



H2020 MORE-CONNECT

**Development and advanced prefabrication of innovative,
multifunctional building envelope elements for MOdular RETrofitting
and smart CONNECTIONs**

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MORE-CONNECT:

solving barriers to come to deep (NZEB) retrofitting

- European building sector is fragmented and not able to offer holistic, integral solutions for nZEB deep renovation for reasonable costs and good quality
- European building process is based on a 'layered' structure:
 - many labour actions on the buildings site
 - many sub disciplines involved
 - leading to extra costs and failure risks
- European building market is top down and supply driven:
 - mismatch between the offered products and the end-user's needs and the affordability
- Due to long-lasting renovation process and failures risks customers hesitate to renovate their property
- High operation costs are still more acceptable for owners-residences than deep renovation with low exploitation/ energy costs



MORE-CONNECT: challenge and solution

- Deep retrofitting by using *prefabricated multifunctional* renovation elements which have the potential to:
 - reduce costs
 - reduce the renovation time and disturbance for occupants
 - enhance *quality and performances*
 - energy efficiency
 - indoor climate
- The *challenge* of MORE-CONNECT is to make a major step forwards by a combination of:
 - product innovation,
 - process innovation
 - innovative market approach
 - in a process of cost and quality optimization
 - driven by motivated and innovation-driven *SME's*.
- Why SME's?
 - Large building companies are very traditional and have no specific economic interest in this transition
 - Transformation in building practice will be initiated by motivated innovative SME's, combined with production-line-design specific experience



The four qualitative MORE-CONNECT objectives

- 1. The development of cost optimal deep renovation solutions towards nZEB concepts with the possibility of extra customize (cost-effective) features*
 - Development of optimal configurations of energy efficiency and renewable energy systems, as one of the quantitative objectives is the offering of nZEB renovation concepts.
 - Concepts will be preselected in balance between demand reduction and renewable production,
 - Most optimal mix within the range of term 'nearly' in Nearly Zero Energy.
- 2. The development and demonstration of prefabricated multifunctional modular renovation elements in series of 1 concepts, in a mass production process*
 - Development and demonstration of a platform for prefabricated, multifunctional renovation elements for the total building envelope (facade and roof) and installation/building services.
 - These elements can be combined, selected and configured by the end-user, based on his specific needs.
 - The configuration can be made on the basis of a pre-selection of elements, based on the specific properties and measures of his home inventoried by advanced geomatics with various aesthetic and architectonic appearances.
 - As input into advanced Building Information Modelling systems it can control and steer the further production process of these elements.
- 3. The development and demonstration of new fully automated production lines for multifunctional modular renovation elements*
 - Development of new designed automated production lines supporting a line production that is effective on series-1 as well as large series
 - Demonstrated that a model for one common platform for a fully automated production line can be used in different geo-clusters
- 4. The offering of a one-stop-shop to the end-user to renovate their homes*
 - End-user will deal with only one party, responsible for the total renovation, starting from an inventory of the existing situation, inventory of specific end-user demands, translation into modular renovation kits, mounting and installing, financing and aftercare
 - Limiting the actual renovation time on site to a maximum of 5 days with a goal for an average of two days, including the complete or partial removal of the existing facades and roofs or other elements



The MORE-CONNECT pillars

- **Product innovation**
 - Modular façade elements
 - Modular roof elements
 - Modular ‘engines’
- **Process innovation**
 - Advanced geomatics to make inventories and gauging of buildings and buildings stock.
 - Web-based and/or digital decision tools will link building characteristics, building (energy) potentials, end-users demands to program requirements, technical solutions, component combinations in concepts, production automation.
 - This will be processed in BIM systems for the steering of industrial processes and for enhanced quality assurance.
- **Optimization** between costs, environmental aspects and quality
 - Integration of components and systems
 - Re-design
 - Smart connectors



- Based on NZE concepts <> **perception of end-user**



Perception of end-user

- End user has three basic questions:
 - *What do I get?*
 - *What does it cost?*
 - *And what does it gain to me?*
- How does MORE-CONNECT respond to this?
 - Development of a **one stop shop concept**
 - Offered as an ‘advanced energy service’
 - User can make his own renovation configuration
 - User can add extra qualities / options
 - End-user deals with only one party, responsible for total renovation, inventory, mounting, installing, financing, after care and performance guarantee



