

**This presentation is  
best seen as a  
Slide Show**



4th International Conference on  
Sustainability Engineering and Science



# Transitions to Sustainability

At the Faculty of Engineering, The University of Auckland, New Zealand | 30 Nov - 3 Dec 2010

## **An Integrated, Transdisciplinary, and Evidence Based Approach for Built Environment Sustainability**

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Dean  
College of Architecture



**TEXAS A&M**  
UNIVERSITY



The New Zealand Society for  
Sustainability Engineering and Science

# Howdy!

**Tēnā koutou,  
tēnā koutou,  
tēnā koutou  
katoa**

**We live in a world where...**



**“It is said  
that the  
present is  
pregnant  
with the  
future.”**

**Voltaire**



And the **Future** arrives every second as today's reality, and it does not have **“Stop,” “Pause,” “Rewind,” “Fast Forward,” “Eject,” “Mute,” or “Reset”** buttons....



**In facing the future,  
the questions is:**

**Are WE (in any  
discipline)...**

...Going to **contribute to make**  
**the Future they want**  
**happen...?**

**As ACTORS...**



...Going to **just wait and see**  
**what Future will happen...?**

**As SPECTATORS...**

...Going to **ask “what happened?”** when whatever  
Future arrives...?

**As CRITICS...**

...Or worse, going to **say “huh,  
something happened?”** when  
whatever Future arrives...?

**As OBLIVIOUS  
BYSTANDERS...**



***And, will the choices we make allow us to ride the wave of the future...?***



***Or be dragged under by it...?***

***Will the realities we face crush us...?***



**Or, will we be able to face them  
together as one...?**





***In any case, there is always hope....***



# A Point of Departure

***To achieve **Built Environment Sustainability (BES)** it is necessary to begin by continuing to acknowledge four **basic challenges**, which still remain elusive, and their corresponding responses...***

# Challenge 1

Achieving **BES** in urban, suburban, and rural communities pose **inextricably linked questions, problems, needs, opportunities, and aspirations**, within a broad and diverse range of stakeholders.

# Response 1

As a result, to achieve **BES** will require that key stakeholders in the public and private sectors **acknowledge these links, and invest in establishing mechanisms to work together** at local, regional, state, national, and even international levels, **to pursue integrated solutions to these challenges.**

# Response 1

- ✓ Answering **questions** through innovative research,
- ✓ Solving **problems** through innovative planning, design, procurement, construction, operation, and/or visualization
- ✓ Satisfying **needs** through innovative **services**,
- ✓ Realizing **opportunities** through innovative entrepreneurship, and
- ✓ Fulfilling **aspirations** through facilitation, coaching, and training...

# Challenge 2

In addition, any **public and/or private sector initiatives to plan, finance, develop, and deliver integrated solutions for BES** have multiple **dimensions**, at urban, civil infrastructure systems, and facilities levels.

# Response 2

Consequently, these **BES** initiatives need to address formally and explicitly, in a systemic, systematic, and proactive way, the social, the economic, the environmental, and the institutional & technological dimensions of sustainable urbanism, sustainable civil infrastructure systems, and/or sustainable facilities, at different scales, from different perspectives, and at different levels of complexity.

# Challenge 3

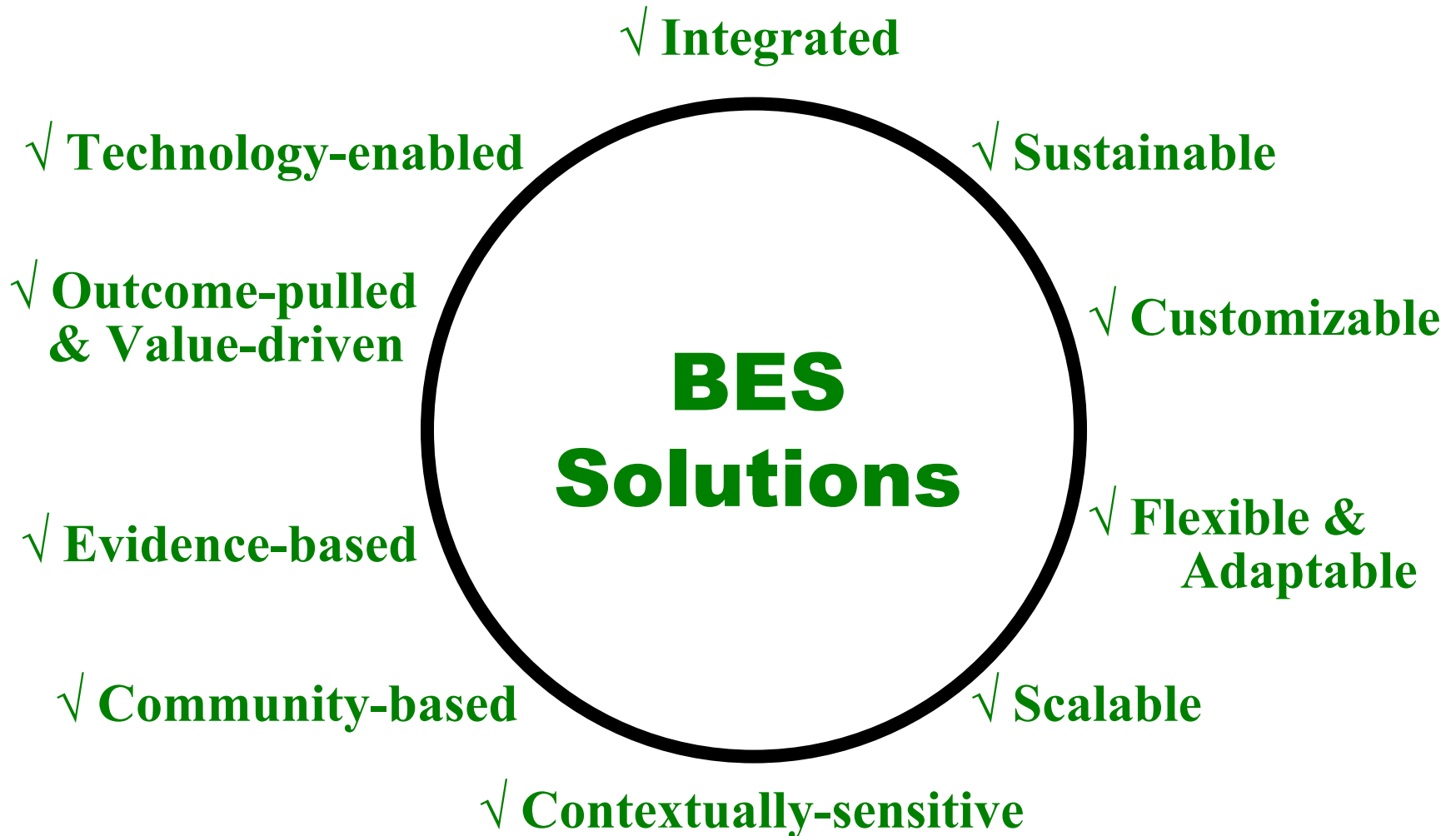
Furthermore, and given that the **interrelationships, interdependencies, and complexity of the external factors** affecting the planning, financing, development, and delivery of integrated solutions for **BES**, these initiatives **cannot afford to continue following the same strategies, mechanisms, and processes that have been used to date.**



# Response 3

Thus, they require **bold, creative, innovative, and entrepreneurial new approaches** that lead to...

