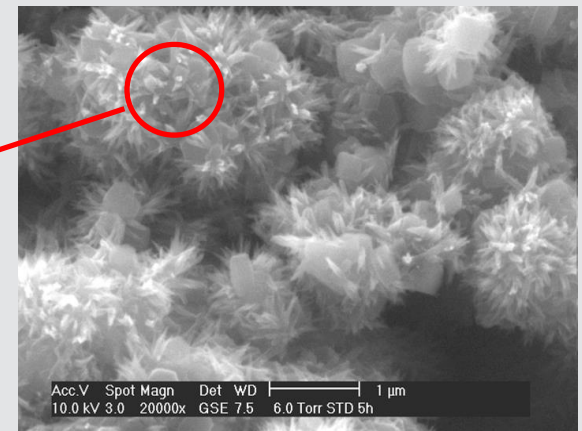
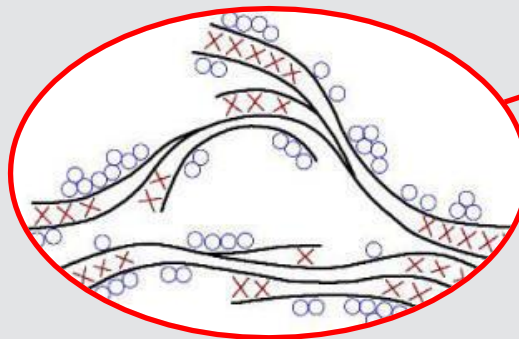
**NEW SYNTHETIC MODIFIED POLYMERIC SILICATE**  
**to CONTROL CEMENT HYDRATION**  
**for the production of SUSTAINABLE and**  
**DURABLE CONCRETE**



Cu<sup>2+</sup> (aq)

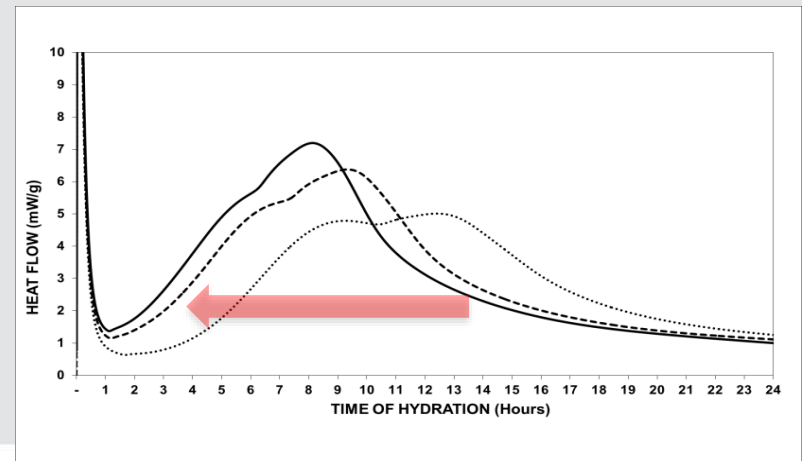
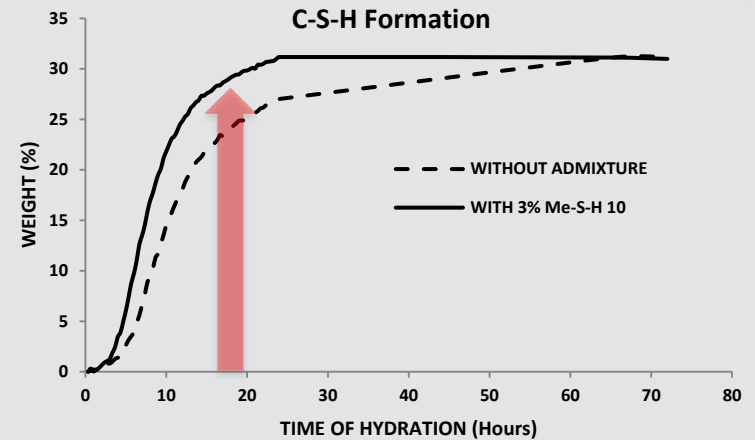
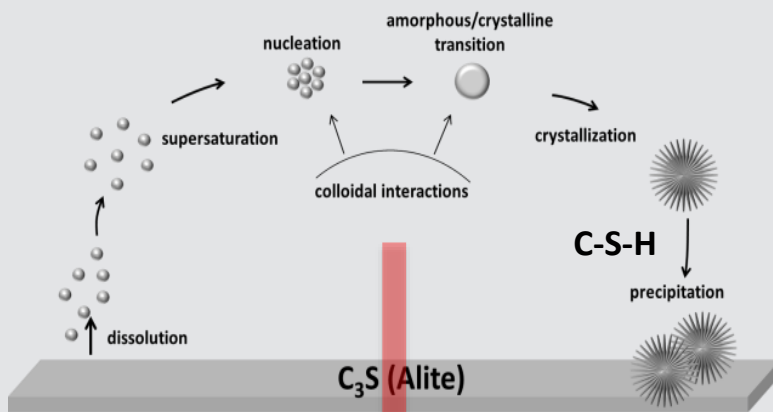
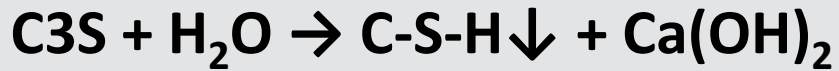
Av. particle size	30 nm
Specific surface	> 450 m <sup>2</sup> /g
N. of particles	> 10 <sup>18</sup> /kg