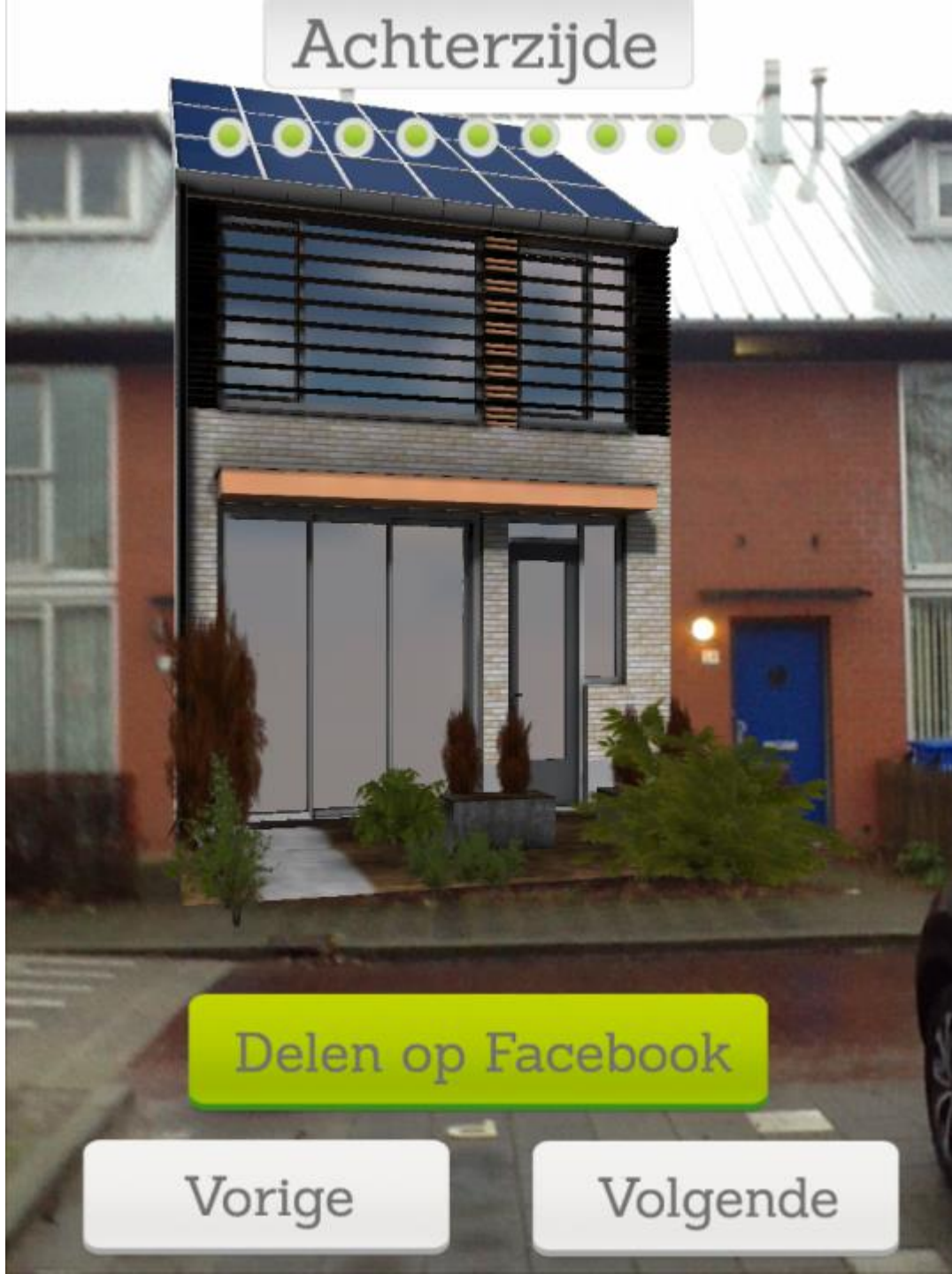
- Development of a system of performance guarantee
 - In production process
 - In practice (‘remote diagnostics’)
- Development of energy cost guarantee proposition to end-users





Customers are able to make their own choices and configurations!