# Response 3



# Challenge 4

Finally, the **challenges** for the public and the private sectors created by the questions, problems, needs, opportunities, and aspirations posed by **BES**, **cannot be overcome by government officials, policy makers, regulatory agencies, finance institutions, community leaders, planners, architects, engineers, suppliers, builders, or end-users alone.**

# Response 4

Rather, overcoming these challenges **requires and demands that all these stakeholders link, coordinate, and integrate their efforts as a single cohesive critical mass, pooling, leveraging, and sharing their resources,** within local, regional, state, national, and international public/private partnerships, **in the pursuit of initiatives, programs, and projects of common interest and benefit to all.**

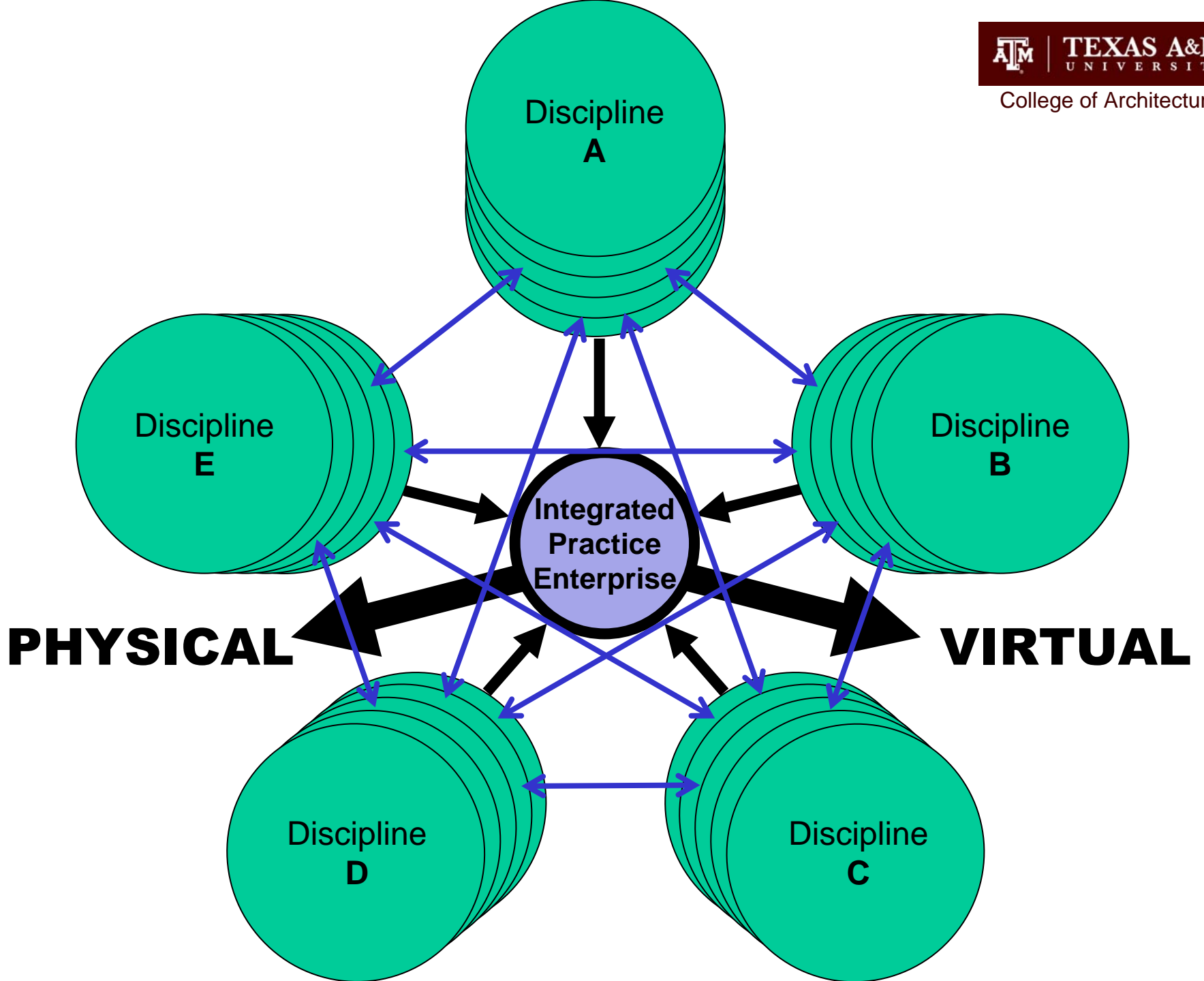
# Three Trends for **BES**:

(1) An **Integrated**  
approach within practice

*To support the delivery of integrated solutions for **BES**, it is necessary to implement five levels of integration in the Architecture, Engineering, and Construction (AEC) industry...*



