

INNOVATION IN CONSTRUCTION: *A COLLABORATIVE APPROACH*

Oleh:

Dr. Arman Jayady, ST., MT.

Dosen Magister Teknik Sipil UPI YAI

Jakarta, 10 Juni 2023

Pada Acara:

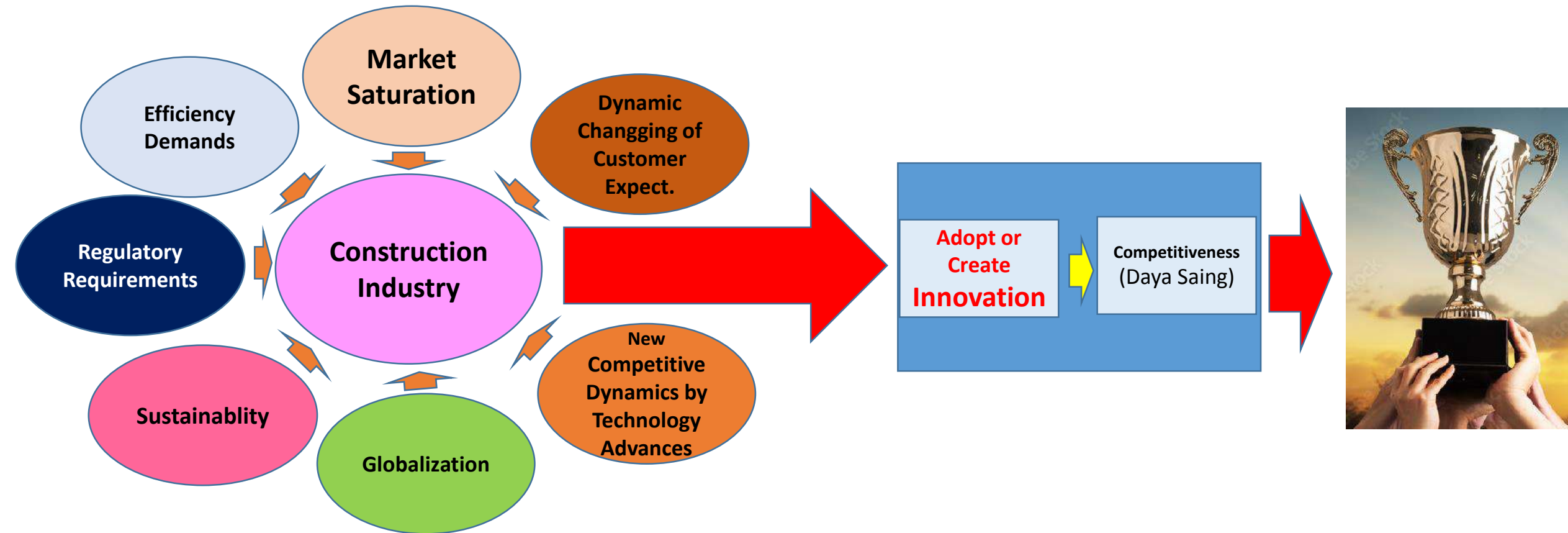
CENT Seminar – Binus University



Challenge.. (National Construction Industry)



Challenge.. (Focus: controllable)



Meaning..

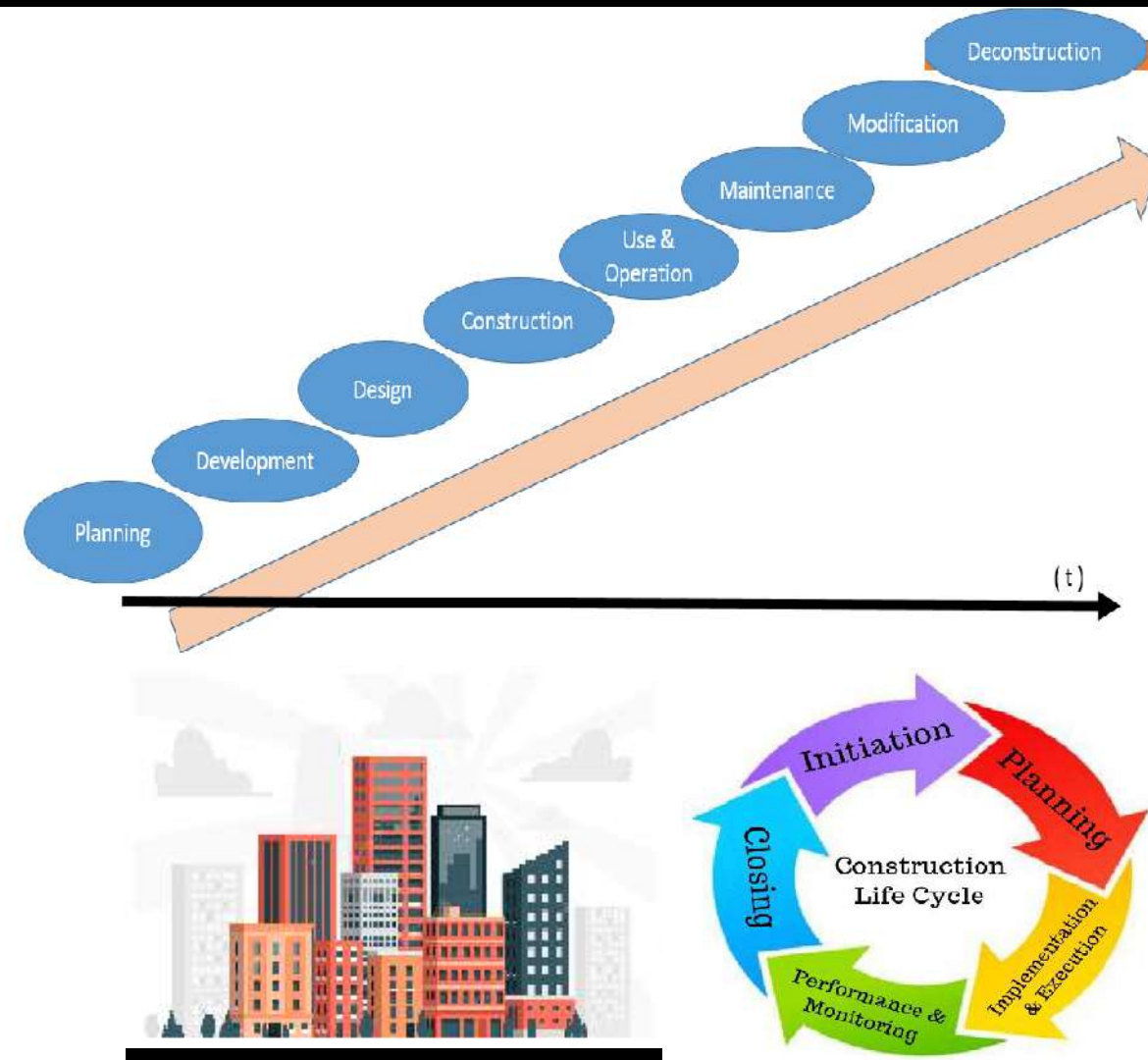
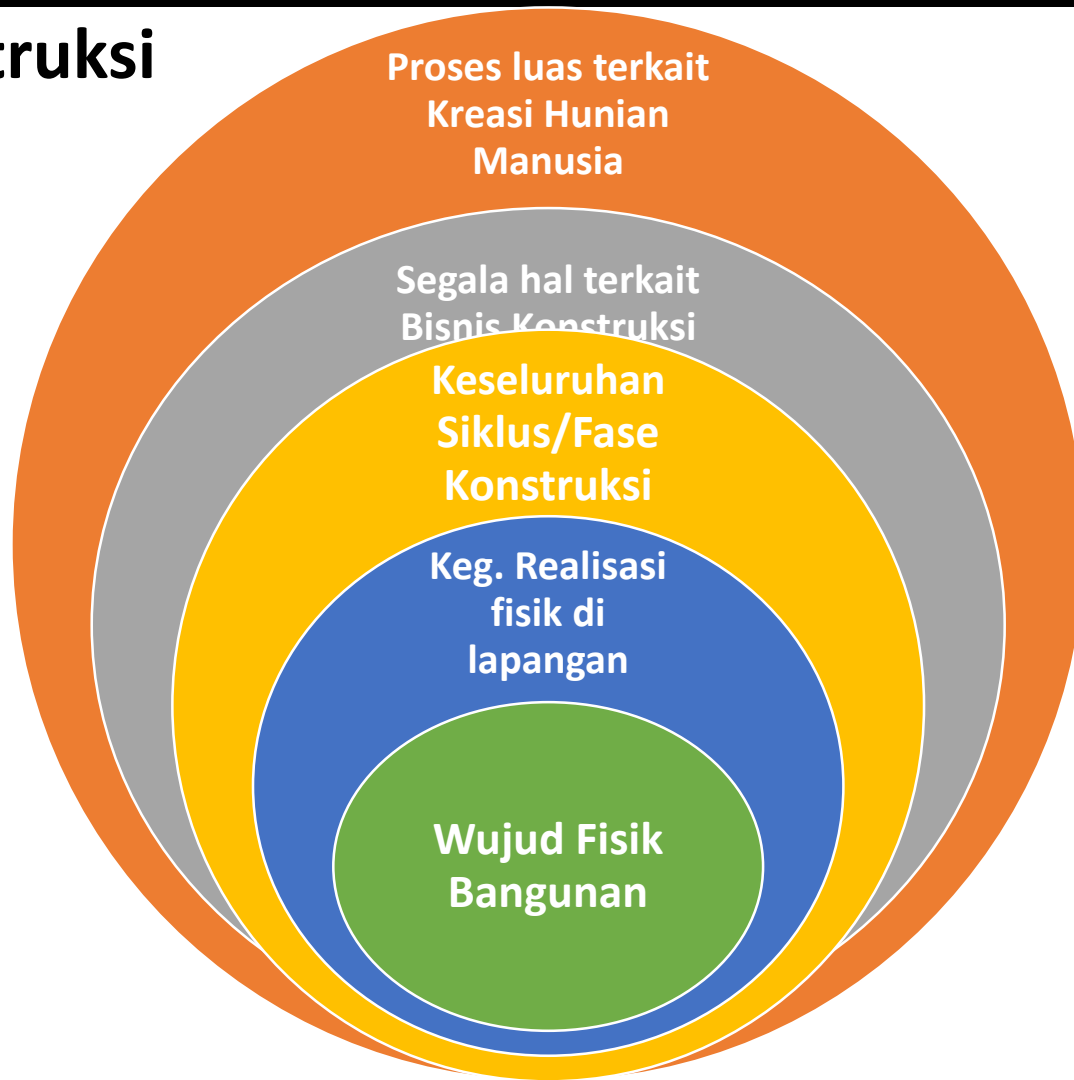
- **Inovasi:** upaya pengembangan *knowledge* dalam menghasilkan *hal baru* (metode, pendekatan, teknik, teknologi) dalam menunjang *proses* dan *produk*, untuk meningkatkan *keunggulan bersaing* (*competitive advantages*) serta *keuntungan ekonomi jangka panjang*
- **Invensi:** konsepsi dari ide yang merupakan subsequent translasi dari Inovasi, yang belum memiliki nilai komersial

Inovasi = Invensi teknikal + Konsep aplikasi prektis + Nilai Komersial



Meaning..

