Intelligence Empowered

Vertical Farming Systems

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ACESys model: Automation, Culture, Environment, and Systems for Vertical Farming

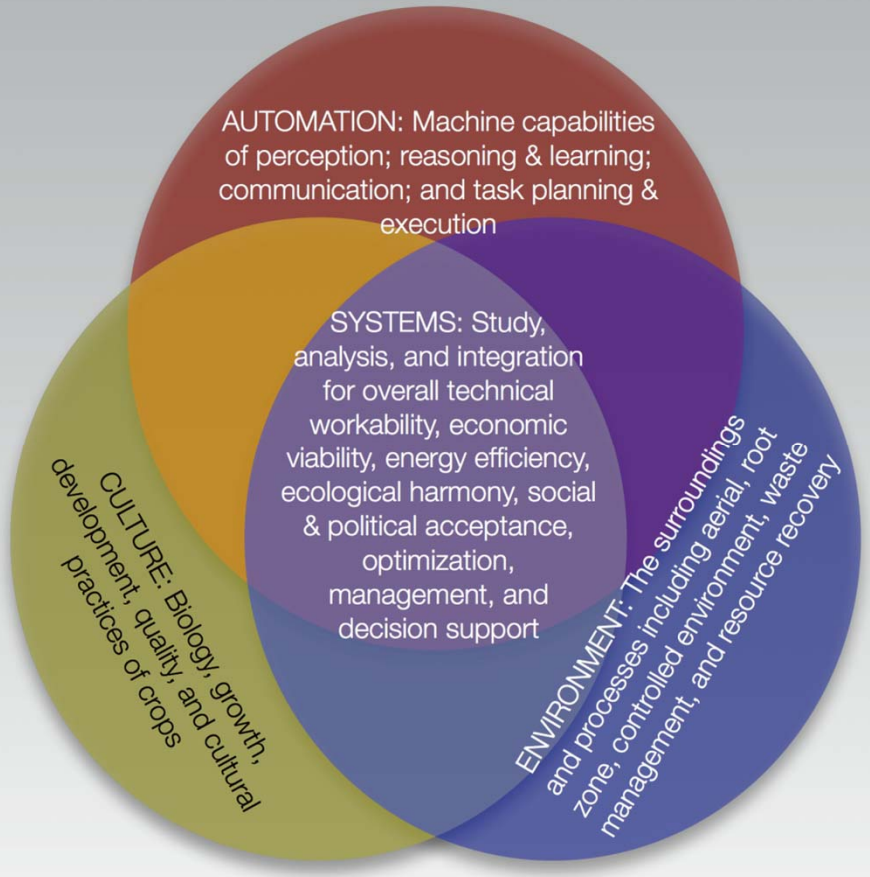
- System
  - Automation
    - Perception
    - Reasoning & Learning
    - Communication
    - Task Planning & Execution
  - Culture
    - Plant Support & Operations
    - Contained Root Zone
    - Nutrient Distribution
    - Root Aeration
    - Micro-Environment
    - Plant Quality
  - Environment
    - Radiative
    - Thermal
    - Gaseous
    - Liquid
    - Nutritional
    - Physical
    - Chemical
    - Biological

RiseCare Company Taiwan

ACESys Core Competencies for Vertical Farming Systems

Scaled Sustainable Business Model

(Local Infrastructure; Finance; and Social, Cultural, Economic, Political and Regulatory Factors)



Education and Training Programs

(Develop Human Capital to Manage and Operate Technical Systems and Business Activities)

Intelligence Empowered Vertical Farming Systems

YaSai Lab
Taiwan

Intelligence
Information needed
Information processing

Mechatronics
Manipulators (Generic or Specialized Mechanisms)
End-effectors
Control

Systems integration
Fixed vs. flexible automation
Component/subsystem interactions and compatibilities
Single function/use vs. multiple function/use
Local vs. global optimization