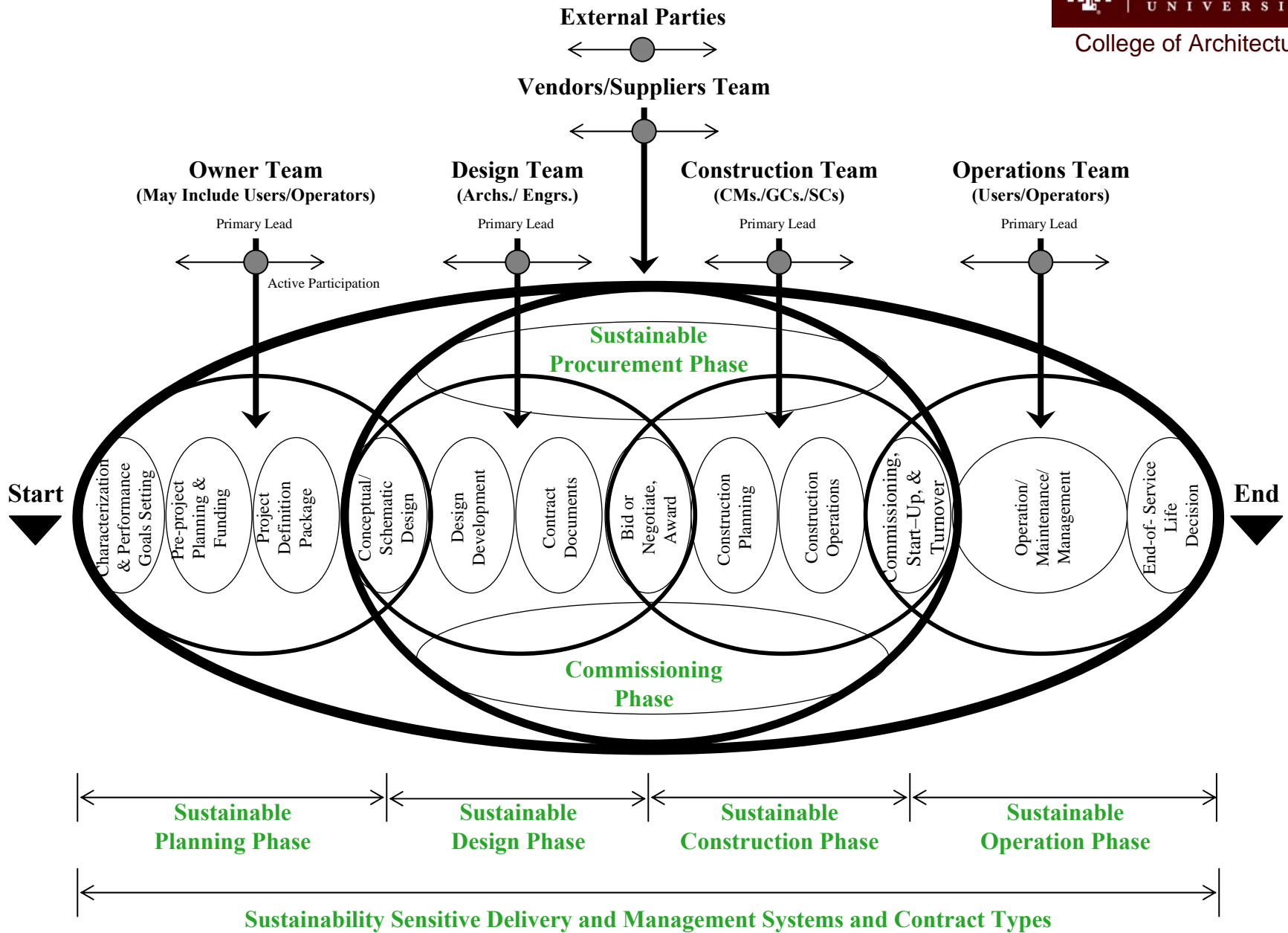
# ***Integrated Business Practice***

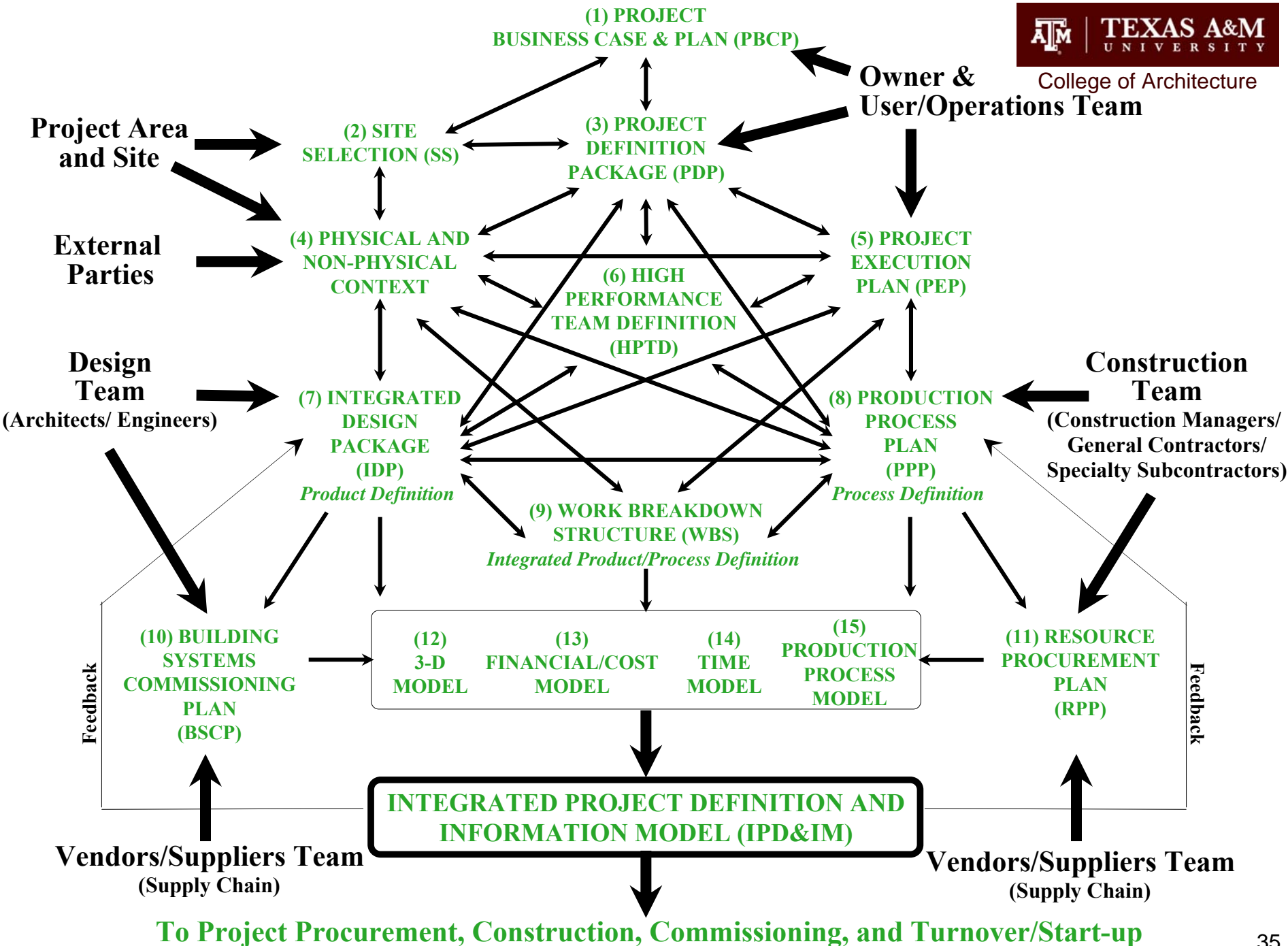






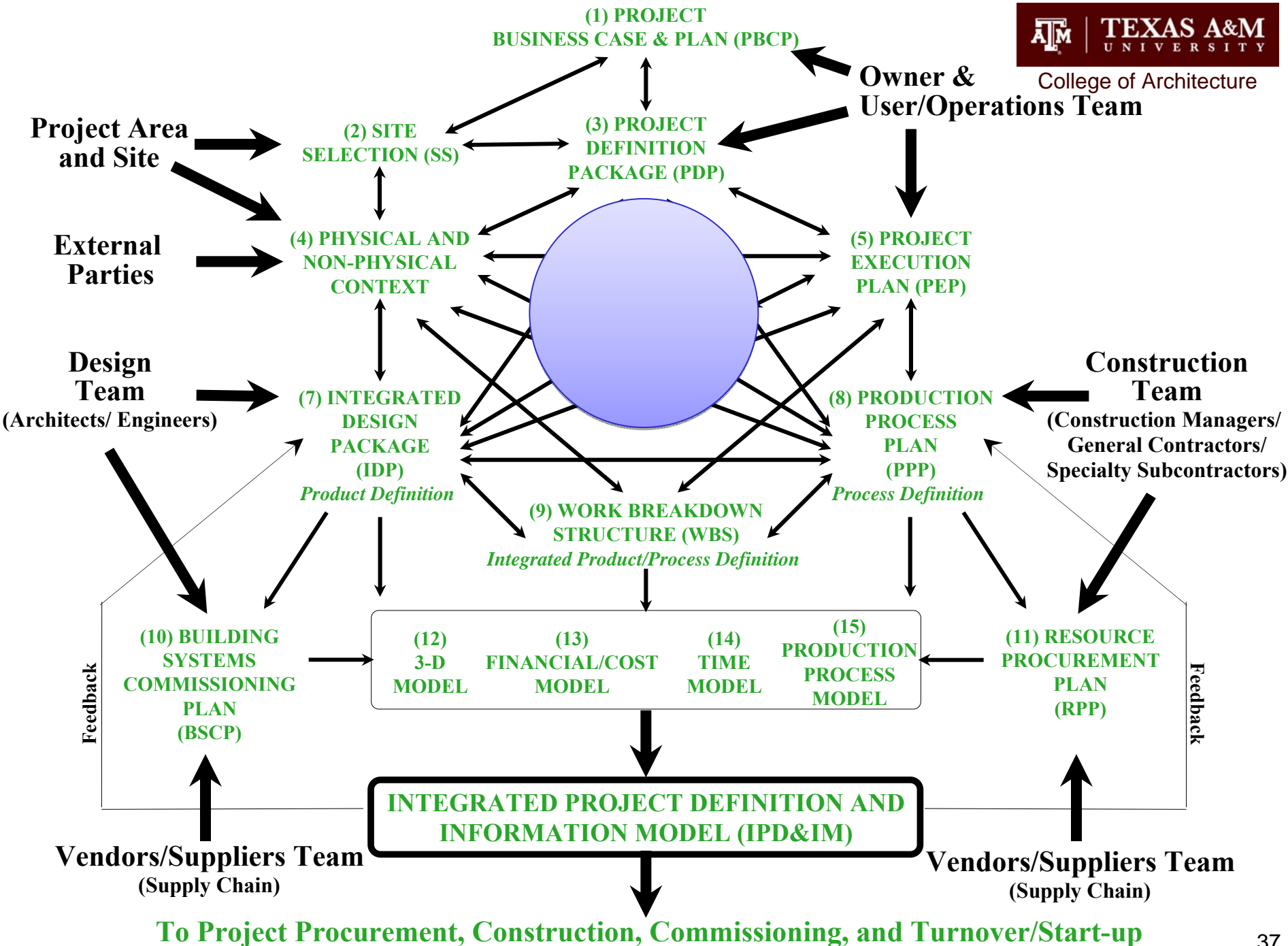
***Integrated Project  
Delivery***

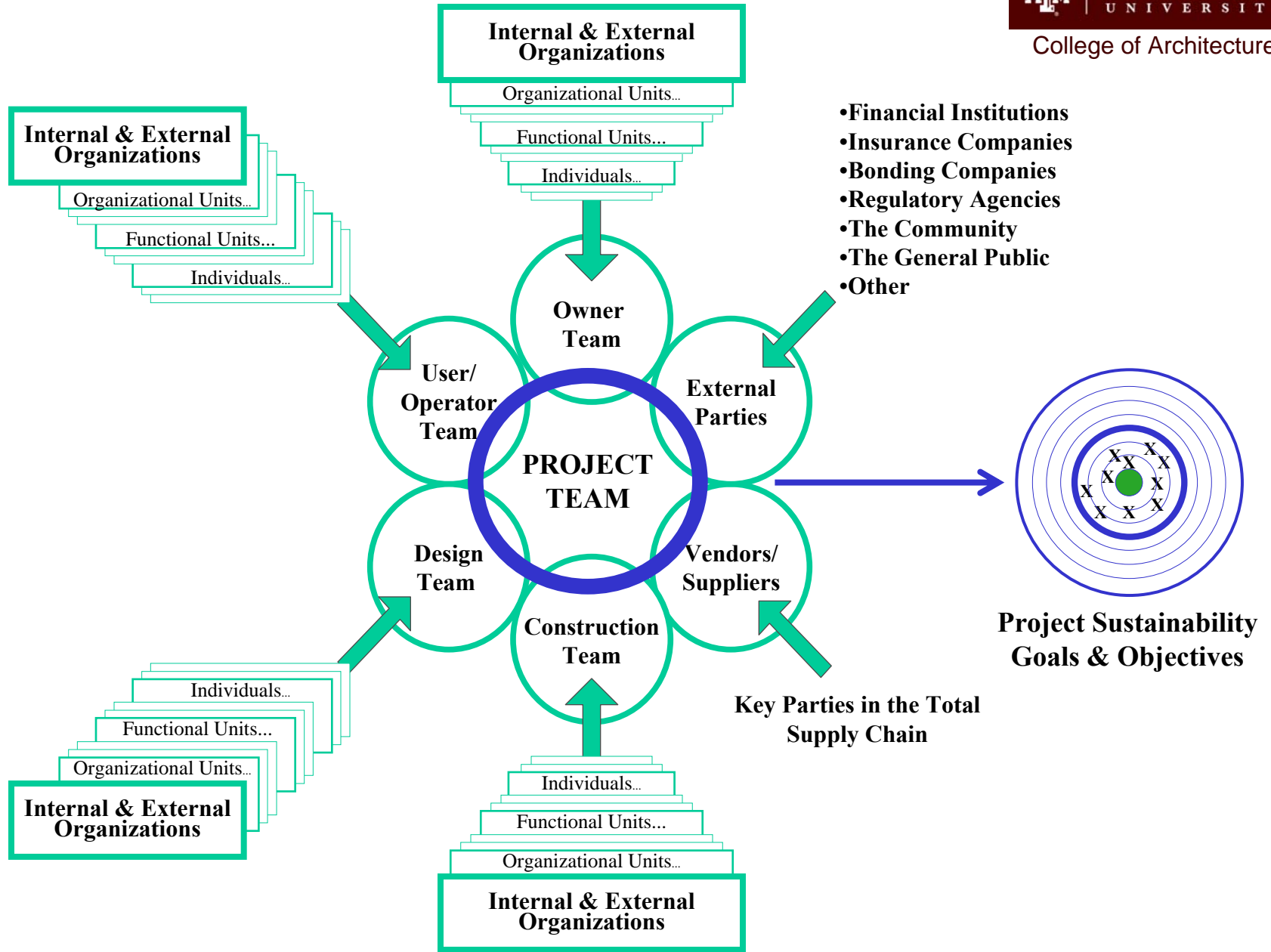