Achterzijde



Delen op Facebook

Vorige

Volgende

MORE-CONNECT approach:

one philosophy – different solutions for several geoclusters

- Geo-cluster 1: Northern.
 - NZE renovation concepts for post-war multifamily dwellings in Denmark.
- Geo-cluster 2: Continental Northern East.
 - focusing on a collaboration between Estonia and Latvia. Focus on application of prefabricated products for typical post-war Soviet multifamily buildings
- Geo-cluster 3: Continental Centre.
 - focusing on Czech Republic on solutions for continental climates.
- Geo-cluster 5: Mediterranean.
 - focusing on solutions for mild and warmer climates, with a pilot for the Portuguese market.
- Geo-cluster 6: Western Central.
 - focuses on modular prefab concepts for mass built single houses (50's – 7-'s) for the Dutch/Belgium markets
- Reflected in the consortium: one 'research partner' (university or SME with research capacities) with one or two (SME) industrial partners.



MORE-CONNECT pilots

< Denmark
(3D printed facades)



Estonia >
(adding prefab façades)



Latvia >
(adding prefab façades)



< The Netherlands
(total removal and Replacement)

Czech Republic >
(mock up façade)



< Portugal
(adding prefab façades)



MORE-CONNECT technical developments

- Modular façade elements
 - Solutions depending from building typology/morphology
 - total removal and replacement of façade
 - partial removal and replacement of façade
 - adding façade elements
 - 3D printing
- Modular roof elements
 - Integrated with PV panels (optional)
- Modular platforms for building services ‘engines’
- Smart connectors (mechanical, hydraulic, air, electric, ICT)

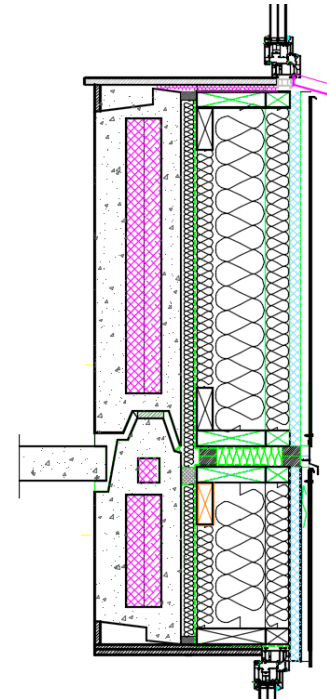
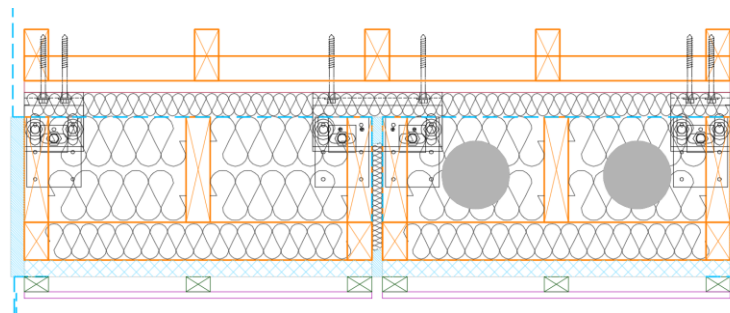
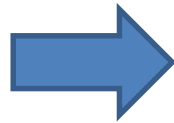


Modular façade elements

- Total removal/replacement (the Netherlands)

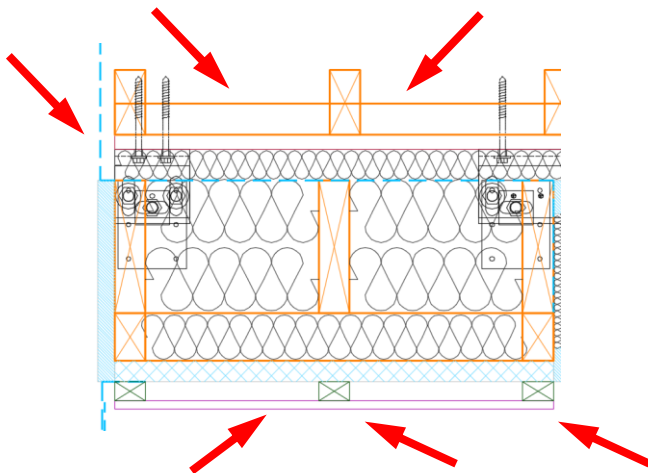


- Adding prefab elements (Estonia)



Development basic modular elements for facades - Estonia

- Design and construction of panels



Modular platforms for building services 'engines'

....which one is more expensive?