**SEEDING  
CATALYSIS**



# NANOTECHNOLOGY PROJECT

## MECHANISM OF SEEDING CATALYSIS





# NANOTECHNOLOGY PROJECT

## 1) ACCELERATED DEVELOPMENT OF MECHANICAL STRENGTH

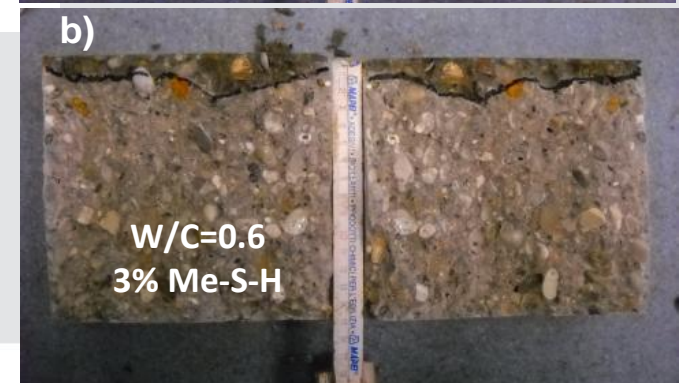
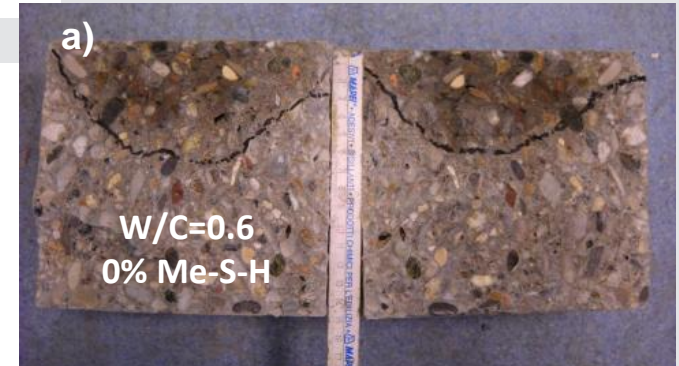
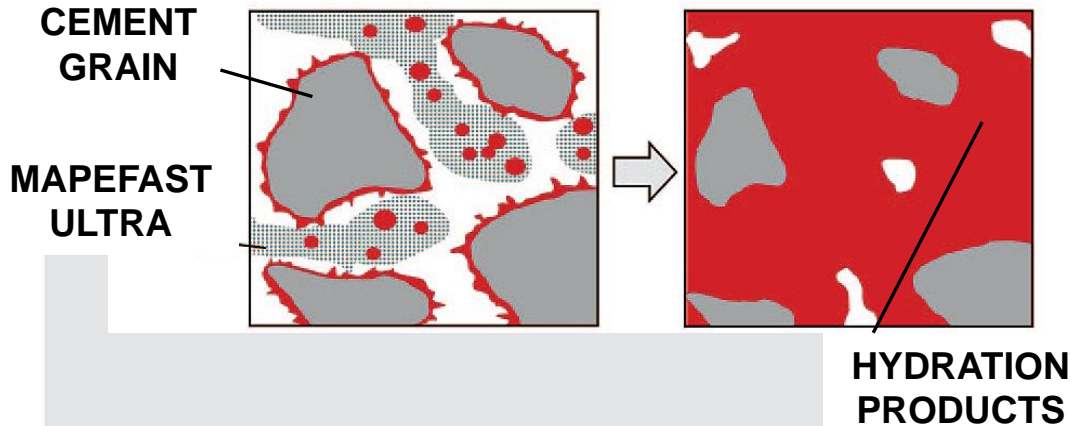
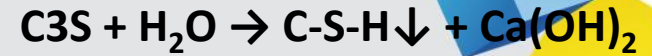
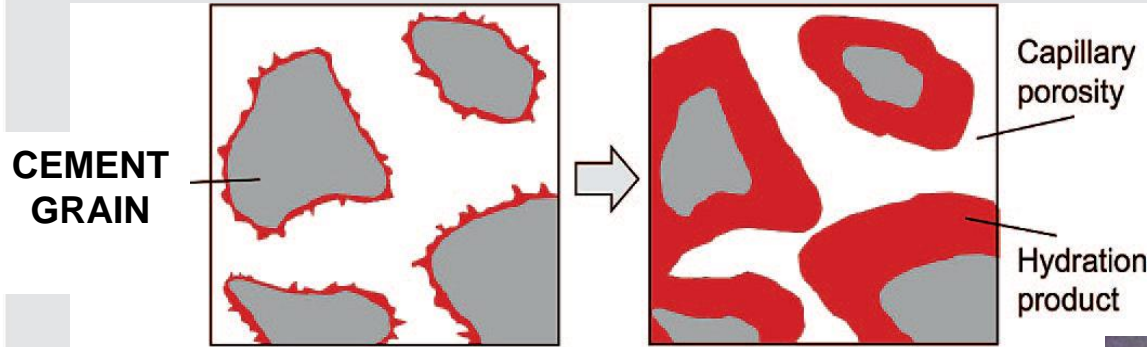
- Energy saving
- Reduction of CO<sub>2</sub> emissions