■ Konstruksi

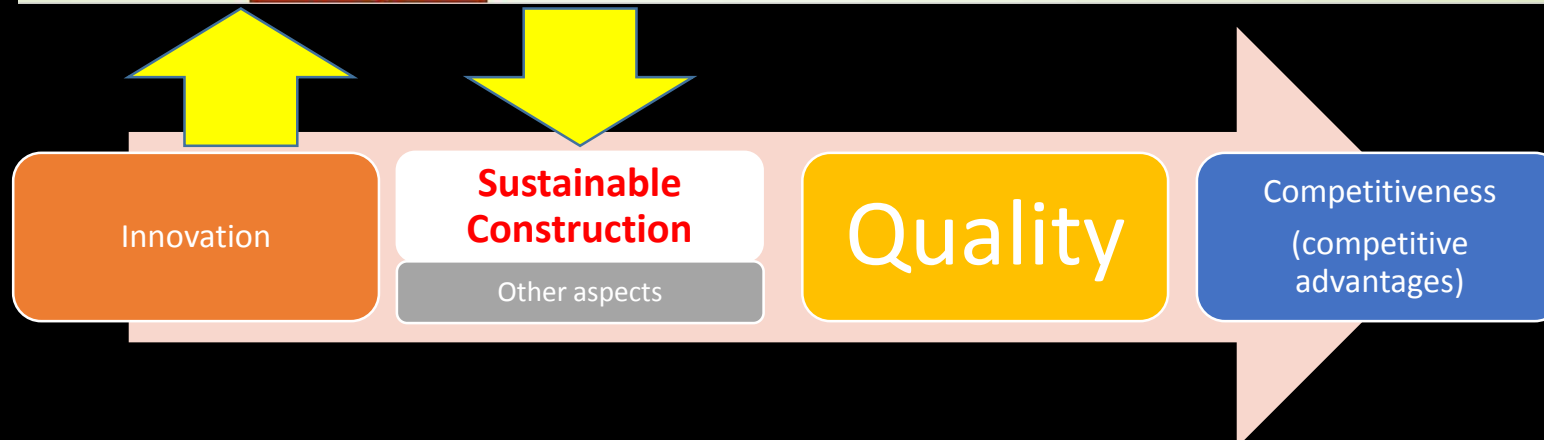
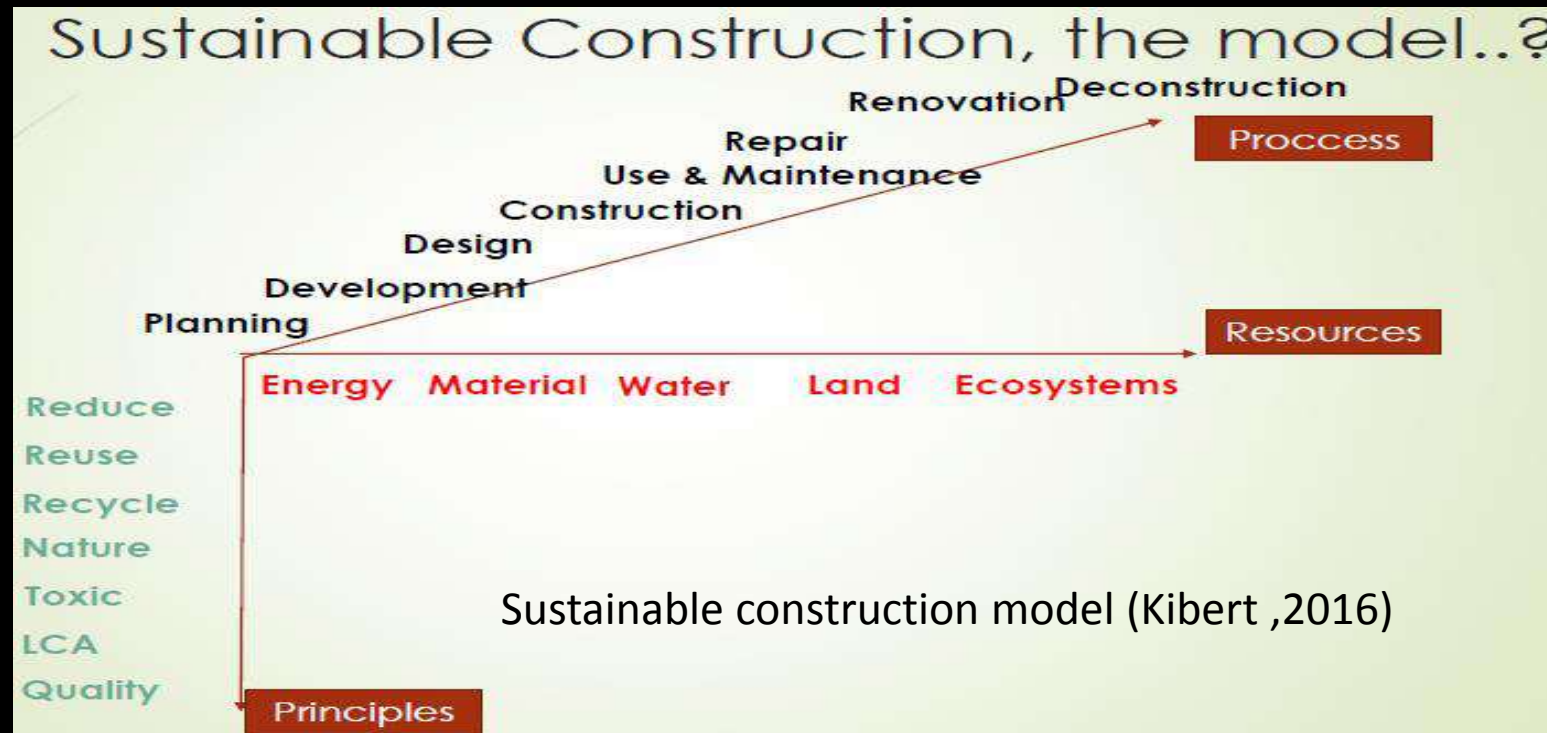


Meaning..

- **Sustainability Construction:** membangun serta mengoperasikan bangunan dengan mempertimbangkan *keberlanjutan lingkungan*, *sosial*, dan *ekonomi* sepanjang siklus hidupnya, mulai dari desain, konstruksi, hingga operasi dan dekomisioning (dekonstruksi). **Tujuan dari konstruksi berkelanjutan** adalah untuk meminimalkan *dampak lingkungan yang negatif*, mendorong *efisiensi sumber daya*, dan menciptakan bangunan yang *aman*, *inklusif*, dan *tangguh* (SDG's, 2021)
- **Kualitas (mutu):** Derajat di mana seperangkat karakteristik yang melekat pada suatu produk, sistem, atau proses memenuhi persyaratan yang ditetapkan (ISO 9000)
- **Daya Saing (perusahaan):** Kemampuan perusahaan untuk *membedakan dirinya dari pesaingnya*, menciptakan keunggulan yang bernilai, dan mencapai kinerja yang unggul dalam pasar yang kompetitif (Porter, M.E., 1990)



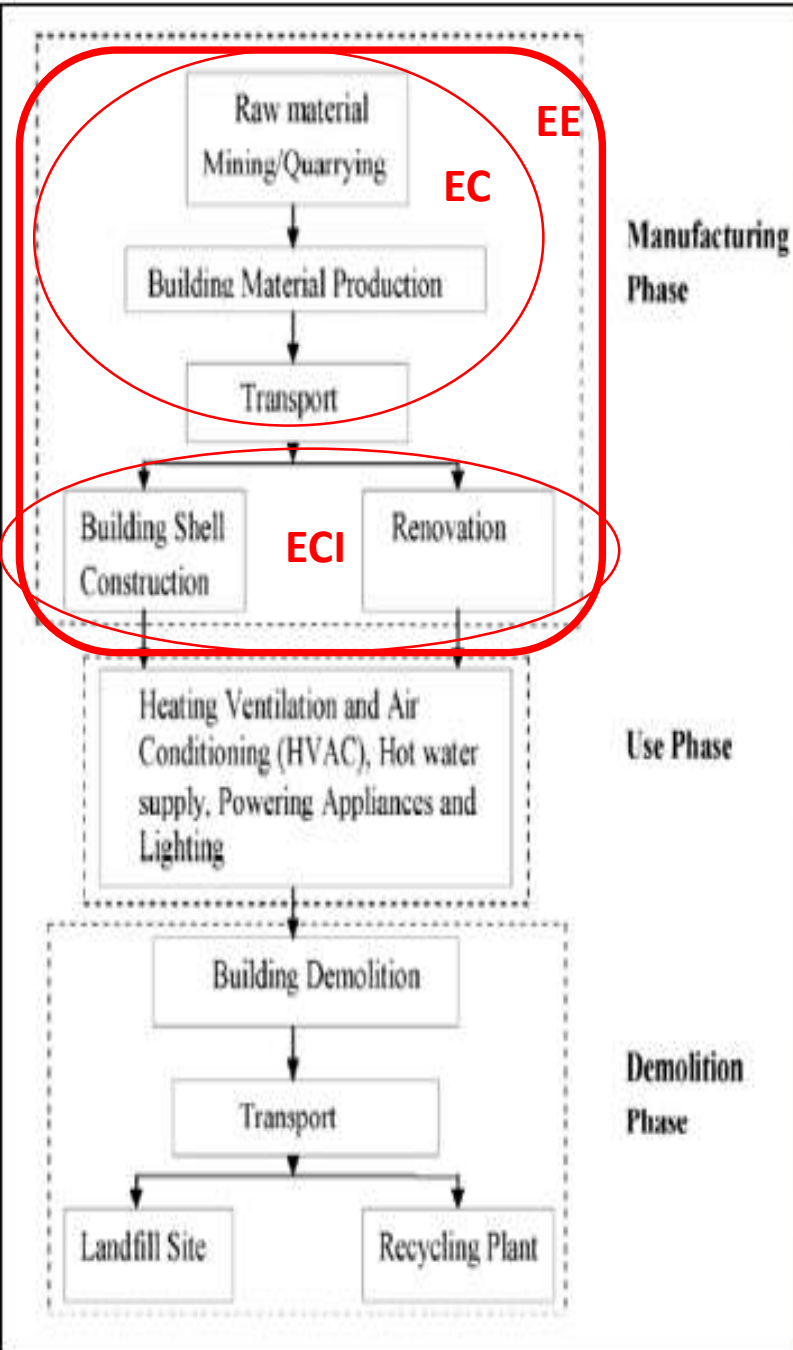
The Relations.....



LCA – Model Konsumsi Energi

$$EE = EC + EI$$

- Energy Embodied (EE), energi yang dikonsumsi mulai dari ekstraksi material hingga terinstal di lapangan
- Energy Content (EC) = energi saat ekstraksi material + energi produksi (pabrik) + energi transportasi
- Energi Instalasi (EI) = energi instalasi (ereksi) materi di lapangan



Classification of Problems in Construction Companies

No.	Problem Level	Innovation
1.	Project	Process/Product Innovation
2.	Organization	Organization Innovation
3.	Management	Management Innovation
4.	Commercial/Marketing	Commercial/Marketing Innovation
5.	Services	Services Innovation

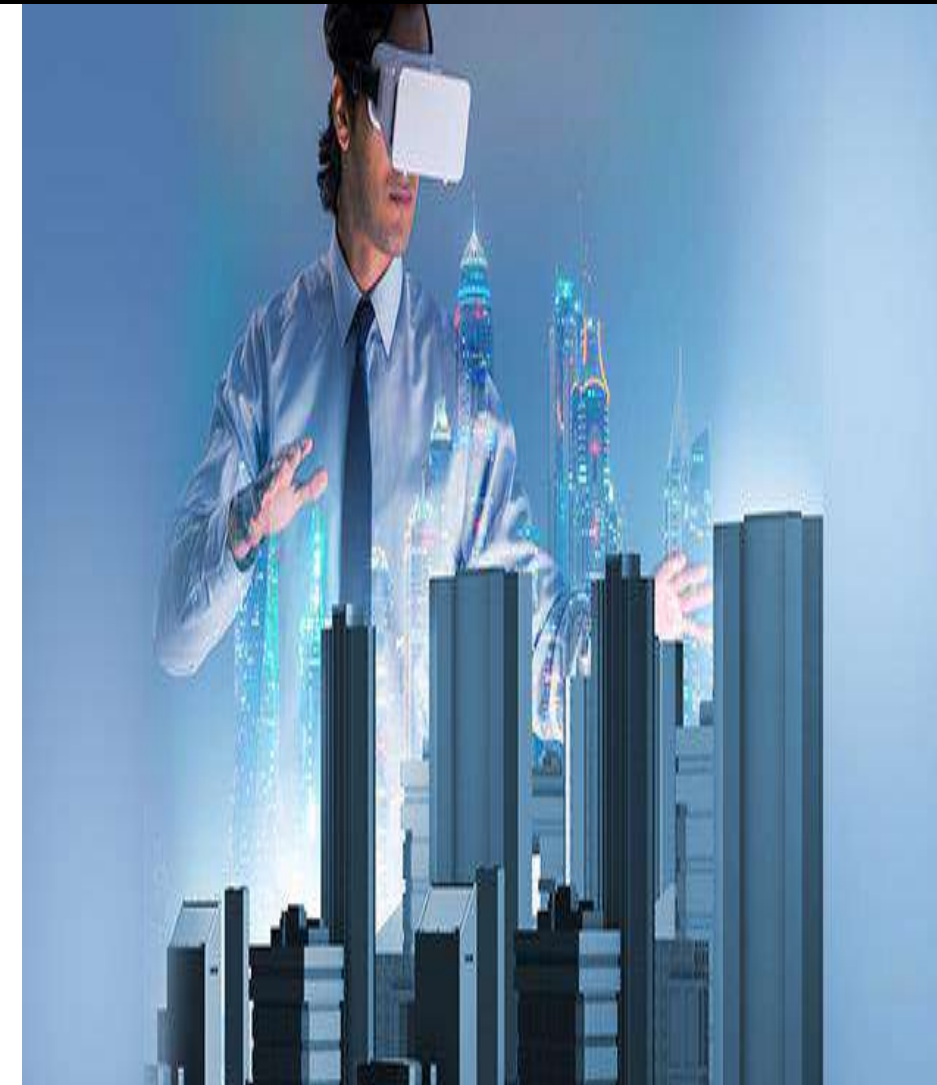
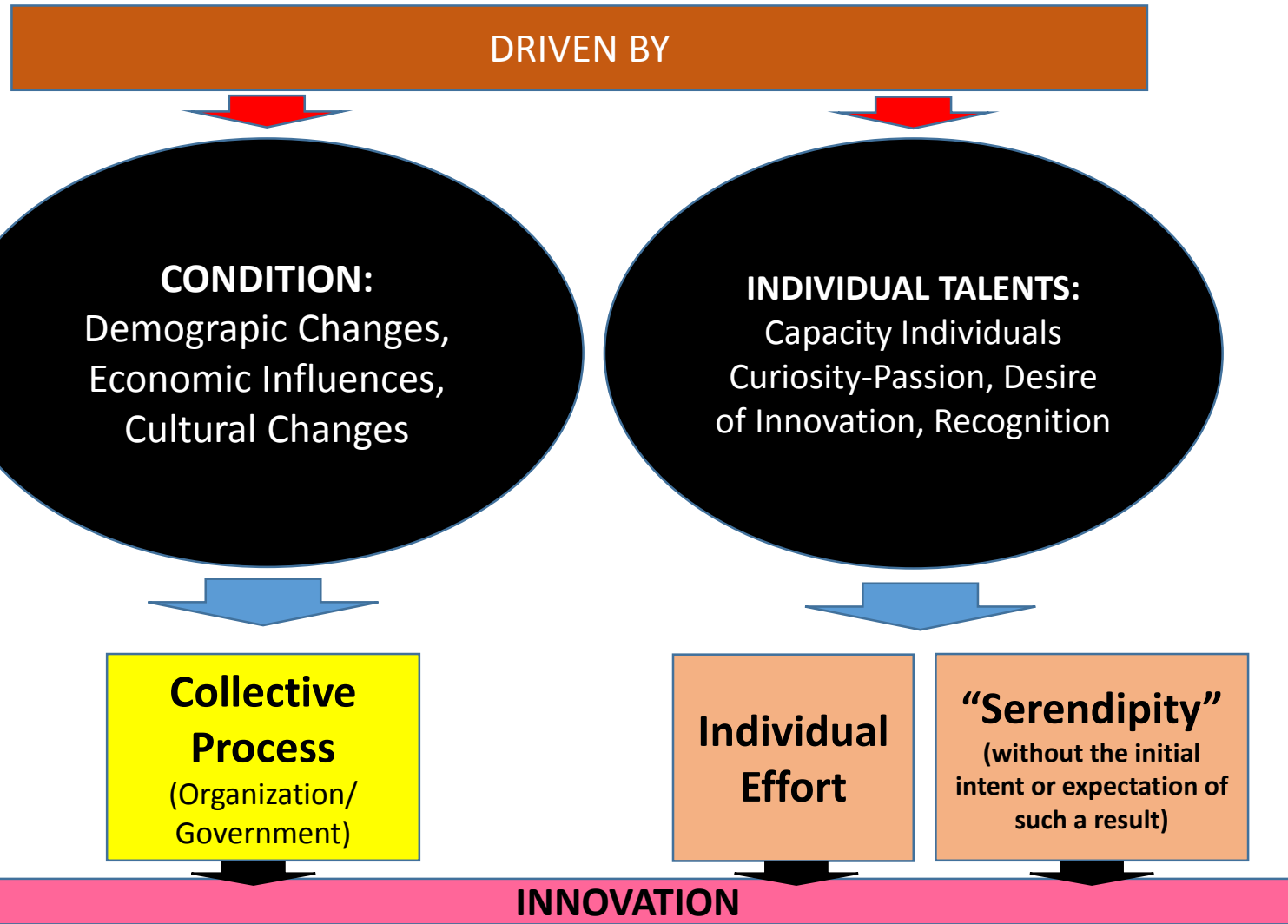
Problems in Construction Process (Contractor)