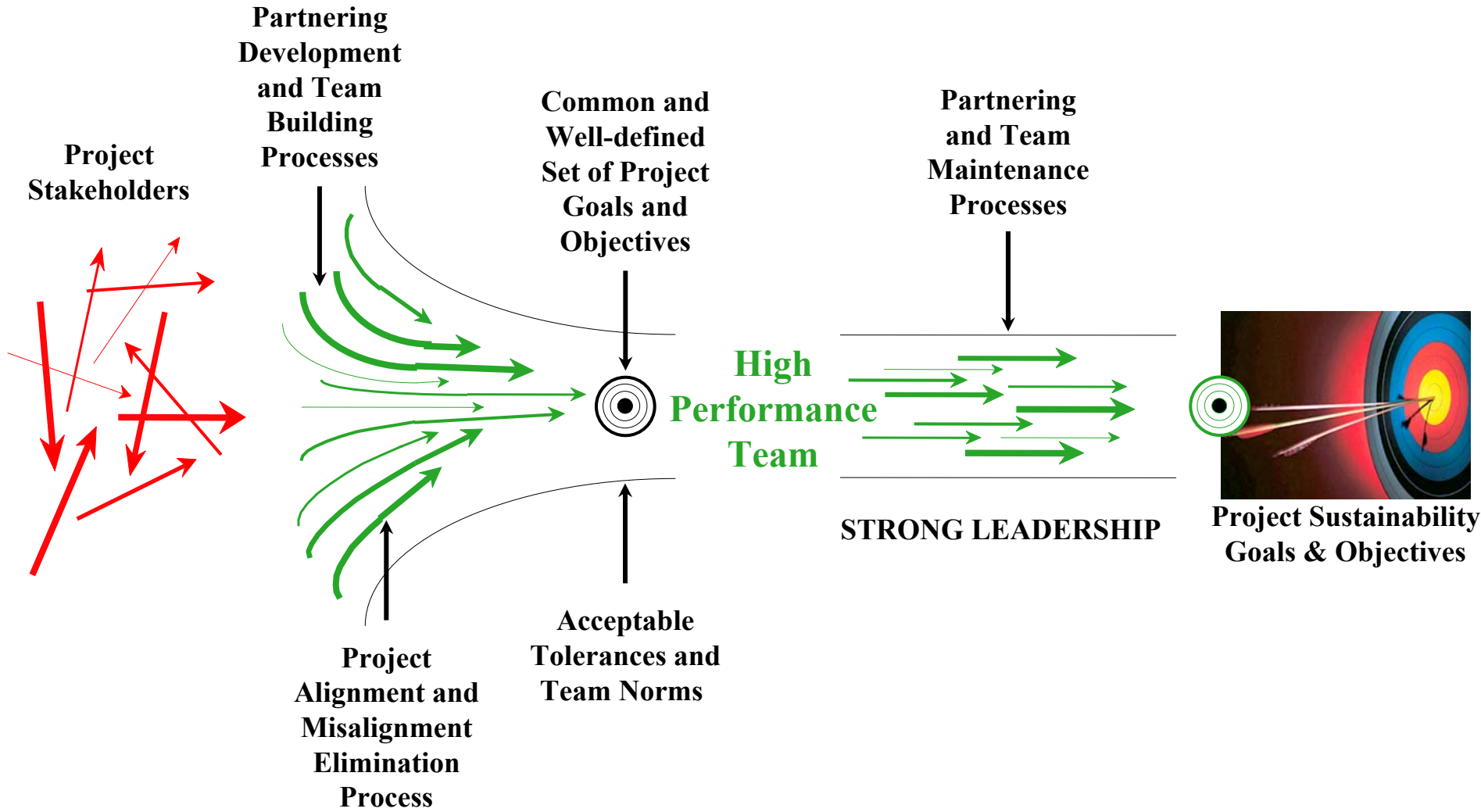




***Integrated High  
Performance Team***



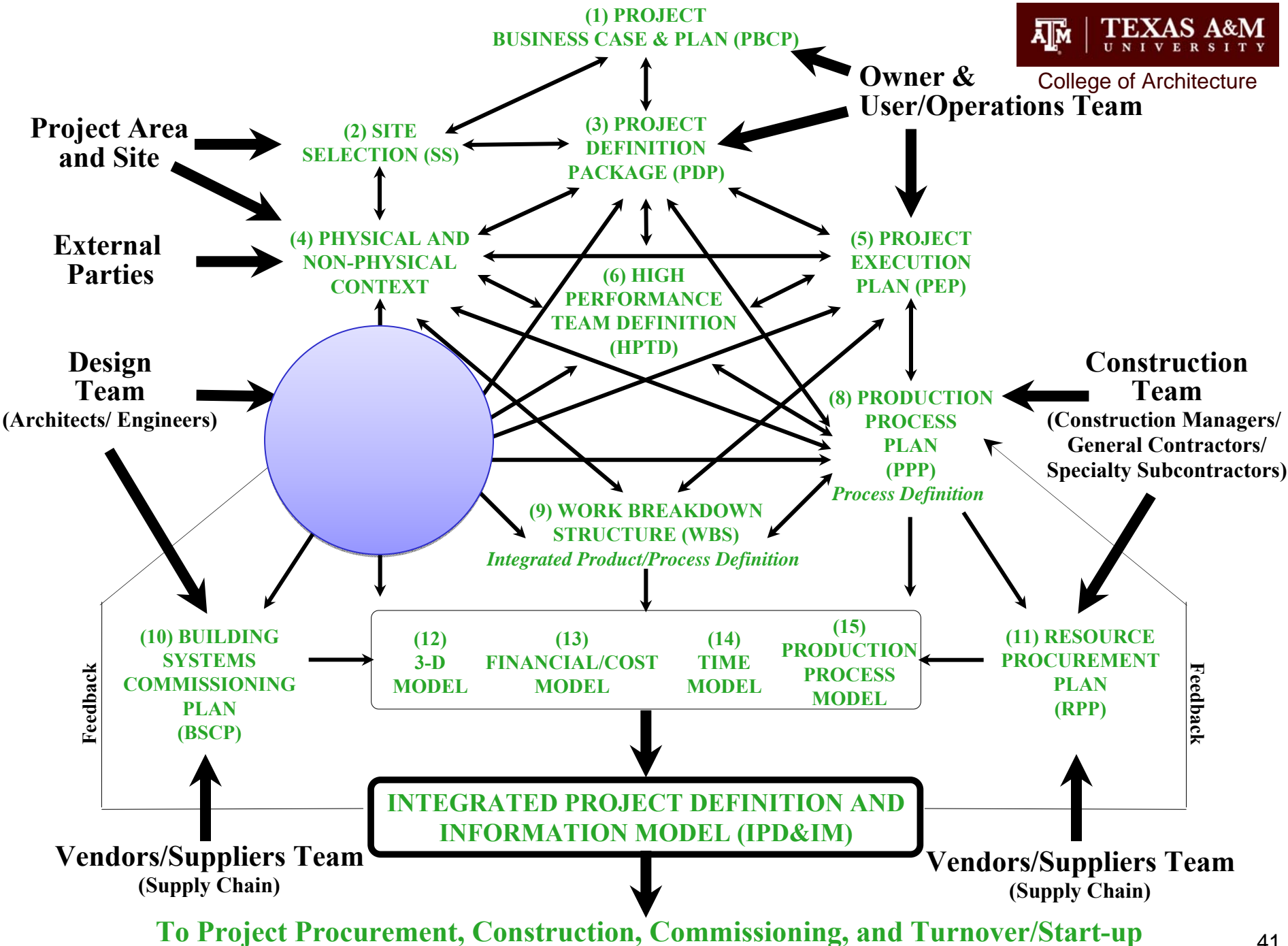






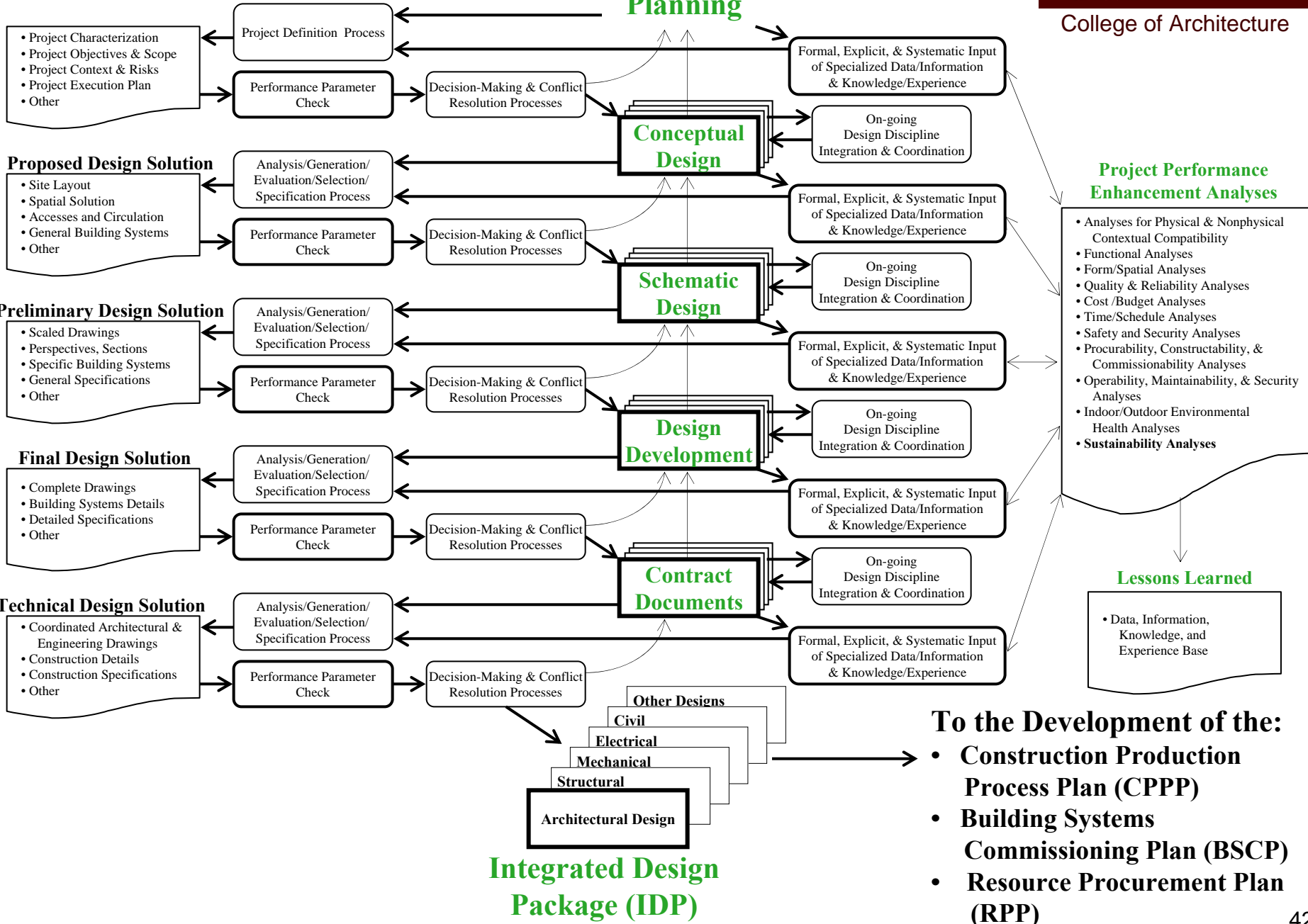
# ***Integrated Design Process***





# Project Definition Package (PDP)