Automation [in addition to Mechanization]

Automation (machines equipped with human-like capabilities of information processing and task execution):

- Perception
- Reasoning / Learning
- Communication
- Task planning / Execution
- Systems Integration

Red Plum Taiwan

Challenges in Automation for Vertical Farming Systems

- Making return on investment attractive
- Systems optimization by proper integration of Automation, Plant Culture, and Environment
- Balancing fixed automation and flexible automation (i.e. identifying appropriate level of necessary machine intelligence)
- Multiple use of machine or parts of machine
- Limited market demand and acceptance
- Concern for safety in operation
- Continuous improvement of research and development capabilities

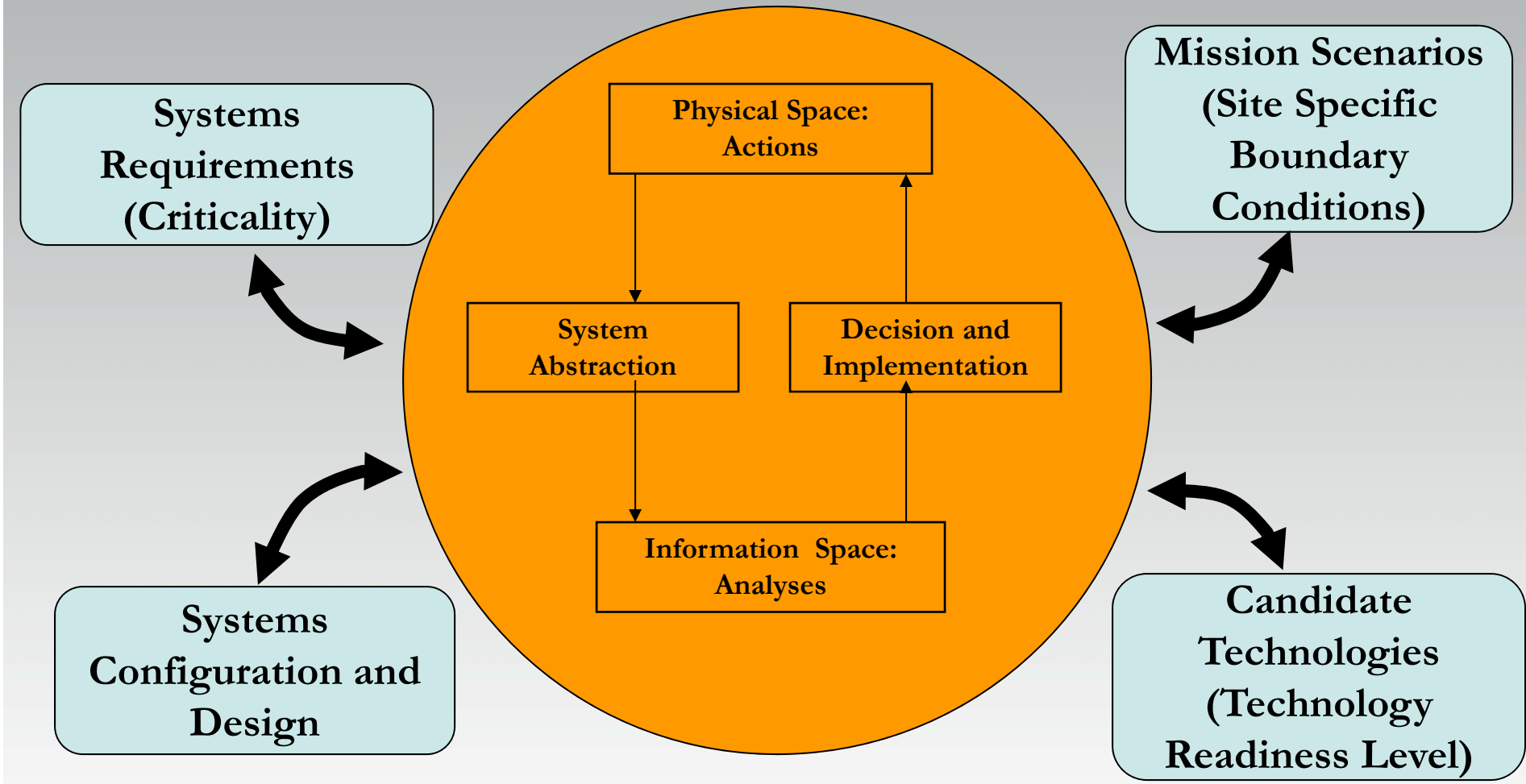
Genesis Company Taiwan

Challenges in Systems Informatics and Analysis for Vertical Farming Systems

- Top-Level vs. Process Level
- Expandability, Compatibility, and Adaptability
- System Abstraction
- Targeted participants and audiences
- Validation
- Handling of heuristic, uncertain, and incomplete information
- Deliverables
- Coordination of activities (i.e. concurrent science, engineering, and technology, ConSEnT)

J&D Restaurant
Taiwan

Concurrent Science, Engineering and Technology (ConSEnT) for Systems Informatics and Analysis



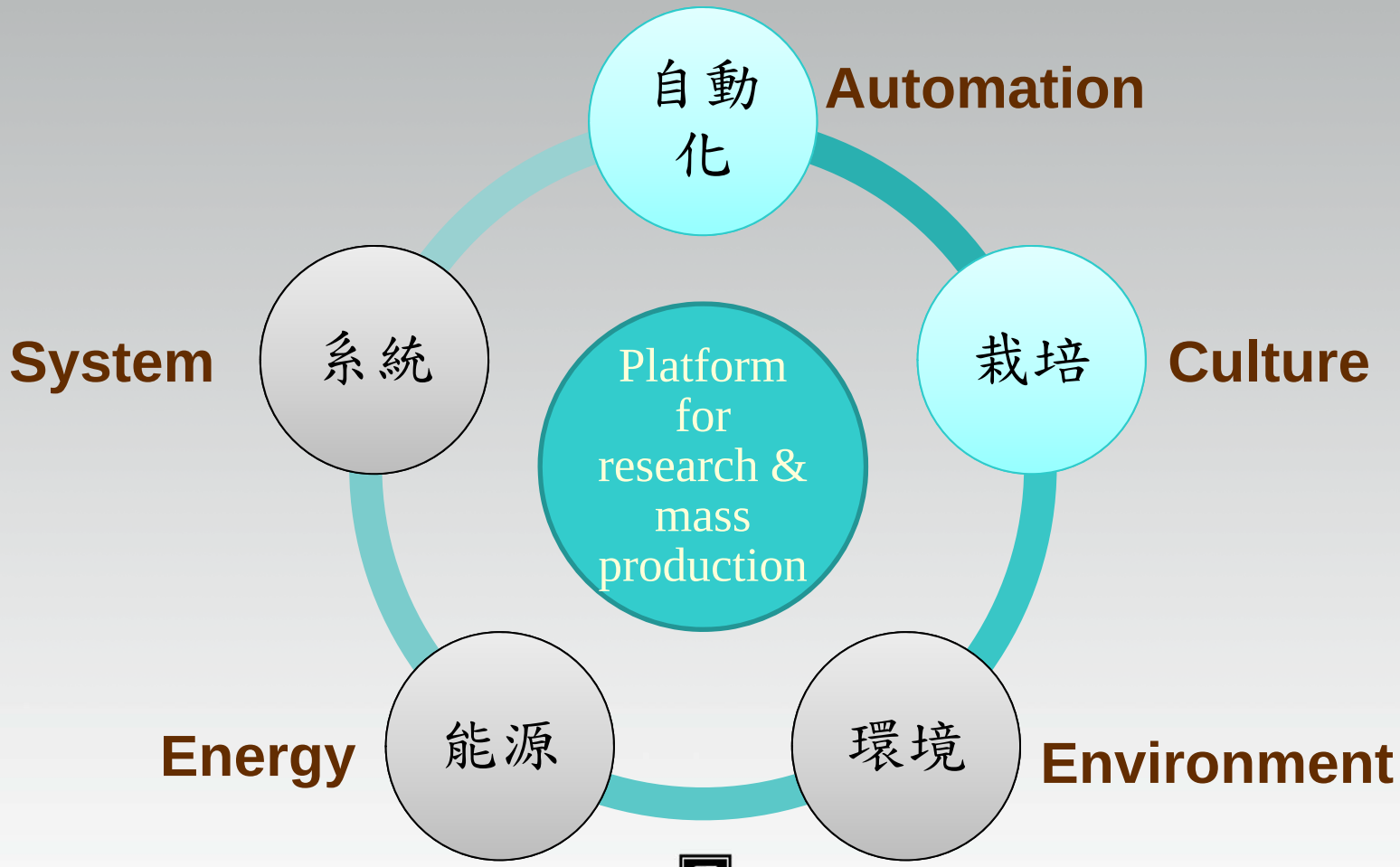
Plant Factory (PF) related projects conducted at National Taiwan University