No.	Problem Area	Innovation Needs
1.	Site Design	Process/Management Innovation
2.	Material Handling	Process & Product Innovation
3.	Installation Process	Process/Management/Organization Innovation
4.	Delay	Process/Management Innovation
5.	Quality Control Issues	Process & Product Innovation
6.	Cost Overrun	Process/Management Innovation
7.	Safety Issues	Process/Management Innovation
8.	Communication and Coordination	Management Innovation
9.	Change Request	Management Innovation
10.	Resources	Process/Management Innovation
11.	Stakeholders	Management Innovation

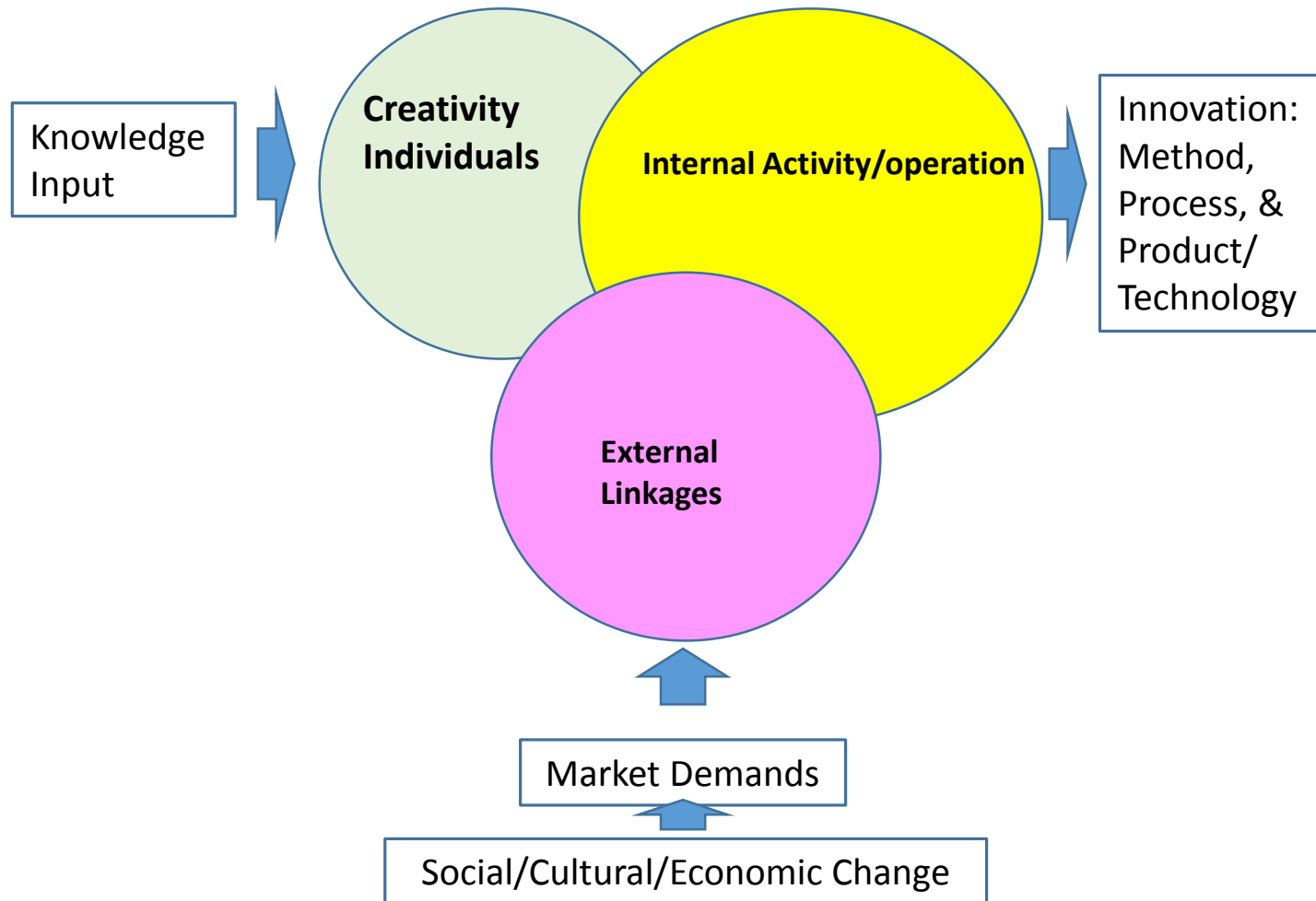


**Sustainability
Principles**

When The Innovation Occur..

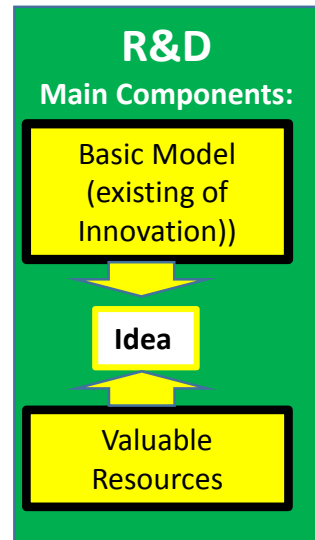


The Basic Characteristics ... (Innovation Process in Company)



Linear Model- 1st Model

Basic Model -1: Technology Push, (Trott, 2017)

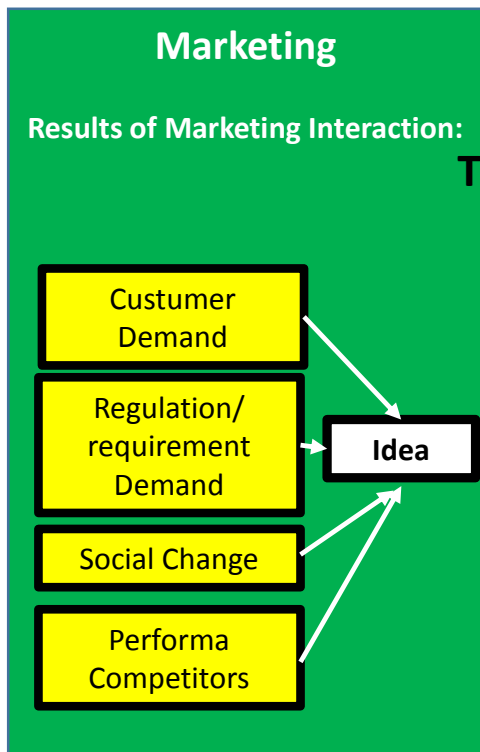


The Model in Construction

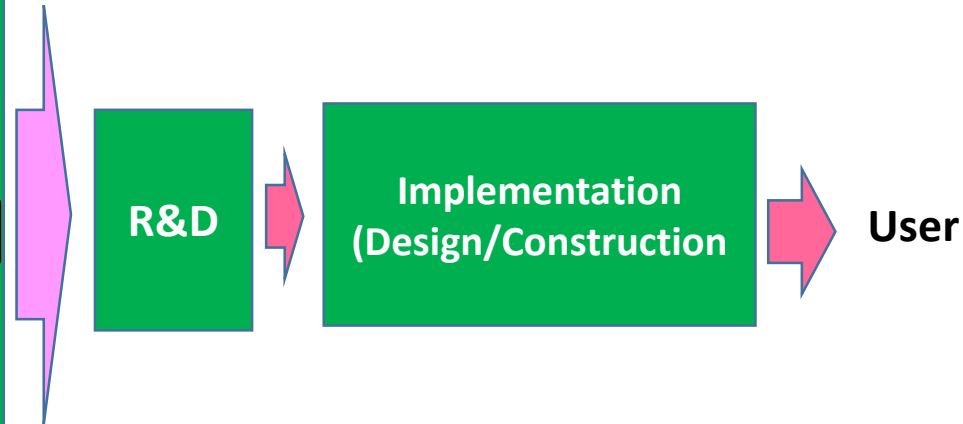


Linear Model- 2st Model

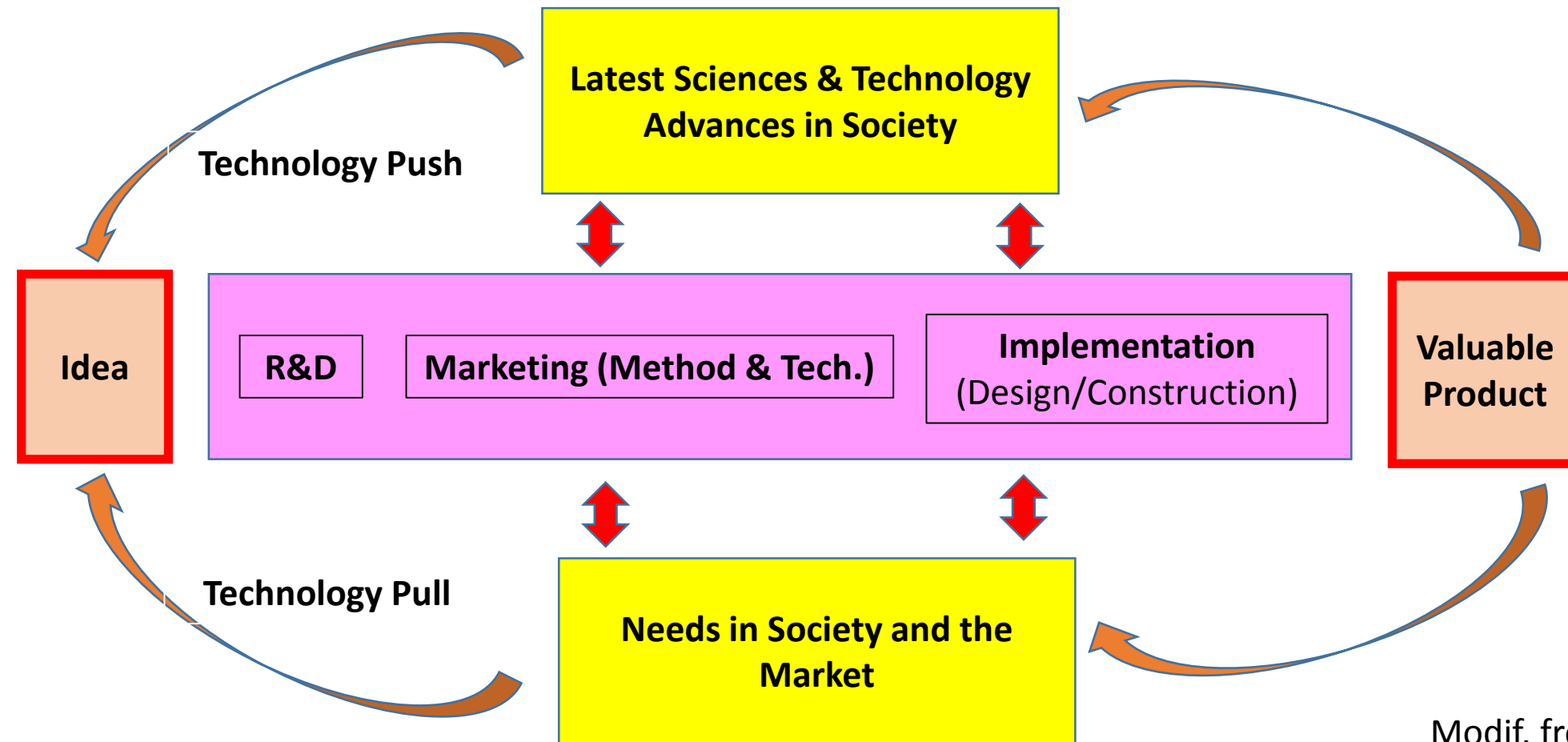
Basic Model -2: Technology Pull, (Trott, 2017)