~ € 900



~ € 25.000

MORE-CONNECT solution: prefab modular 'engine' for retrofitting

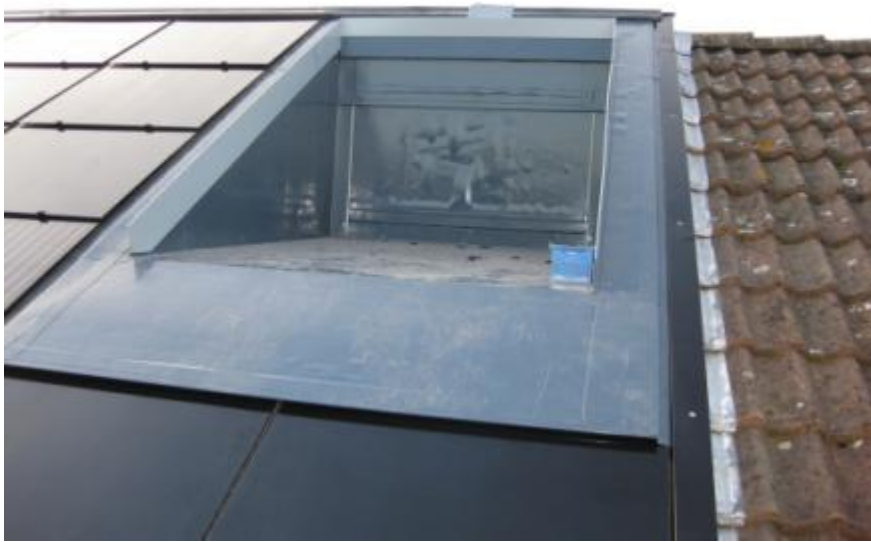
- Combining heating, ventilation, DHW, storage, PV inverters etc. in one compact platform
- Version 1.0: combination of existing components
- Version 2.0: miniaturizing redesigning components, 35% more compact and lighter
- Modularity:
 - Place in the building:
 - Central unit
 - Decentral (split) units
 - Medium for heat transfer:
 - Water
 - Air
 - All-electric
 - Hybrid
 - Phased in time:
 - Upscaling/downscaling (changing families, use, etc.)
 - Starting with (low budget) basic option, later to be extended or adding new technologies ('no-regret options')



...making the engine 1.0 (still 'hand-made')



...placing the engine on/in the (integrated PV) roof



MORE-CONNECT dwelling
Heerlen, The Netherlands



New development and redesign engine(2.0)



CO2 controlled MVHR
Storage
Heat pump
PV

Optional:
Solar thermal
PCM storage
E-storage
(DC?)

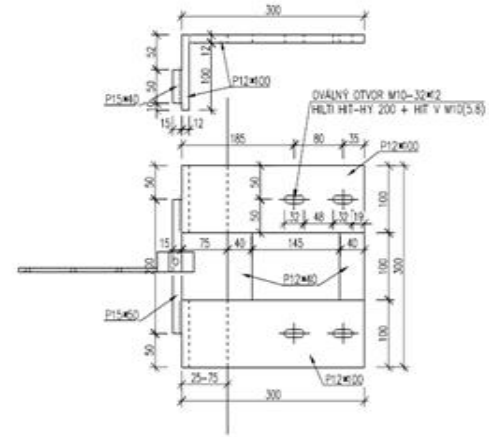
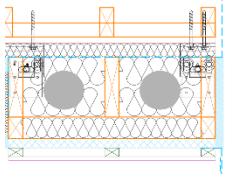
Plug & Play
Maintenance and repair off site
Scalable up/down



MORE-CONNECT Smart connectors

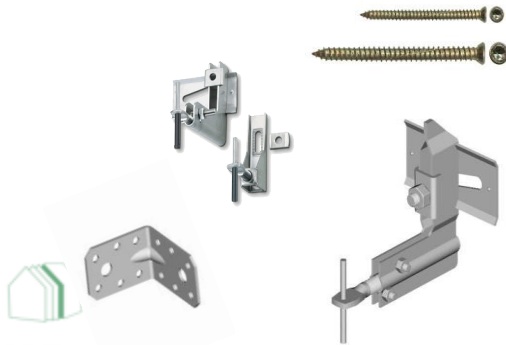
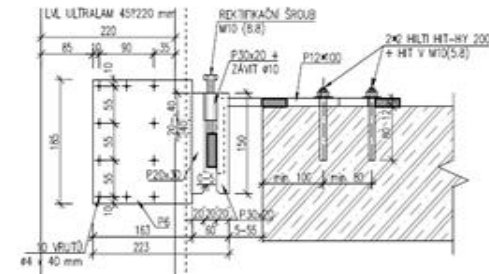
air, mechanical