8 m x 40 m = 320 m^2

illinois.edu

National Taiwan Univ Plant Factory Projects

ACE²S team (Mirroring ACESys)

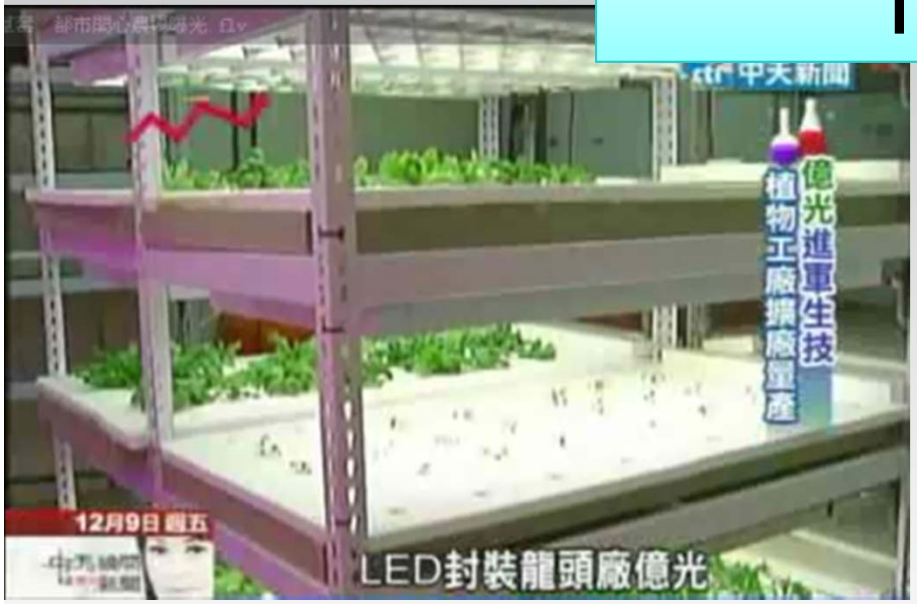


More Commercial Plant Factories (i.e. Vertical Farming Systems) in Taiwan

Partners and Interested Parties:

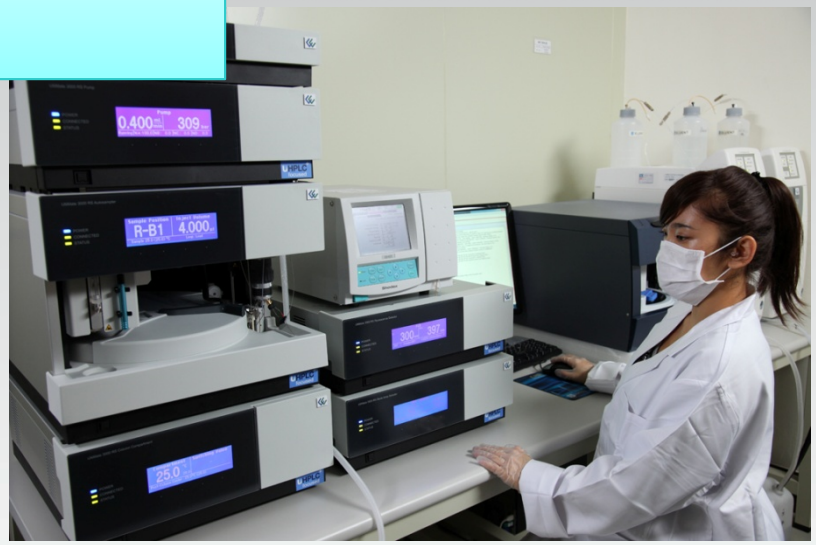
- Research and educational institutions
- Governments
- Real estate developers and builders
- Construction companies
- HVAC industry
- Electronics industry
- Supermarkets
- Restaurants
- Consumers
- Media
- Etc.