# From Pre-project Planning





***Integrated  
Technologies***

## Project and Facility Management, Coordination and Control

Project  
Planning

Design

Job Site

Operational  
Facility

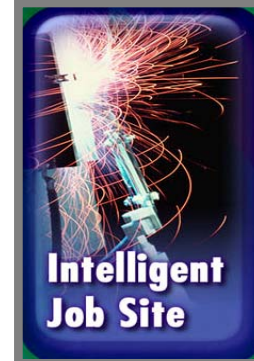
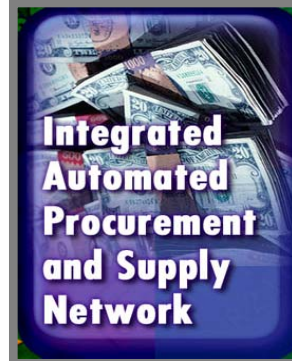
Procurement  
and Supply

Materials, Methods, Products and Equipment

Workforce

Data and Information Management

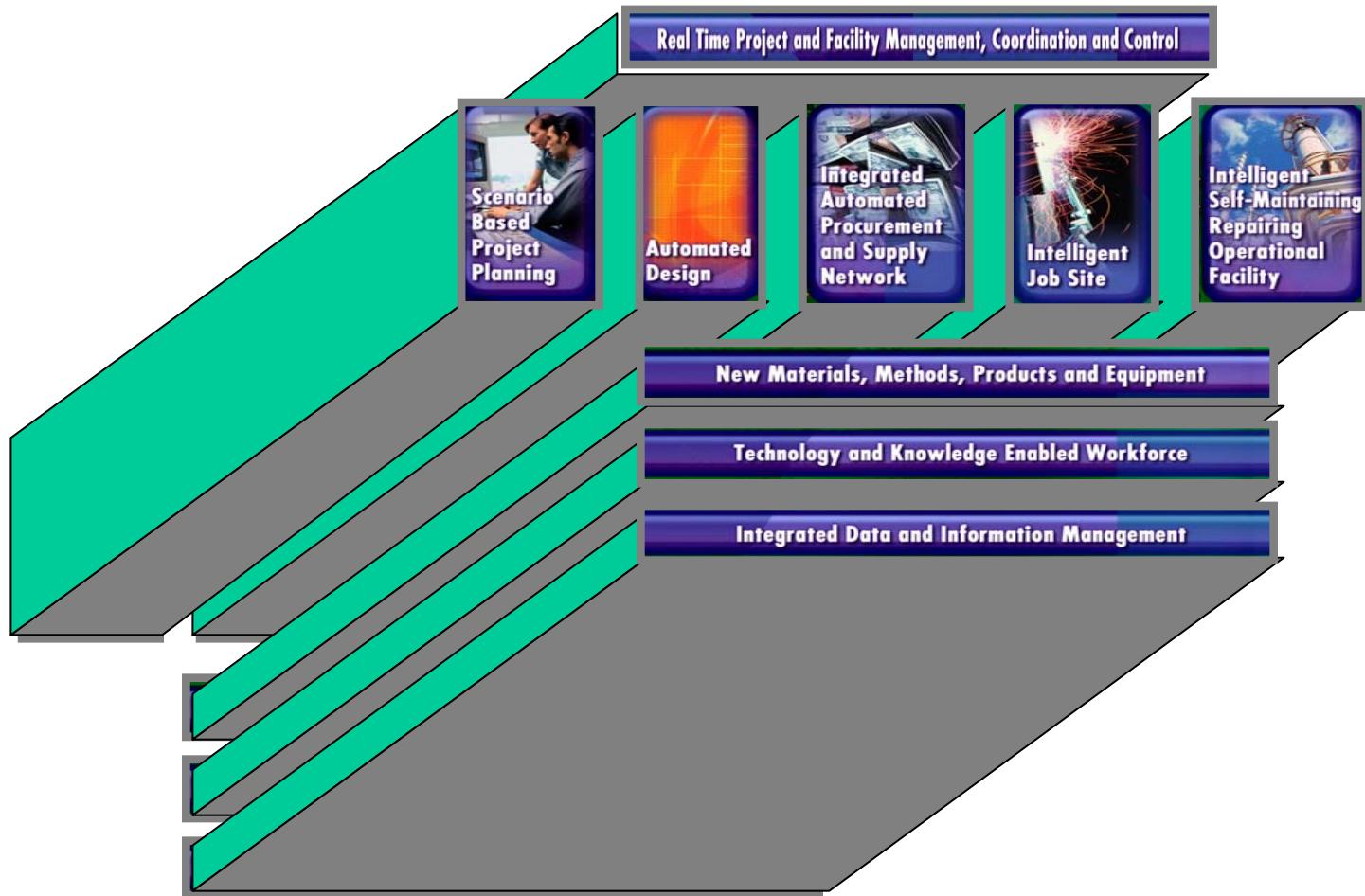
**Real Time Project and Facility Management, Coordination and Control**