The Model in Construction



Development of Interactive Model in Construction

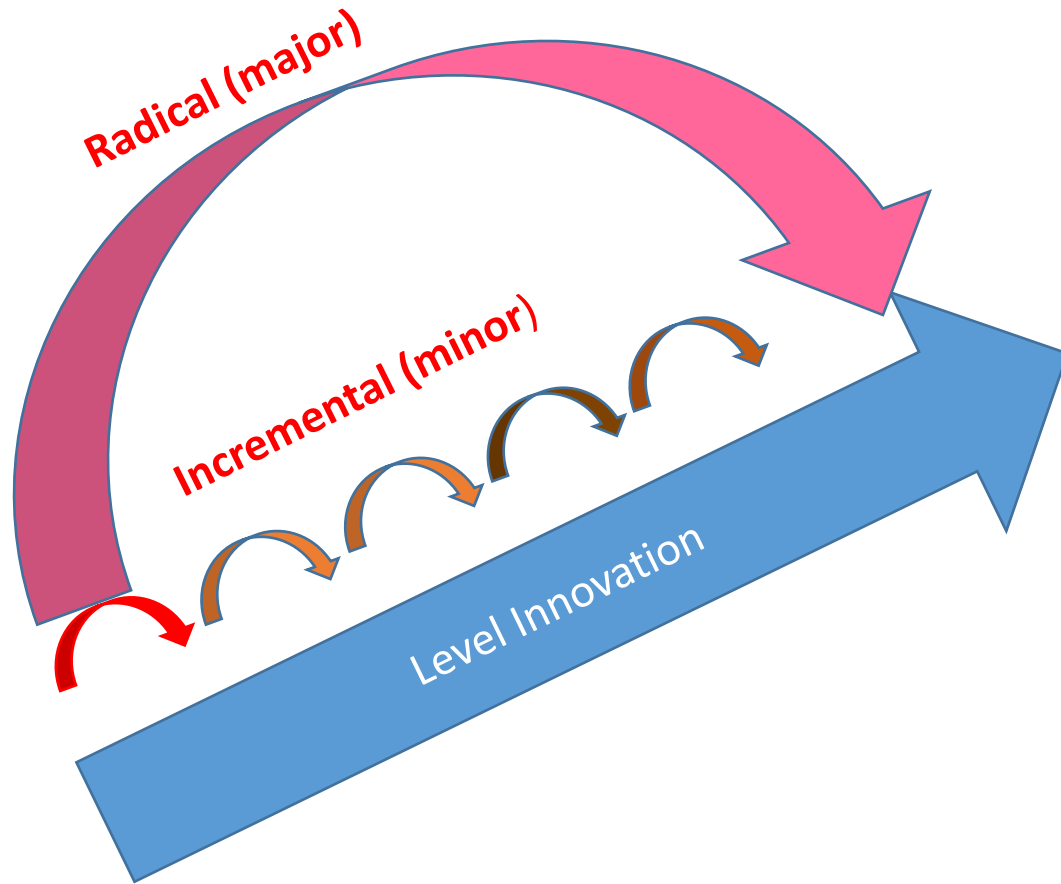


Modif. from
Trott, 2017



The Types of Innovation

(Based on **Level of Change**)



Incremental Innovation – Lifting Equipments

Anti-Collosion Tower Crane (anti-tabrakan)



Object Detection

Proximity Warning

Automatic Braking

Data Analysis

Integration with TC Systems

Radical Innovation – Lifting Equipments

Done for Material Lifting –
Construction Site



Safety

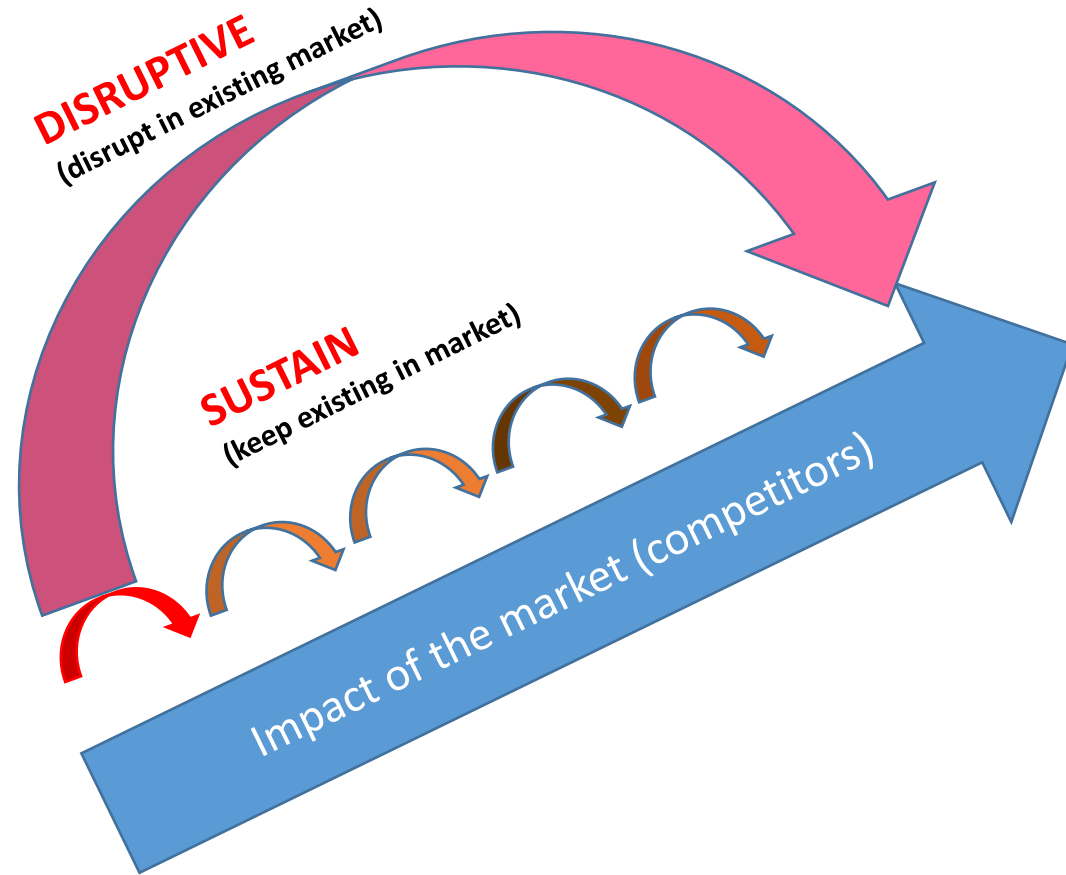
Efficient

Cost-saving

Access to Inaccessible Areas

Real-time Monitoring

The Types of Innovations Based on **Impact** of the Market (Competitors)



Disruptive Innovation – Impact

Done for Material Lifting –
Construction Site



Disrupt – TC Manufacturer

Disrupt – TC Rental/Service

Change of Site Management

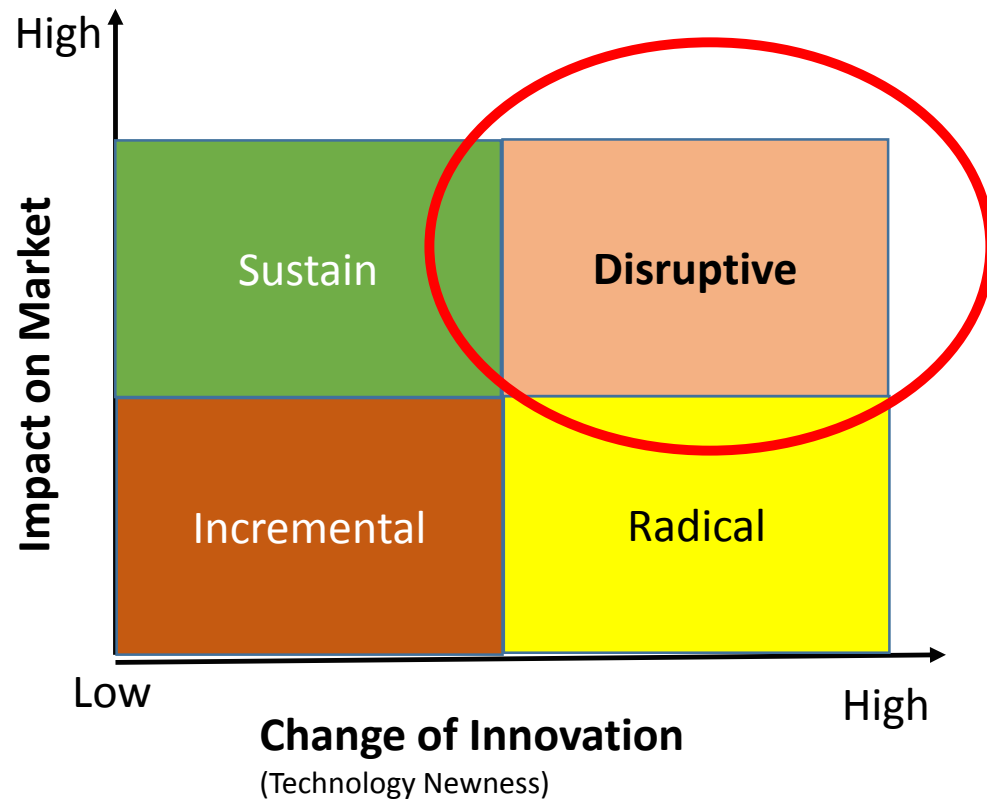
Change of Work Method

Change of Airspace
restrictions

Job Transformation/
displacement

Create New Job Roles

Matrix Innovation



Hybrid Construction Equipment

Autonomous Construction Equipment

Prefabrication & Modular Construction

Building Information Modeling

Sustainable Construction Materials

Drones and Aerial Imaging

3D Printing in Construction: 3D printing

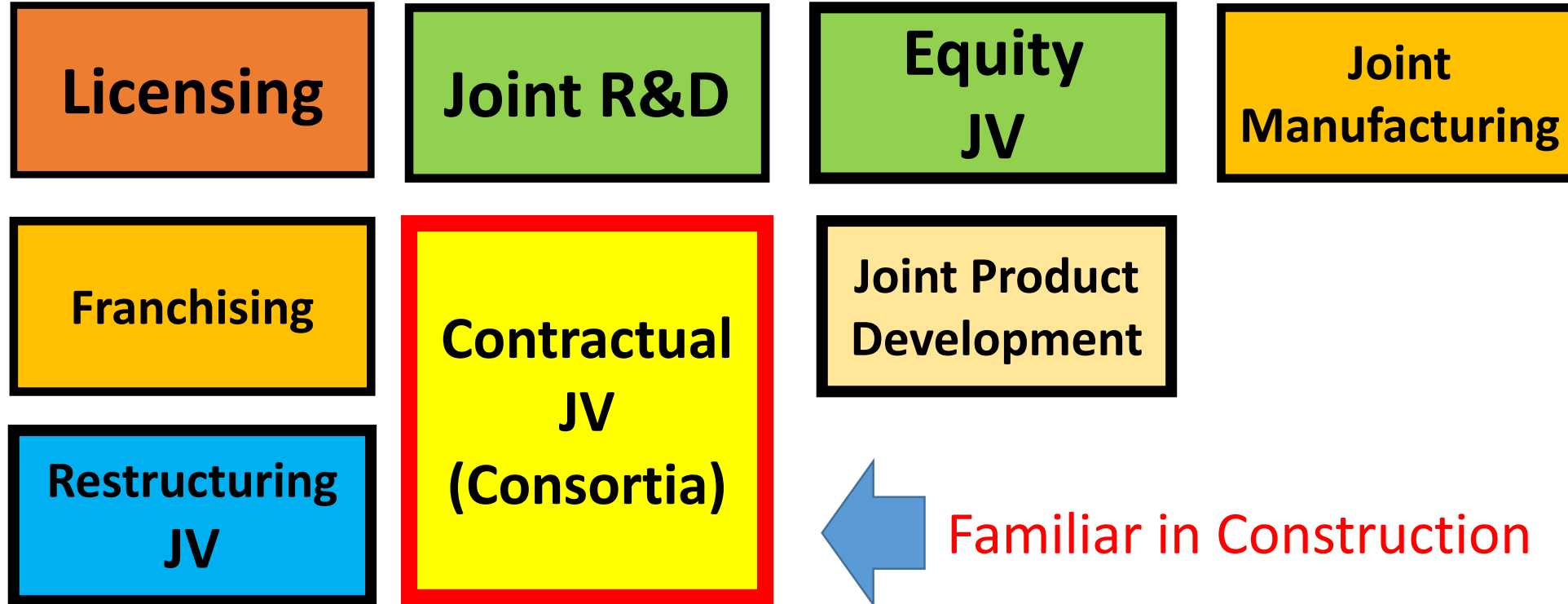
Internet of Things (IoT) and
Smart Building Technologies