Concrete test	Compressive strength (N/mm <sup>2</sup> )		GWP <sub>100</sub>
	15 hours	80 days	kgCO <sub>2</sub> eq/m <sup>3</sup>
Steam cured	35.6	56.8	358
2 % MFU	32.6	72.6	315

# NANOTECHNOLOGY PROJECT

## 2) IMPROVEMENT OF THE MICROSTRUCTURE OF HYDRATED CEMENT



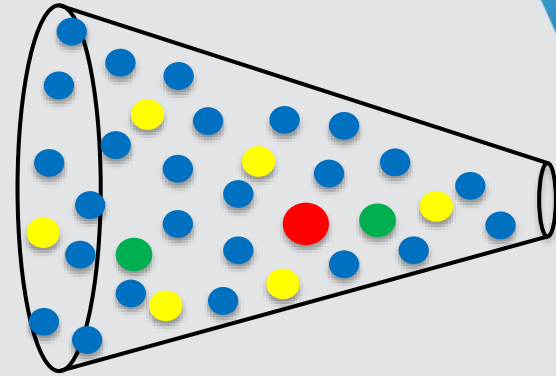
- *Capillary porosity reduction*
- *Permeability reduction*
- *Improved durability*



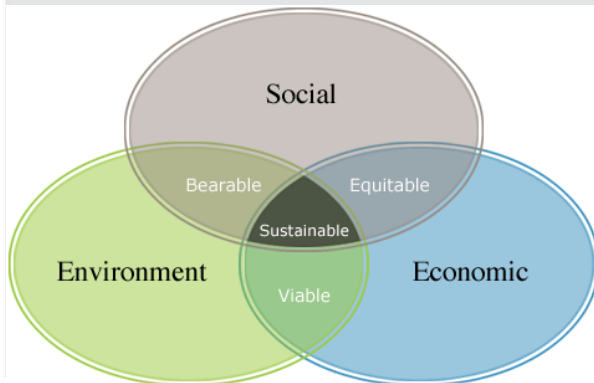
# CONCLUSIONS

## INNOVATION IN CONSTRUCTION

- *Incremental Product's Innovation*
- *From Products to Systems*
- *Radical Innovation*
- *Technological Discontinuity*



## SUSTAINABILITY IS A PERVASIVE CONCEPT IN CONSTRUCTION'S INNOVATION



1. *Resource consumption*
2. *Impact on health*
3. *Life cycle of products*
4. *Recycling*



**THANK YOU FOR YOUR ATTENTION!**