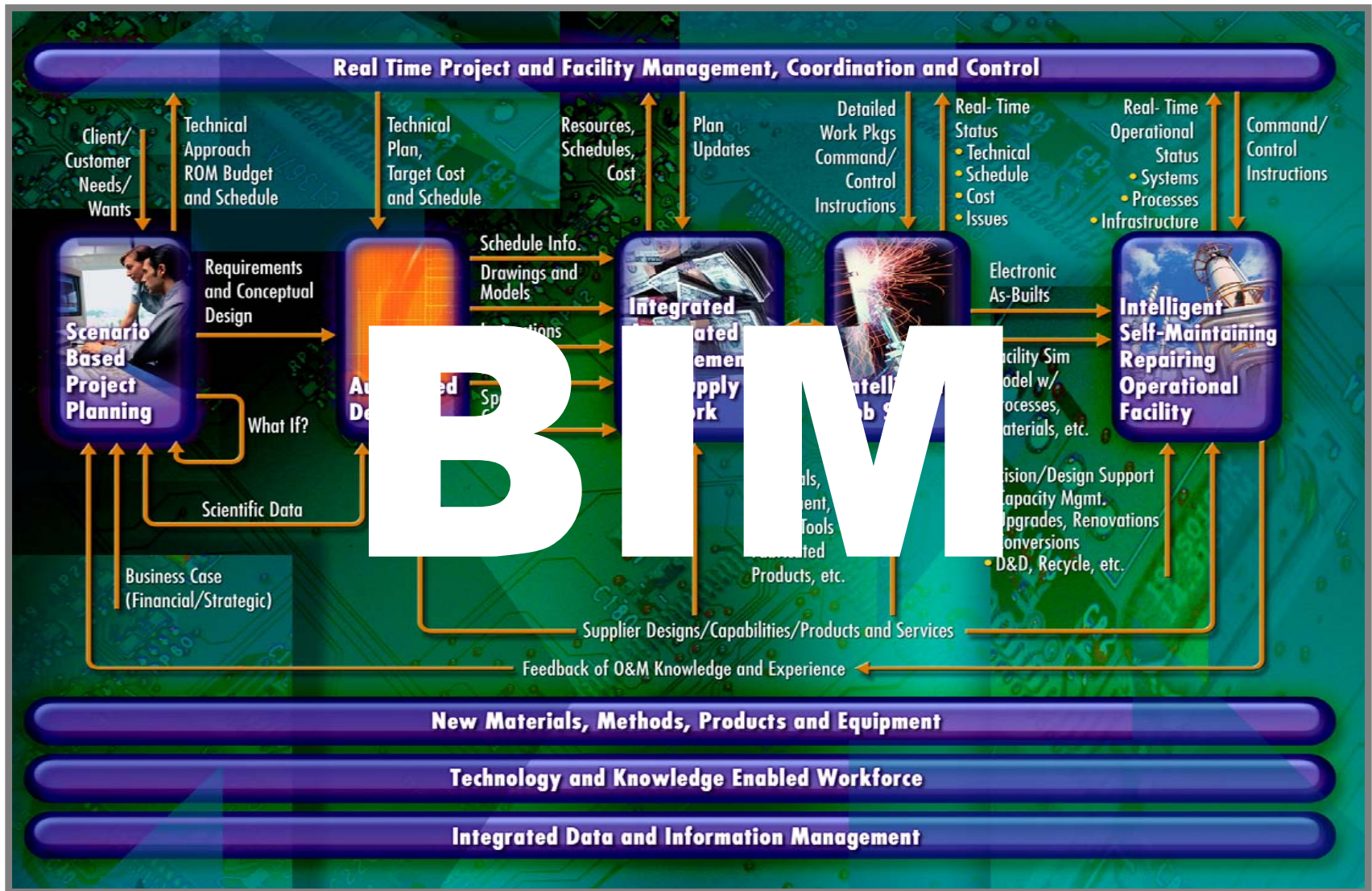


**New Materials, Methods, Products and Equipment**

**Technology and Knowledge Enabled Workforce**

**Integrated Data and Information Management**



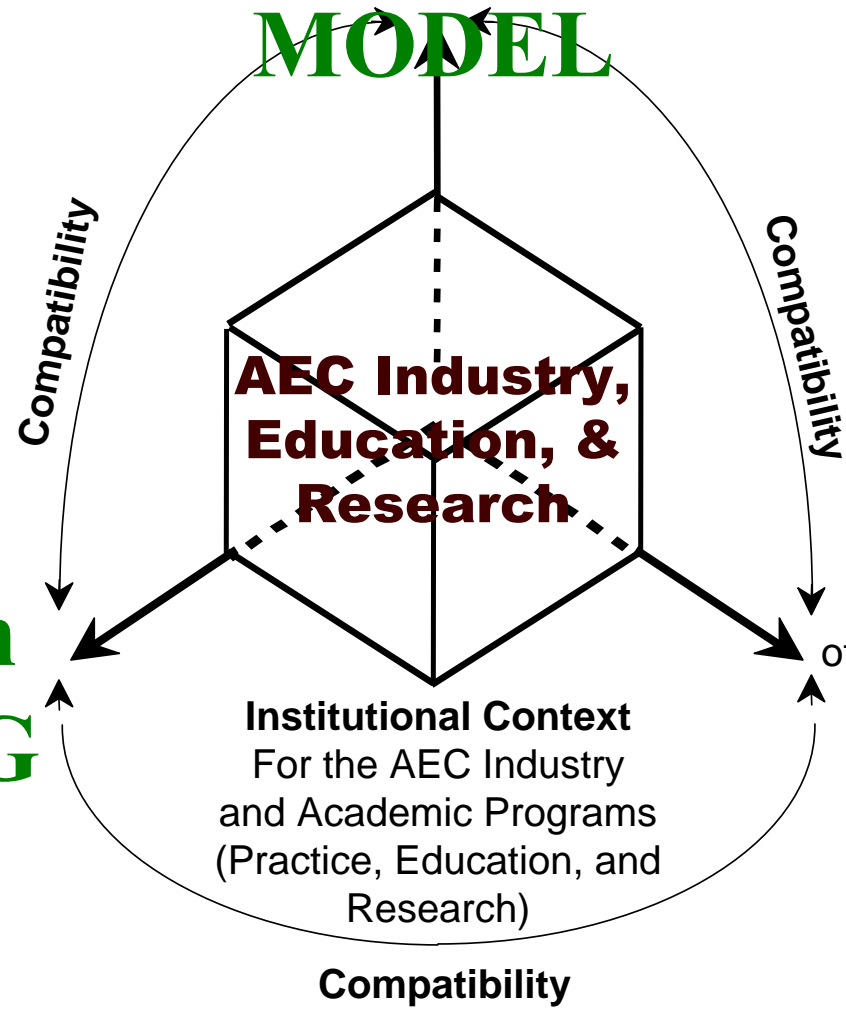


# Framing BIM...

**Building Information MODEL**  
 Characteristics and Requirements  
 of What We Teach  
 (Curriculum)

**Building Information MODELING**  
 Processes for the  
 Delivery  
 of What We Teach  
 (Pedagogy)

**BIM Platform**  
 Resources for the  
 Delivery  
 of What We Teach and How  
 (Technology)