Geopolymer Concrete

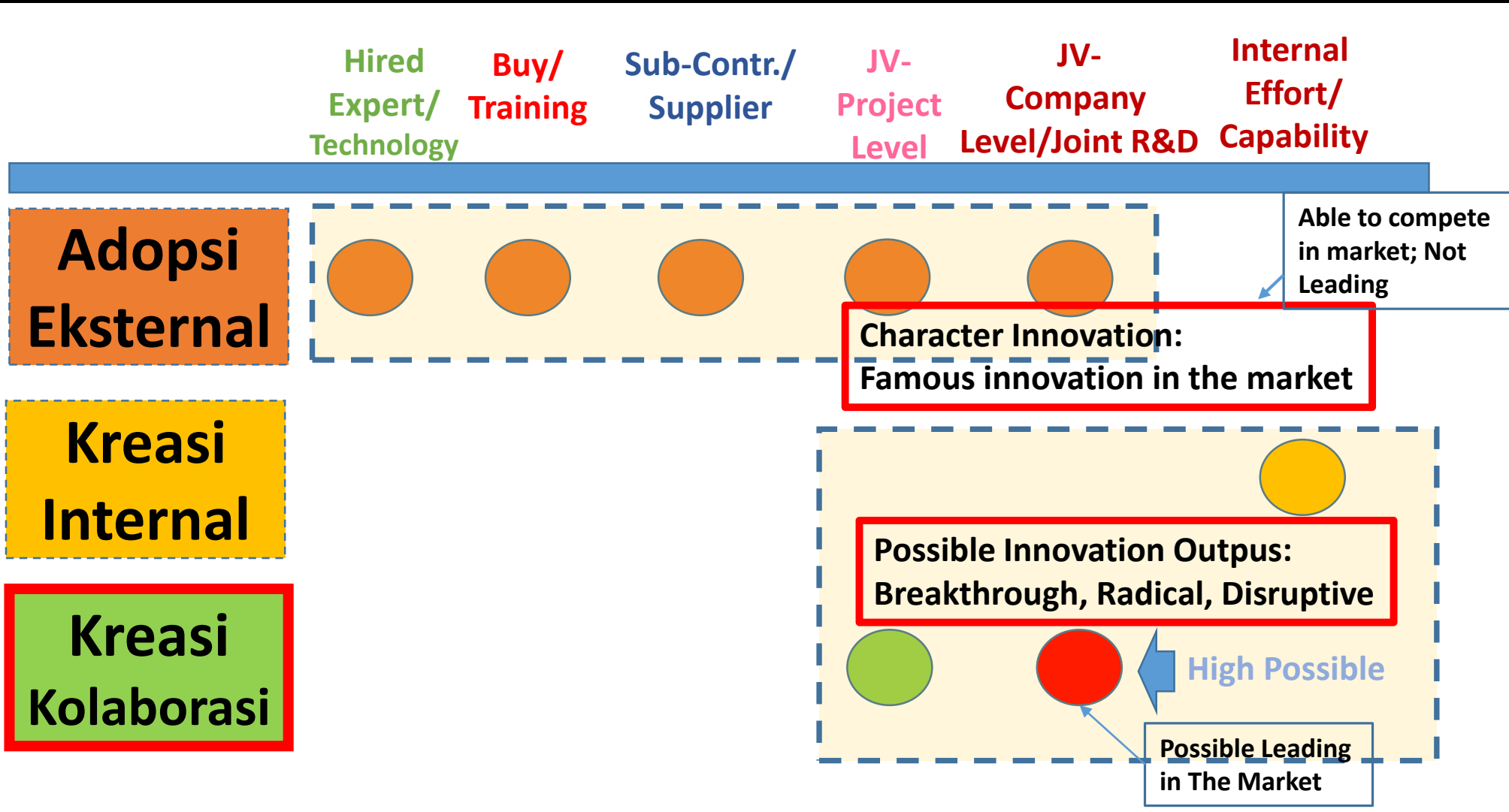
Choices to get Innovation



Typology of Collaboration..(UNIDO perspective)



Approach..



Why Collaboration Approach..

Resources Sharing:

Knowledge, Technology,
Experiences, Expertise,
Method, Idea, Facilities

Cost Sharing

(Efficiency)

Risk Sharing

Corporate Reputation

(partner with the reputable company)

Possibility of Success (high)



Lack of (Internal) Self-Creation

Limited Resources

High Risk
(Finance, Cost, Fail)

Novelty (minim)

**In-efficient
Problem-Solving**

**In-efficiencies and Suboptimal
Outcomes**

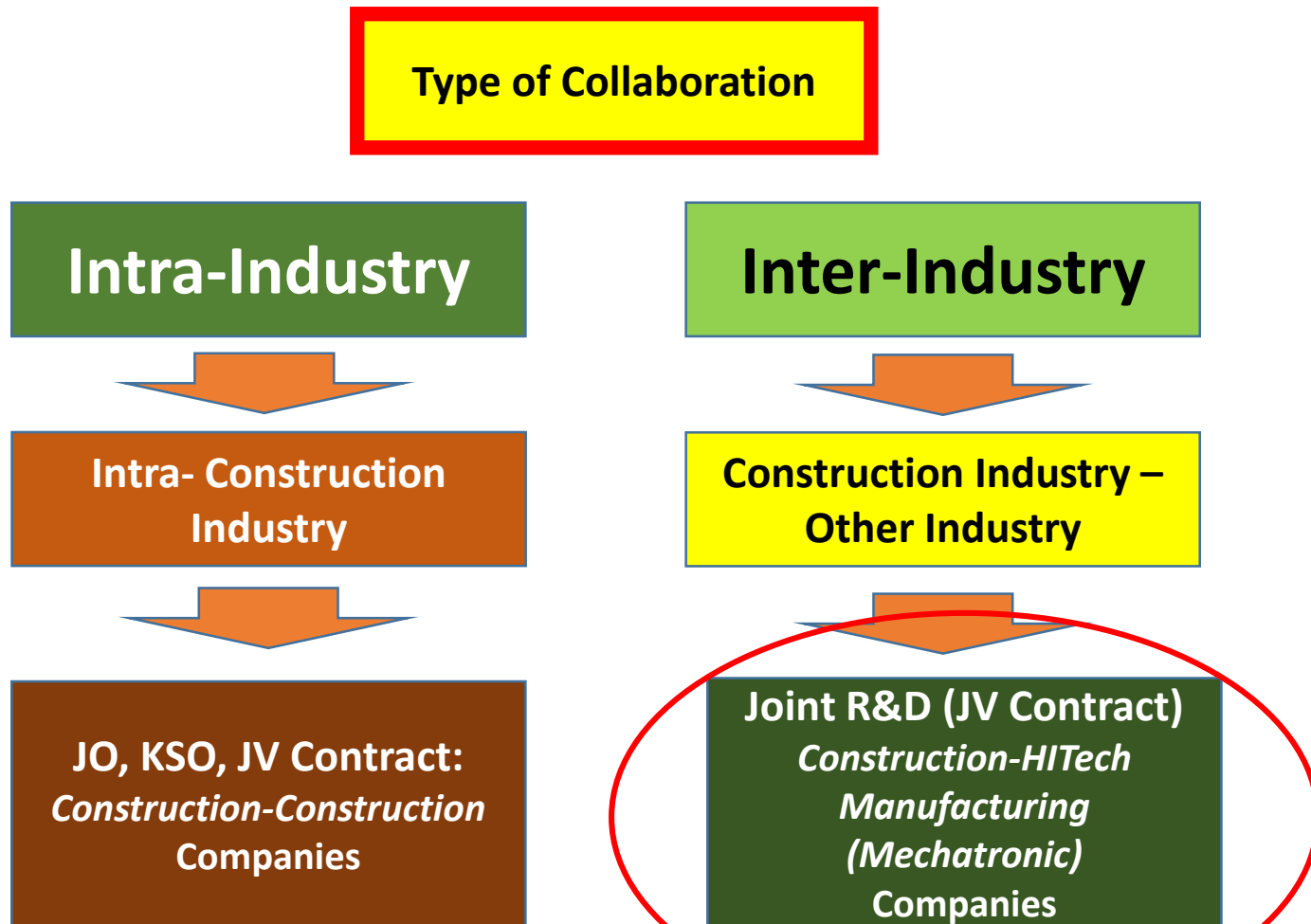




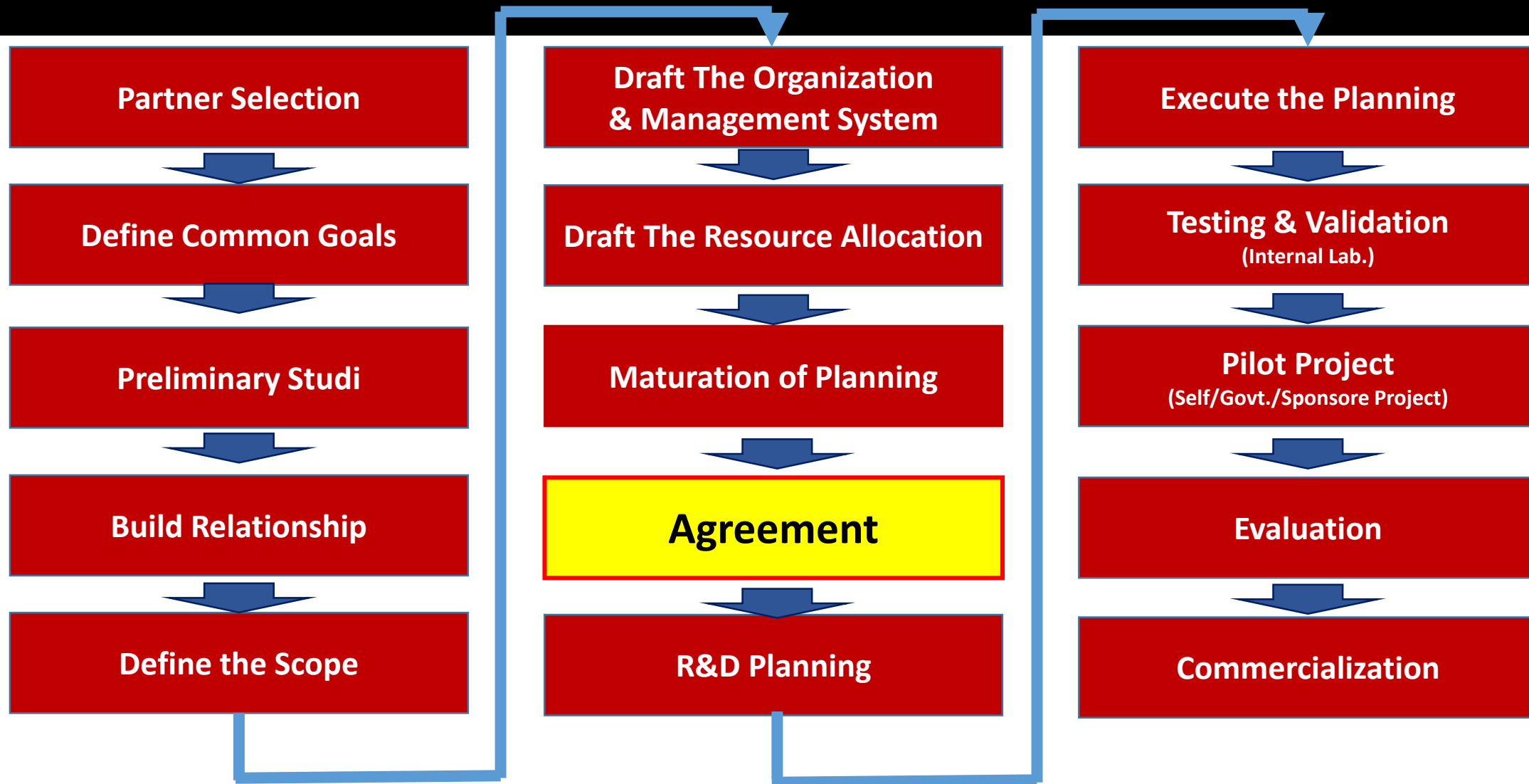
Construction Technology Innovation Joint R&D – Construction Vs. Mechatronic



Types of Collaboration: Sector Perspective



Steps of Joint R&D Project



Partner Selection - Consideration

Expertise & Specialization

Complementary Capabilities

Work Culture (compatible)