- Air (ventilation ducts)



- Mechanical connectors

- rectification in 3D
- anchoring only to the ceiling structures



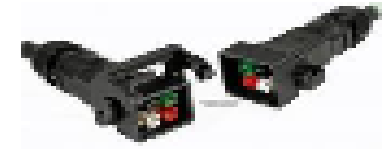
MORE-CONNECT Smart connectors

Electric, ICT

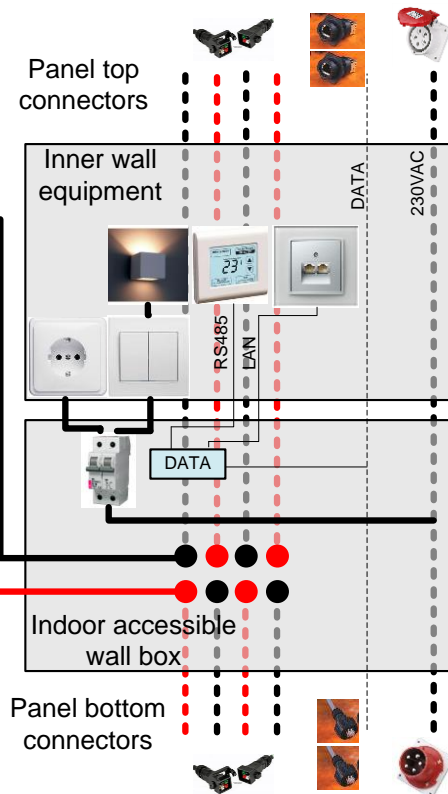
- Distribution of power 230VAC to the flats (Mennekesh)