Ever Light Company
Taiwan



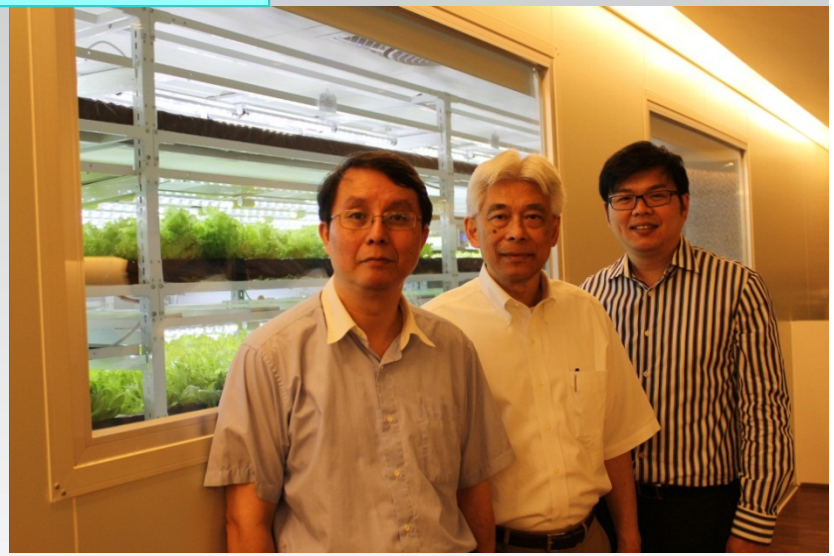
Pacific Group
Taiwan

Cal-Comp Biotech Taiwan

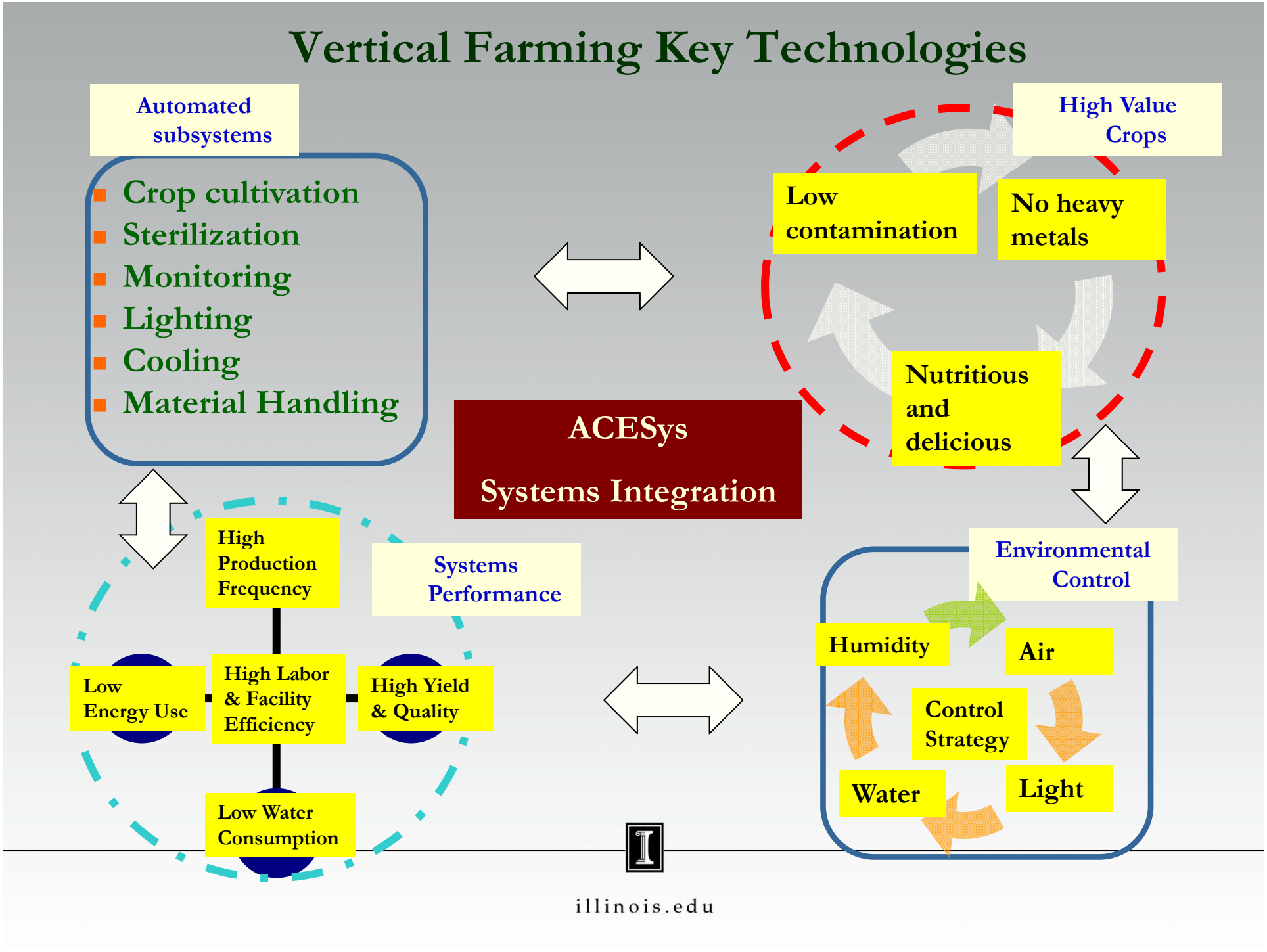


http://www.kinpo.com.tw

Ting-Mao Corp.
Taiwan



Vertical Farming Key Technologies



Opportunities in Automation for Vertical Farming Systems

- Improve technology readiness level and economic viability of automated information gathering/processing and materials handling
- Build on past success of agricultural mechanization and modeling capabilities
- Utilize effective communication systems and computational platforms
- Enhance market acceptance
- Increase potential of spin-off technologies
- Facilitate implementation of emerging technologies

Opportunities in Systems Informatics and Analysis for Vertical Farming Systems

- Establish information protocols and analysis algorithms for vertical farming systems
- Develop a computerized environment for real-time information integration and analysis
- Produce unified and robust models of vertical farming components and entire system
- Perform studies at the system level to aid in design, operation, and research recommendations of vertical farming systems
- Implement the system informatics and analysis environment in a concurrent computational platform (e.g. ConSEnT); i.e. make things work better and together

Thank you!

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