Resources & Infrastructure

Communication and Project Management

Collaborative Mindset

Financial Considerations

Reputation & References



Define Common Goals - Consideration

Determine the technology to be developed

Commitment in sharing knowledge and technology

Commitment to risk mitigation

Focus on generating competitive advantage

Commercialization and Revenue Generation

Commitment to environmental and social, sustainability



Preliminary Study- Activities

Assess the Feasibility and Potential Benefits of Collaboration

Analysis of Market Trends

Analysis of Technology Advancements

Analysis of Regulatory Considerations, and the Competitive Landscape



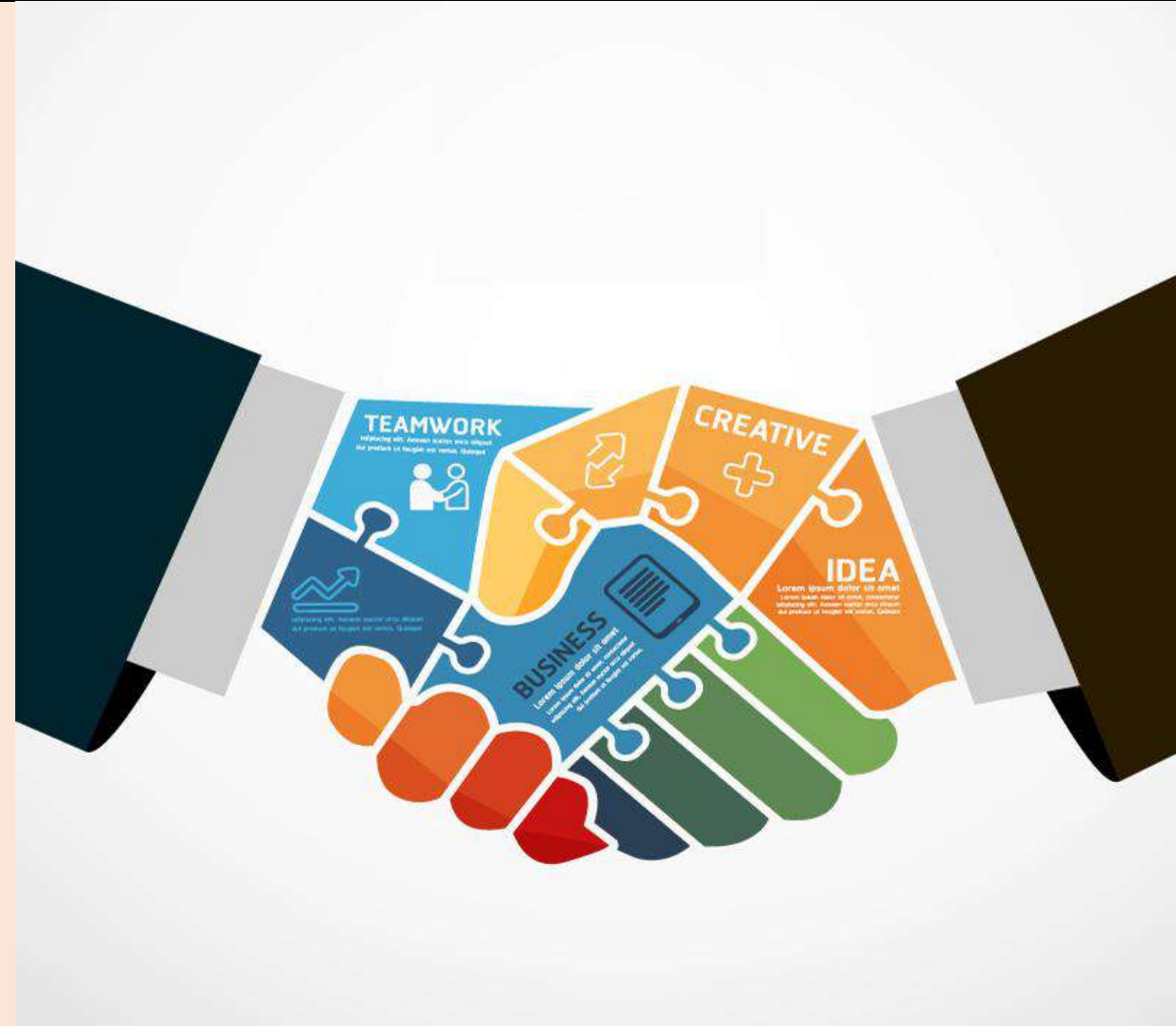
Build Relationship- Activities

Establishing Trust & Mutual Understanding

Establishing Clear Communication Channels

Initial Meeting/Site Visit

Workshops



Define the Scope - Activities

Outline the Specific Scope

State the Research Area (focus)

State the Problem Statement

State the Specific Challenge



Organization & Management System - Draft

Purpose and Objectives of Organization

Governance Structure

Leadership

Ethics & Compliance



The Resource Allocation - Draft

Determine
the Allocation of Resources

Esthablish Mechanism for:
sharing costs, *responsibilities*, and
benefits among the participating
organizations

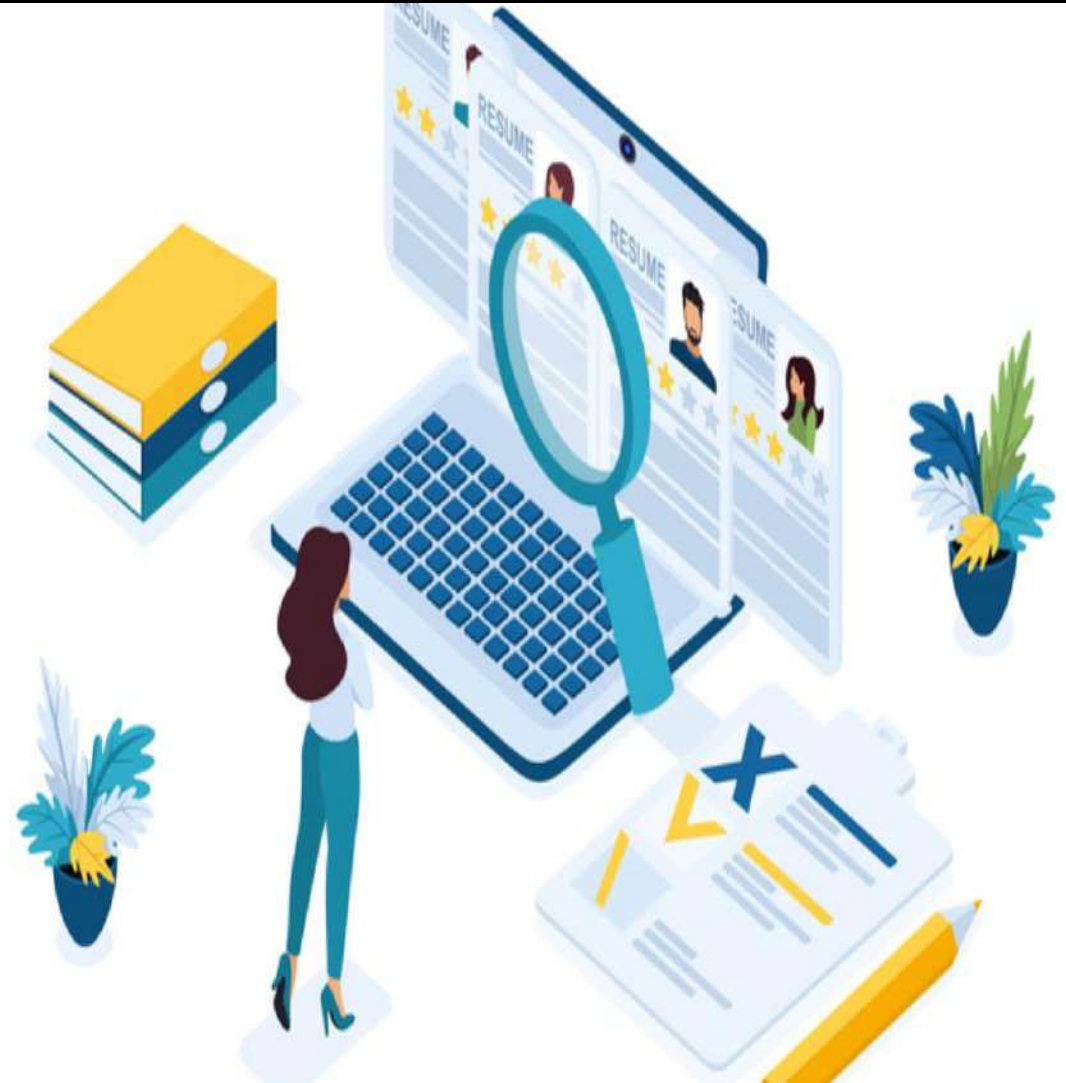


Maturation of Planning

Review and Refine:

Planning

**Collaboration
Mechanisms**



Agreement



R&D Planning

Definitive: Organization & Management System

Definitive: Program Detail, Milestones, and Responsible Parties

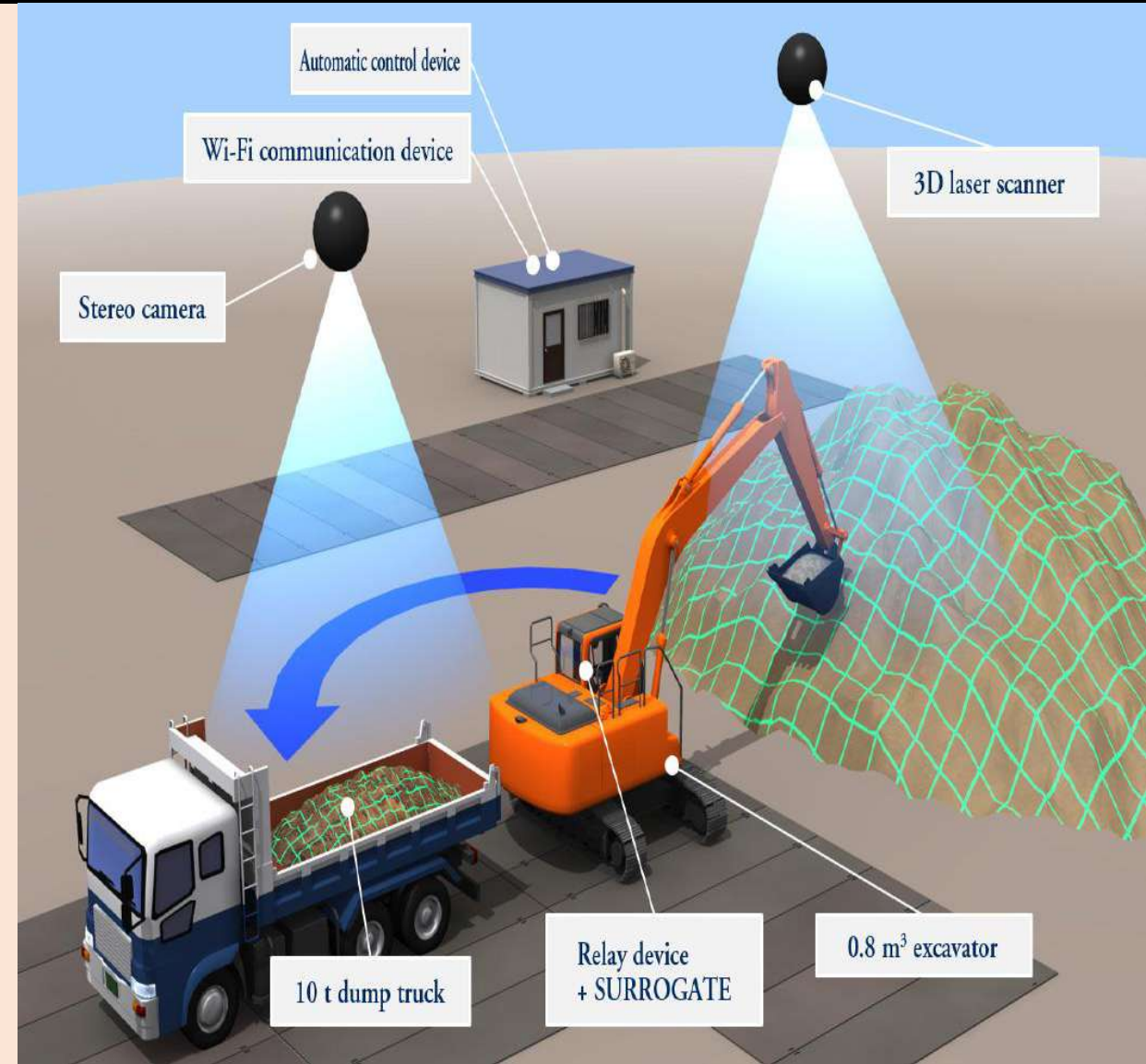
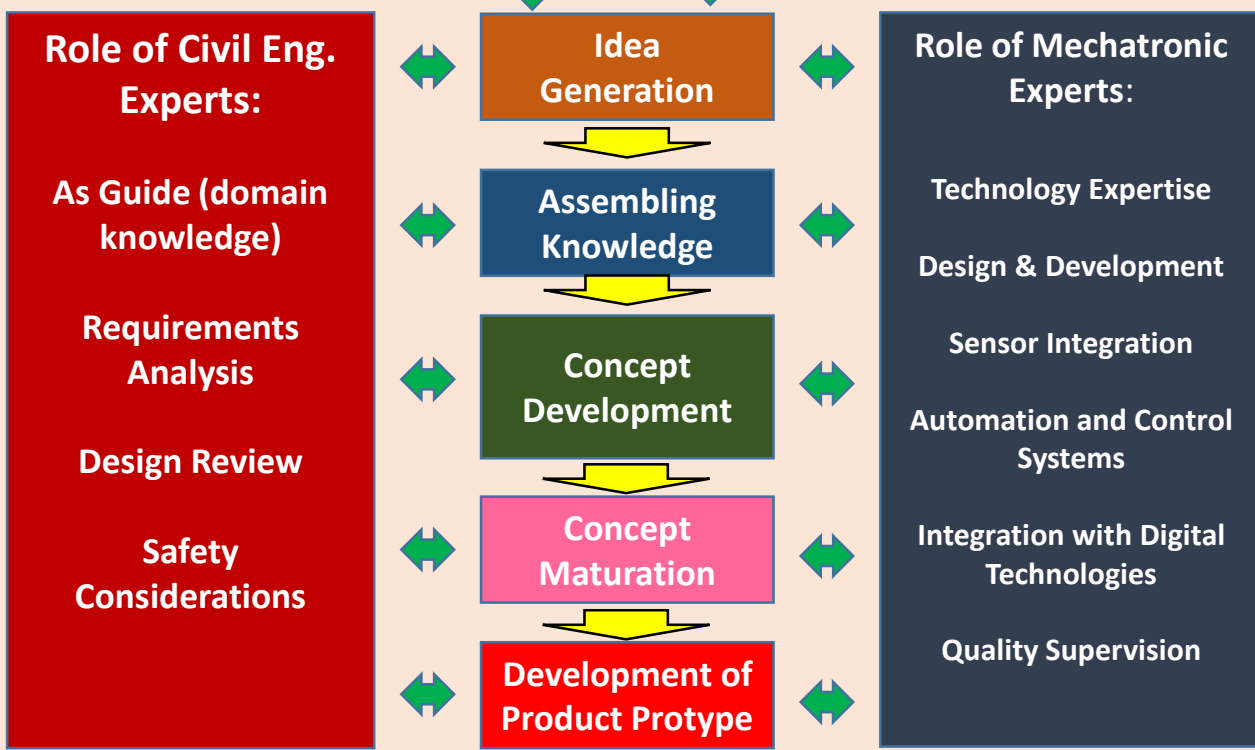
Definitive: Budgeting and Financial Planning