- Distribution of Photovoltaic DC bus to string the integrated PV panels

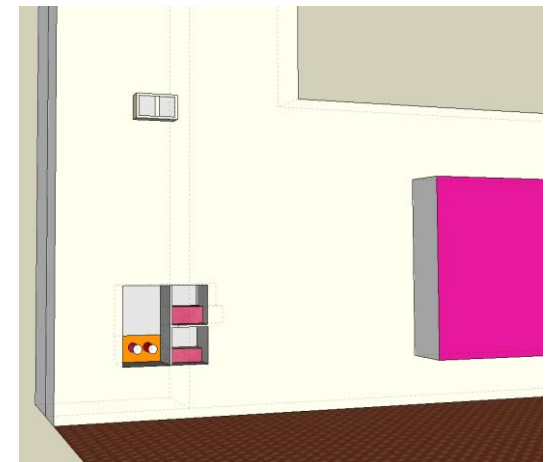
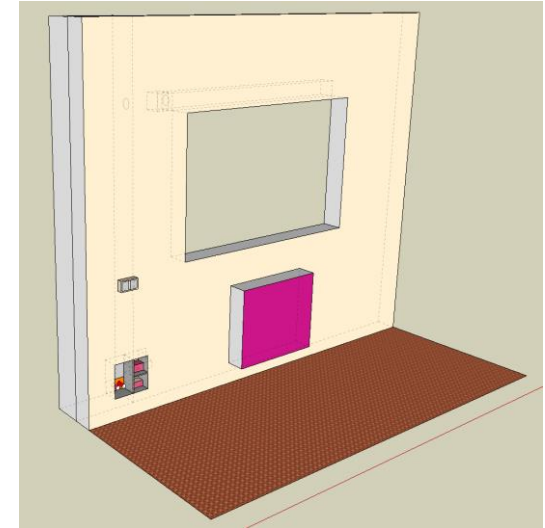
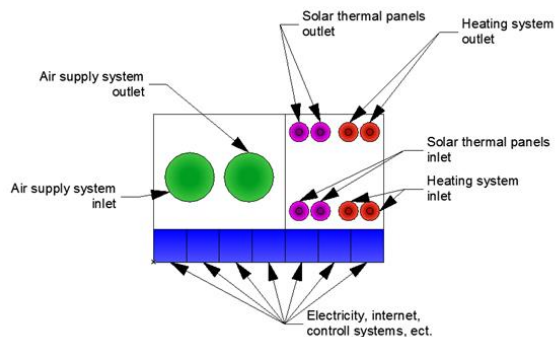
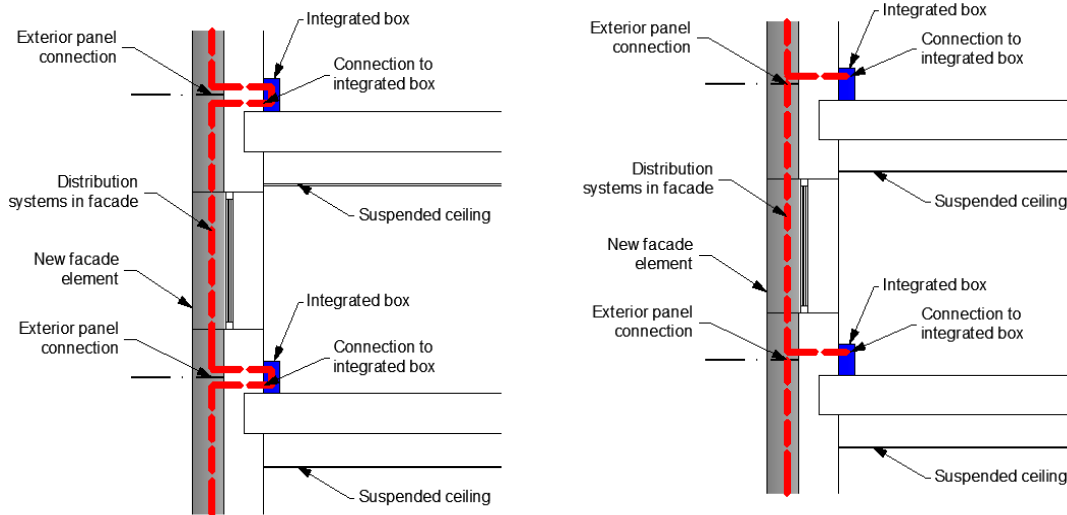


- Distribution of ethernet and communication bus for sensors and controller



MORE-CONNECT Smart connectors

- Example smart connection box:
 - Heating by heat emitters below the window
 - Connections in connection box – heating, regulation, electricity)
 - Heating system connected from façade panels
 - Use of special facade elements for hydraulic piping systems



Conclusions

- Series of 1 in mass production possible if production process is fully automated and BIM controlled
- Further improvements to be made by the development of
 - compact installation platforms ('engines')
 - Smart connections (mechanical, hydraulic, air, electric, ICT)
- By extreme prefabrication deep renovation of single family dwellings to a nZE level is possible:
 - For € 45.000 – 50.000 (now € 65.000)
 - Within less then 5 days (now 8 days)



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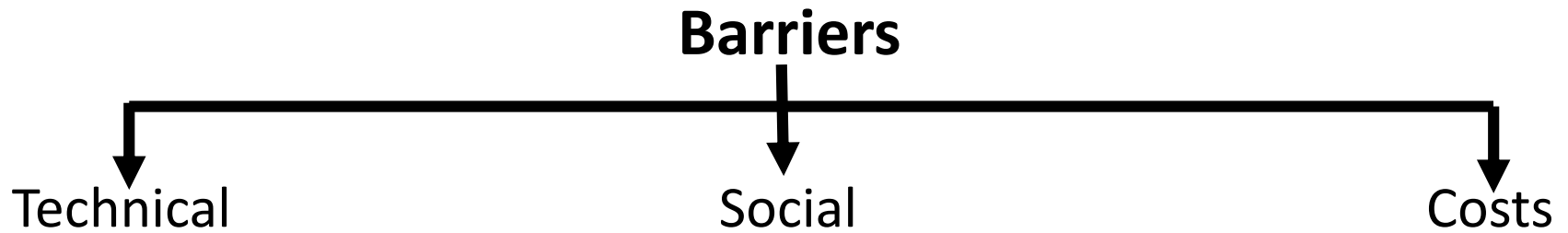
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MORE—CONNECT



Discussion: barriers versus benefits



Benefits