Ethical and Regulatory Considerations



Execute The Planning

Existing Product	Individuals	Practitioners
Existing Technology	Brainstorming	Senior Mangmt.
Customers/Vendors	Competitors	Unexploited Patents



Execute The Planning – Characteristic of Innovation (Idea Phase)

Incremental Innovation Ideas

- **Gradual Innovation**, based on existing: processes, materials, or equipment in construction process
- **Idea upon existing knowledge**
- **Compatible in existing systems**
- **Meet specific needs in field**

Radical Innovation Ideas

- **Revolutionary change** compared traditional methods.
- **“Big jump”** in ideas; Challenging conventional approaches
- **Incompatible** with existing systems
- **Addressing Unmet Needs** (to solve problem previously **unsolve** or **overlooked**)



Execute The Planning – Principles in Knowledge Assembling

Foster Interdisciplinary Collaboration

Embrace Emerging Technologies

User-Centric Design

Learning from Failures and Successes

Regulatory and Standard Compliance



Execute The Planning – Principles in Concept Development

Maximum Effort of Ideas and Creativity

Integration of Emerging Technologies

Feasibility Assessment

Iterative Development

The Unique Selling Points



Execute The Planning – Principles in Development of Product Prototype

Clear Design Objectives & Goals

**Emphasizing Collaboration between
Expertise**

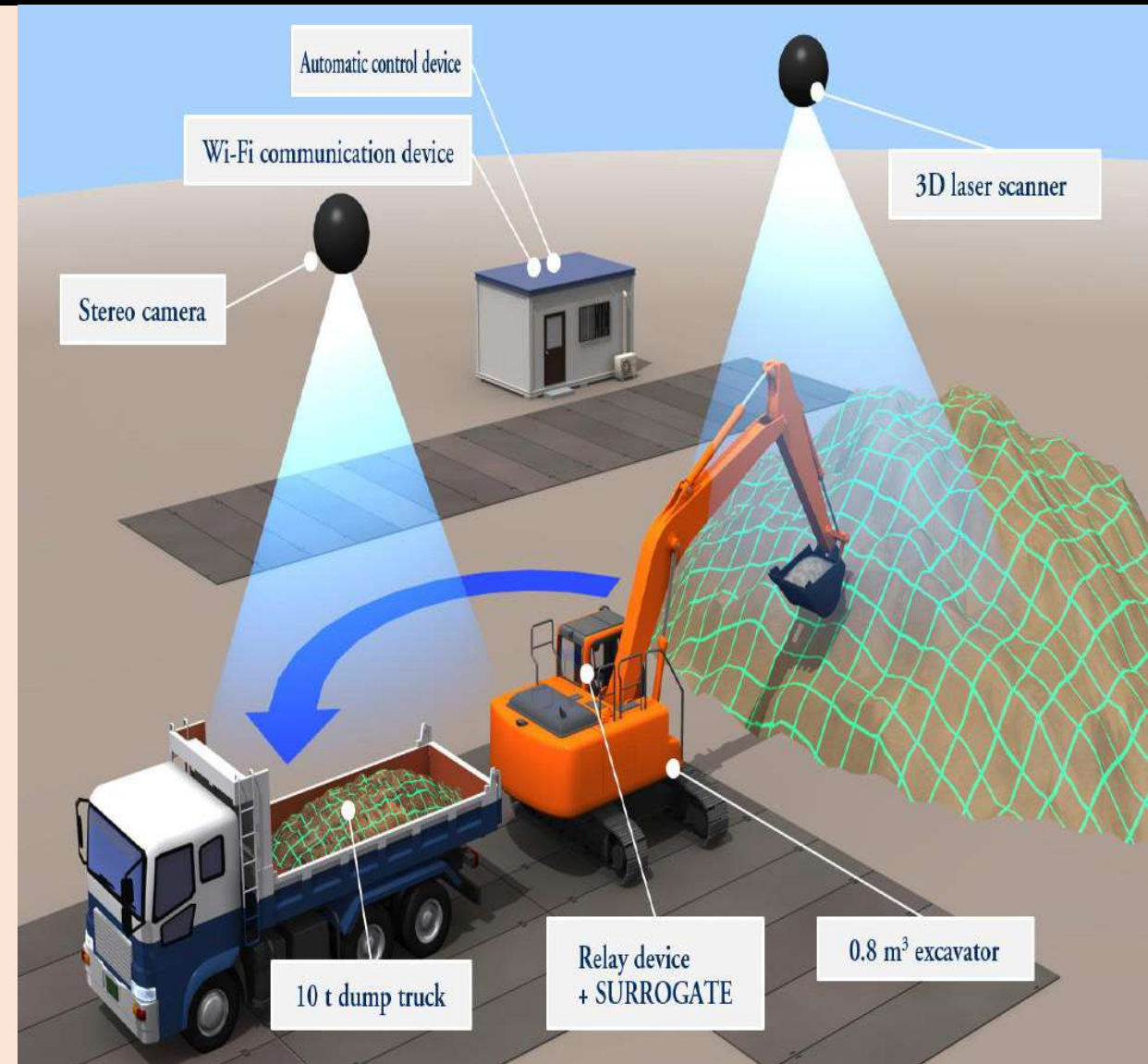
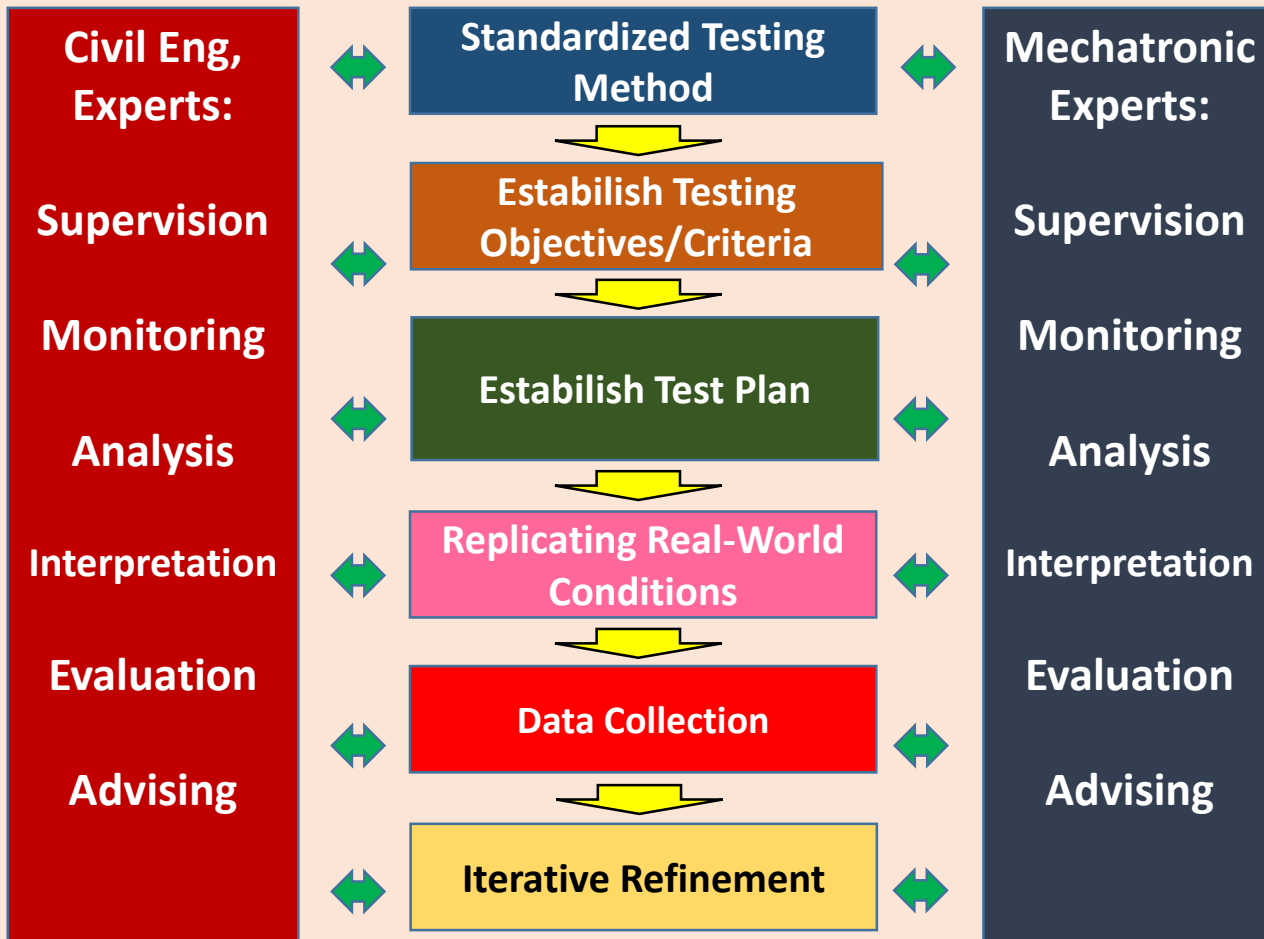
User-Centric Approach

Accuracy in Material Selection

Regulatory and Standard Compliance



Validation & Testing – Internal Lab.



Pilot Project – Criteria

Representative/relevant
(the project, showcases the technology's capabilities)

Full Supported by Project Stakeholders

Government/Public Attention

Reputable Project Executor

**Potentially Access
For Business Collaboration**



Evaluation

Clear Component of Evaluation

Data Collection

Comparative Analysis

Multi-Dimension Analysis

Performance Validation



Evaluation

Clear Component of Evaluation

Data Collection

Comparative Analysis

Multi-Dimension Analysis

Performance Validation



Commercialization

Intellectual Property Protection

Business Model Development

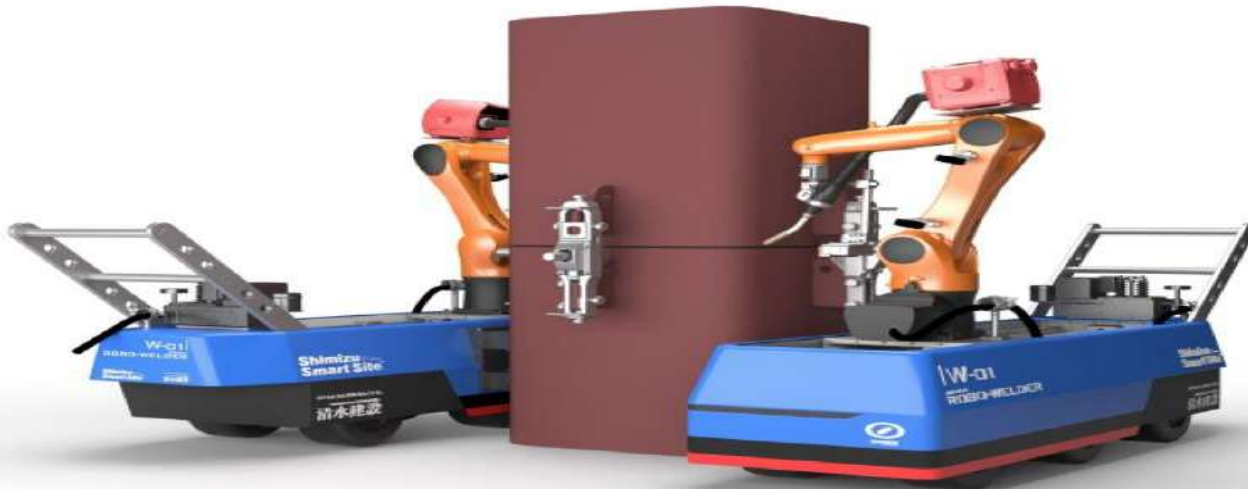
Marketing and Communication

Technology Demonstration

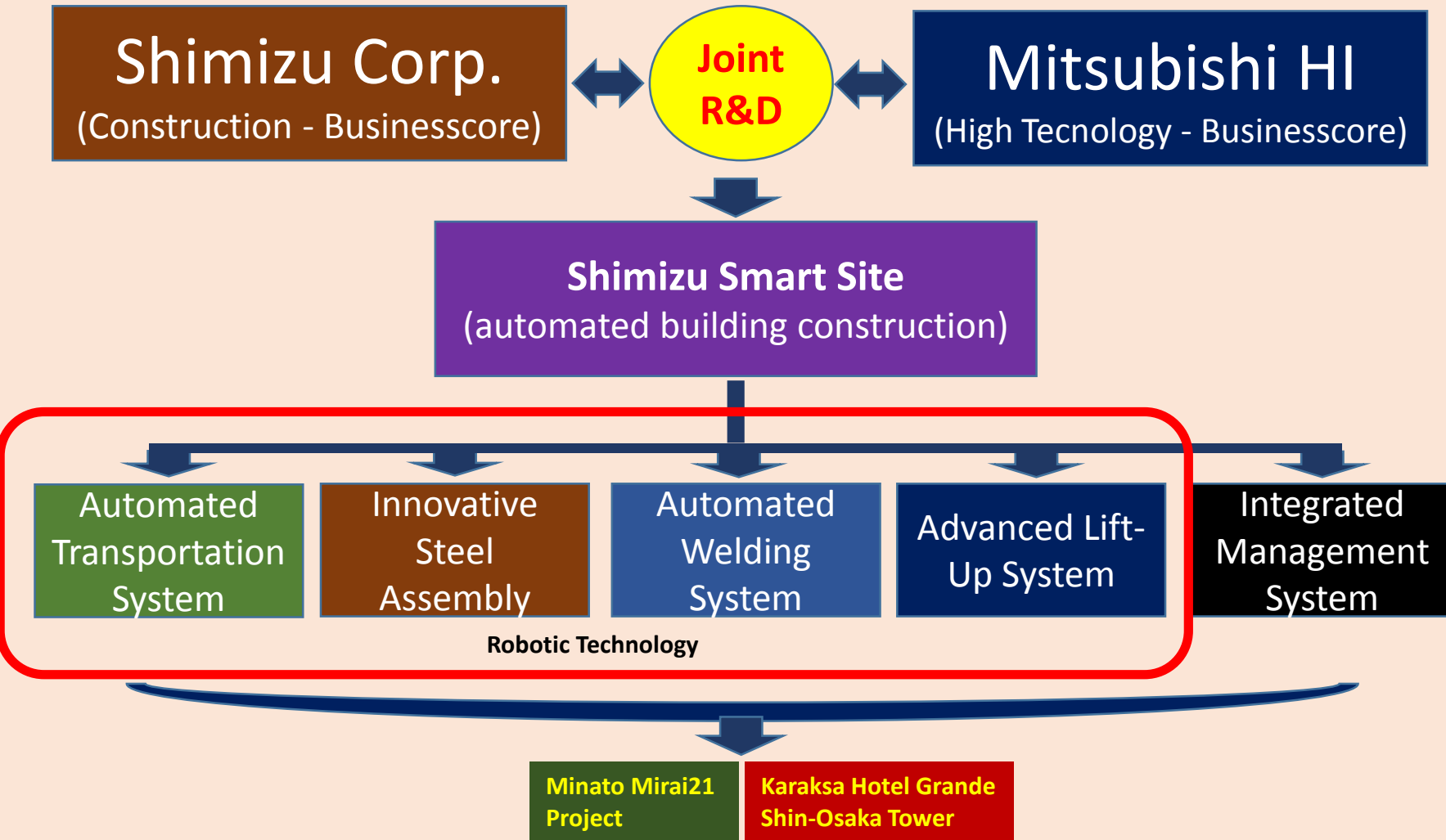
Project Funding



Japan Case: Shimizu Smart Site – Automated Building Construction (Robotic Technology)

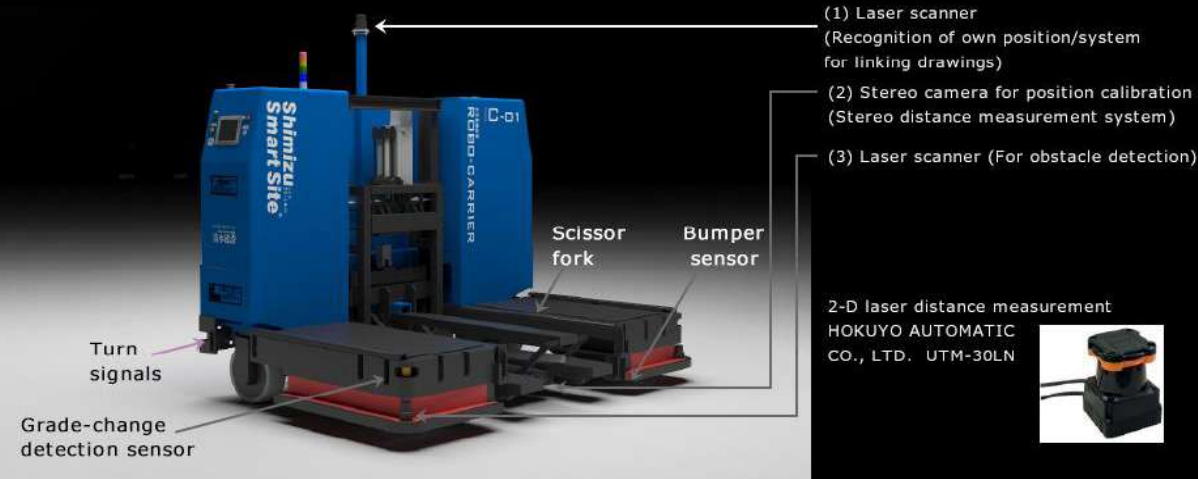


Joint R&D: Japan Case



Joint R&D: Japan Case

ROBO-CARRIER

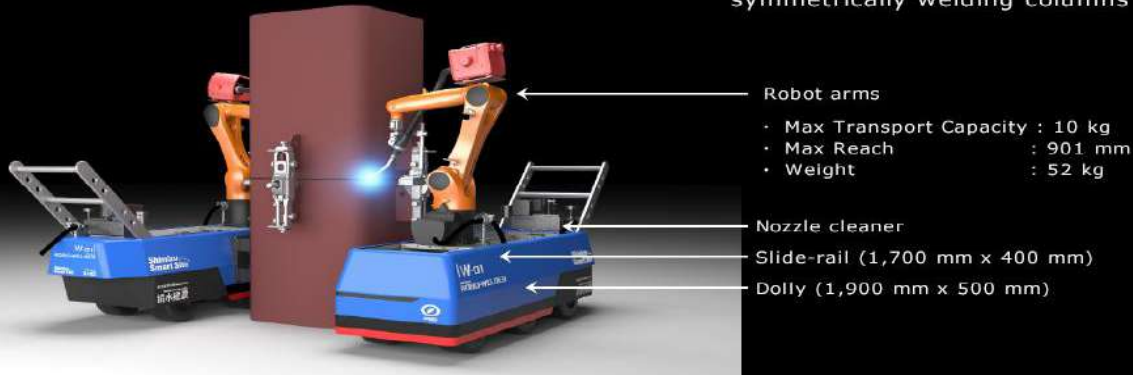


ROBO-BUDDY



ROBO-WELDER

Two robots work in concert symmetrically welding columns



Shimizu Smart Pilot Project: Efficient



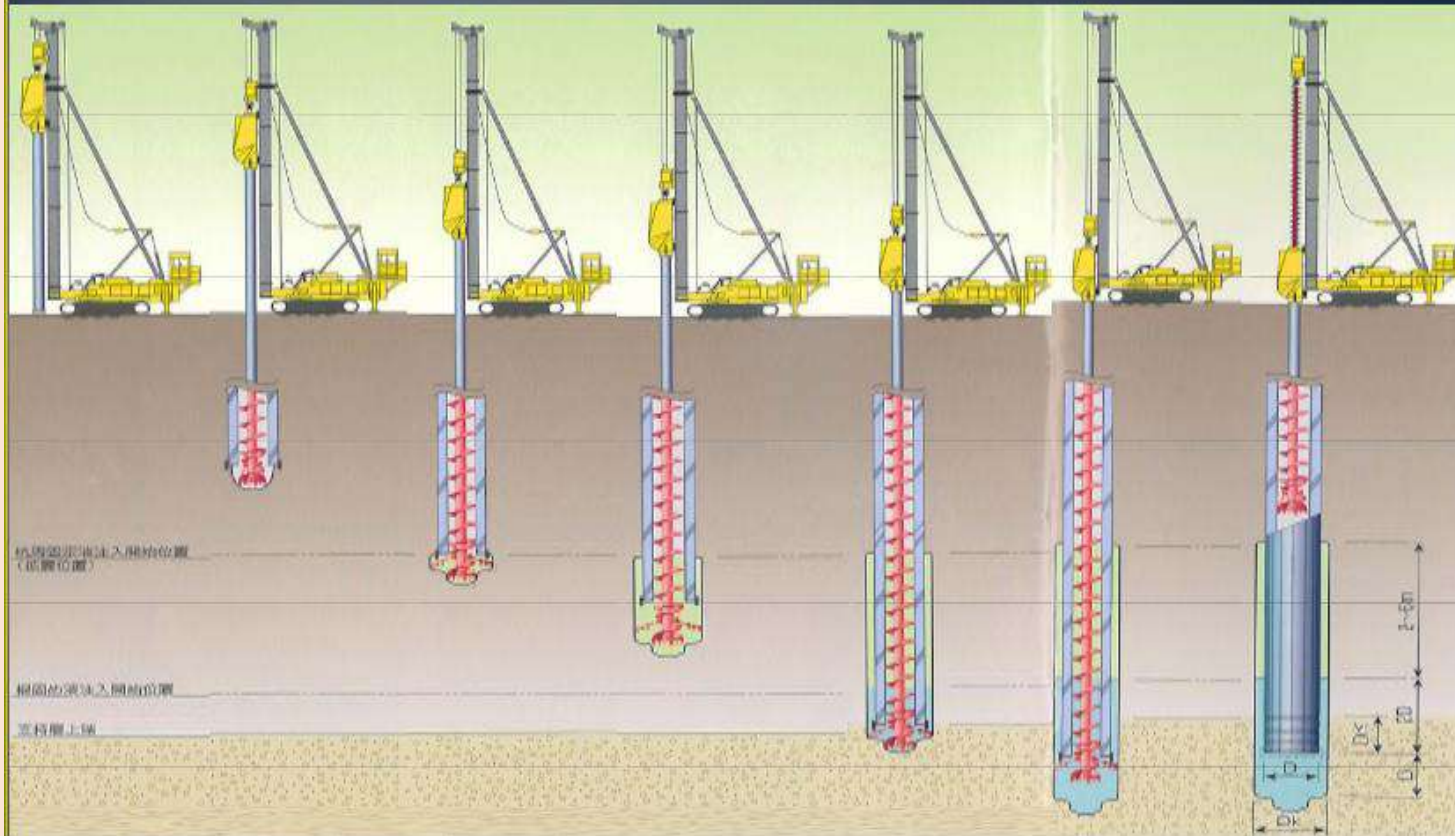
Effect of “Shimz Smart Site” Adoption

	Before	After
Transport work	3,600 people	900 people (↓ 75%)
Ceiling/floor work	2,700 people	600 people (↓ 78%)
Beam welding work	1,450 people	300 people (↓ 79%)

If applied to 30-floor building with standard area 3,000 sqm
(Based on research by Shimizu)

Wika Beton - Innovation: Inner Bore Piling

PROSES INNER-BORE PILING



Inovasi: Metode Kerja Pemancangan

Inovasi: Mata Bor

Inovasi: Komponen Alat Berat Pendukung

Tiang Pancang – Terfabrikasi/Mutu Terjamin

Minim Getaran

Minim Bising

Ramah Lingkungan

Tust/ Reputation



Thanks
for Academic Community
Binus University

Jakarta, June 10 2023

Arman Jayady

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FAKULTAS TEKNIK

Kampus D : Jl. Salemba Raya 7/9 A Jakarta 10340, Indonesia
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Website : www.yai.ac.id, E-mail : fti.upi@yai.ac.id

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Yang bertandatangan di bawah ini Dekan Fakultas Teknik Universitas Persada Indonesia Y.A.I, menerangkan bahwa :

Nama Dosen : Dr. Arman Jayady.ST. MT
Jabatan : Dosen Program Studi Magister Teknik Sipil S2

Kami tugaskan untuk mengkadi Pembicara dalam kegiatan CENTS (Civil & Environmental Engineering Technology Seminar dengan tema Maximizing Efficiency And Sustainability in Construction yang diselenggarakan oleh Binus University pada tanggal 10 Juni 2023.

Demikianlah surat Tugas ini kami buat untuk diketahui dan dilaksanakan sebagaimana mestinya.

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Dekan



Dr. Ir. Fitri Suryani. MT



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As a Speaker in Civil and Environmental Engineering Technology Seminar

Dr. Arman Jayady, S.T., M.T.

Civil and Environmental Engineering Technology Seminar
"Maximizing Efficiency and Sustainability in Construction"
held by Civil Engineering Study Program, Bina Nusantara University, Indonesia in collaboration with
University of Indonesia, Universitas Persada Indonesia Y.A.I, and Jakarta State University
on Saturday, 10th June 2023 at Anggrek Campus, Bina Nusantara University, Jakarta, Indonesia

Dr. Ir. Nina Nurdiani, S.T., M.T.
Dean of Faculty of Engineering
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Dr. Ir. Oki Setyandito, S.T., M.Eng., IPM.
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