**BIM is ...**

Technical  
Processes  
IPD

**BIM-**

**A**

Accelerates the drawing production  
processes

**BIM-**

**B**

exchanges data with partners to transform Business

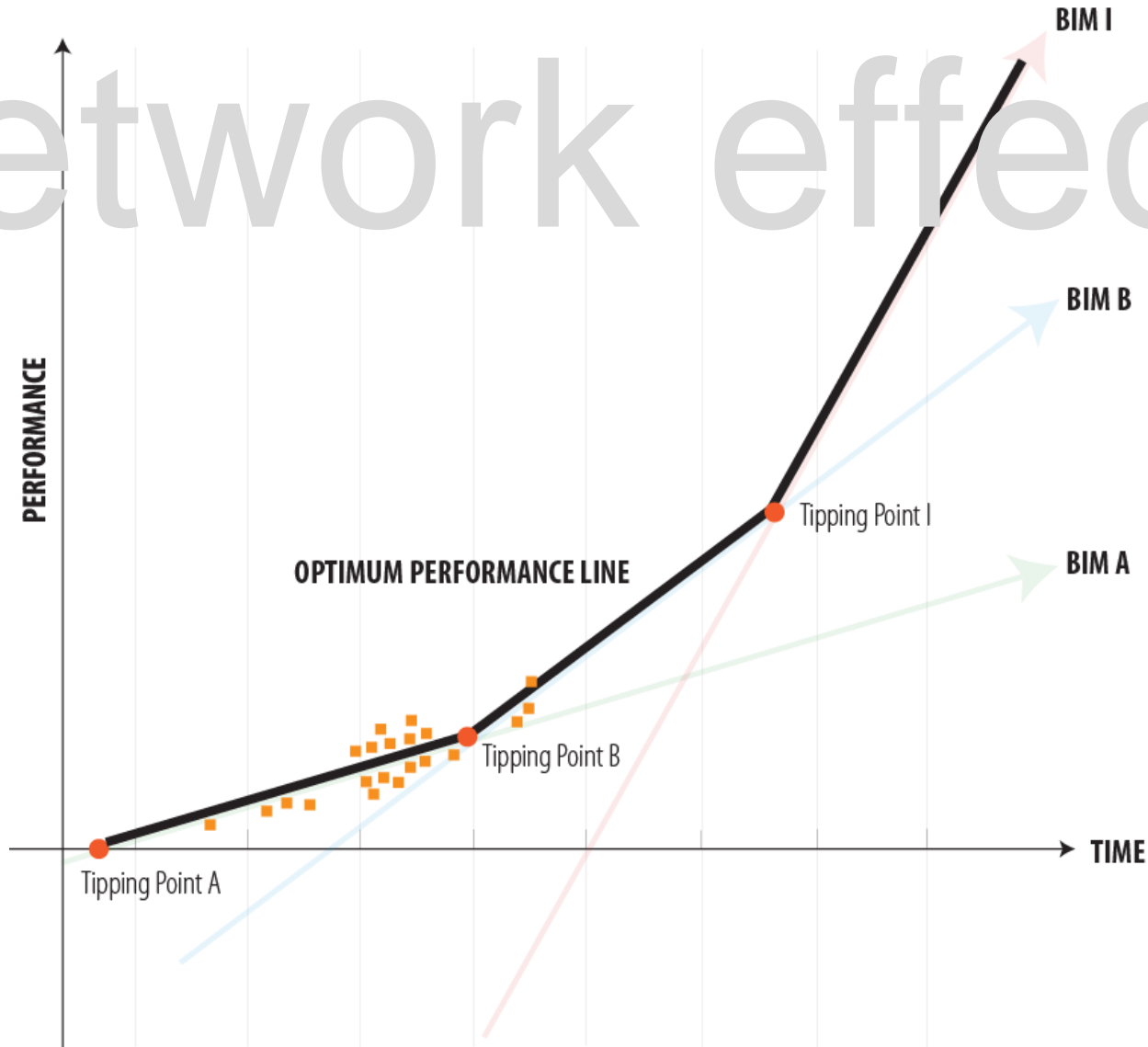
The background features several large, thin, light gray concentric circles and a thick, solid black vertical bar that intersects them. The text 'BIM-' is positioned to the left of the black bar.

# BIM-

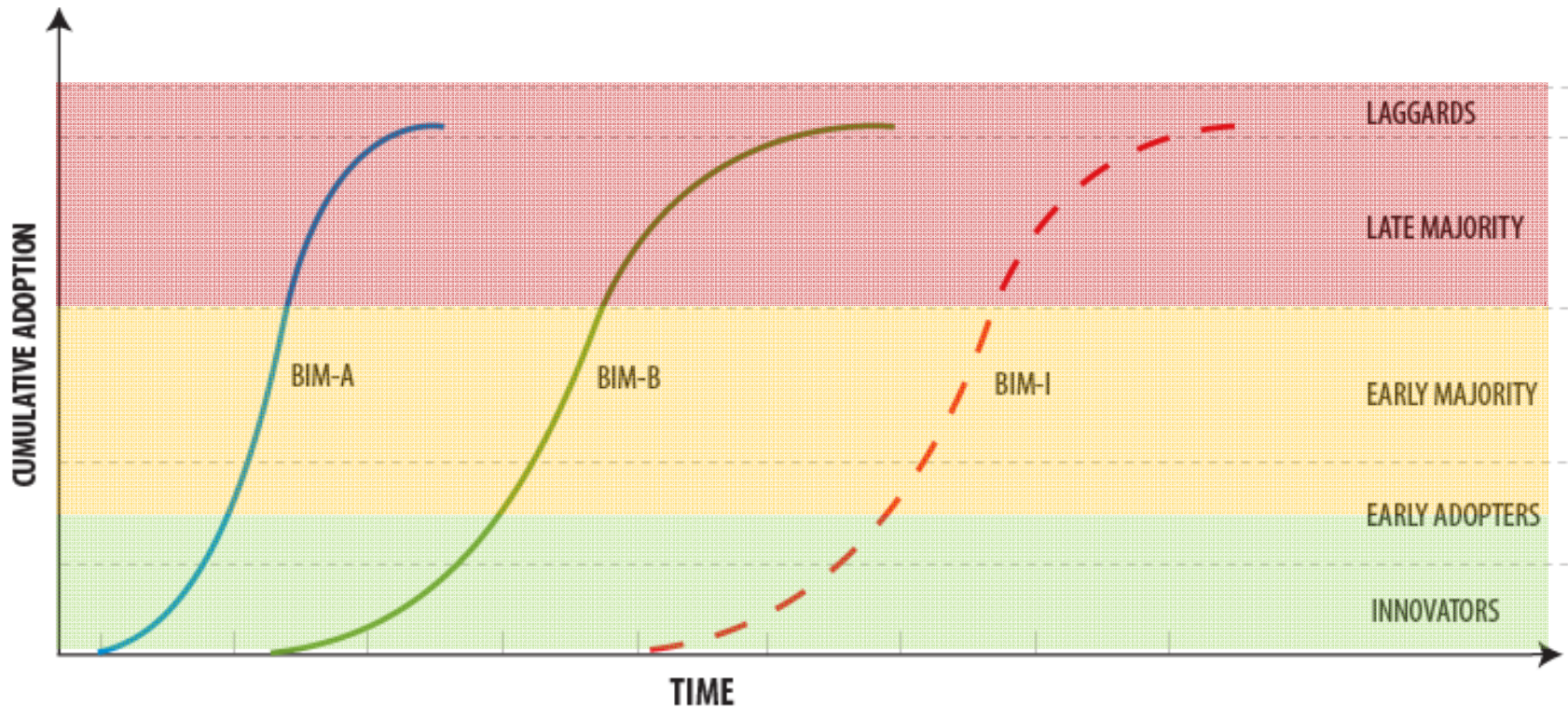
Industry-wide transformation to smooth supply chains

# Value proposition

# Network effect



# Adoption trends

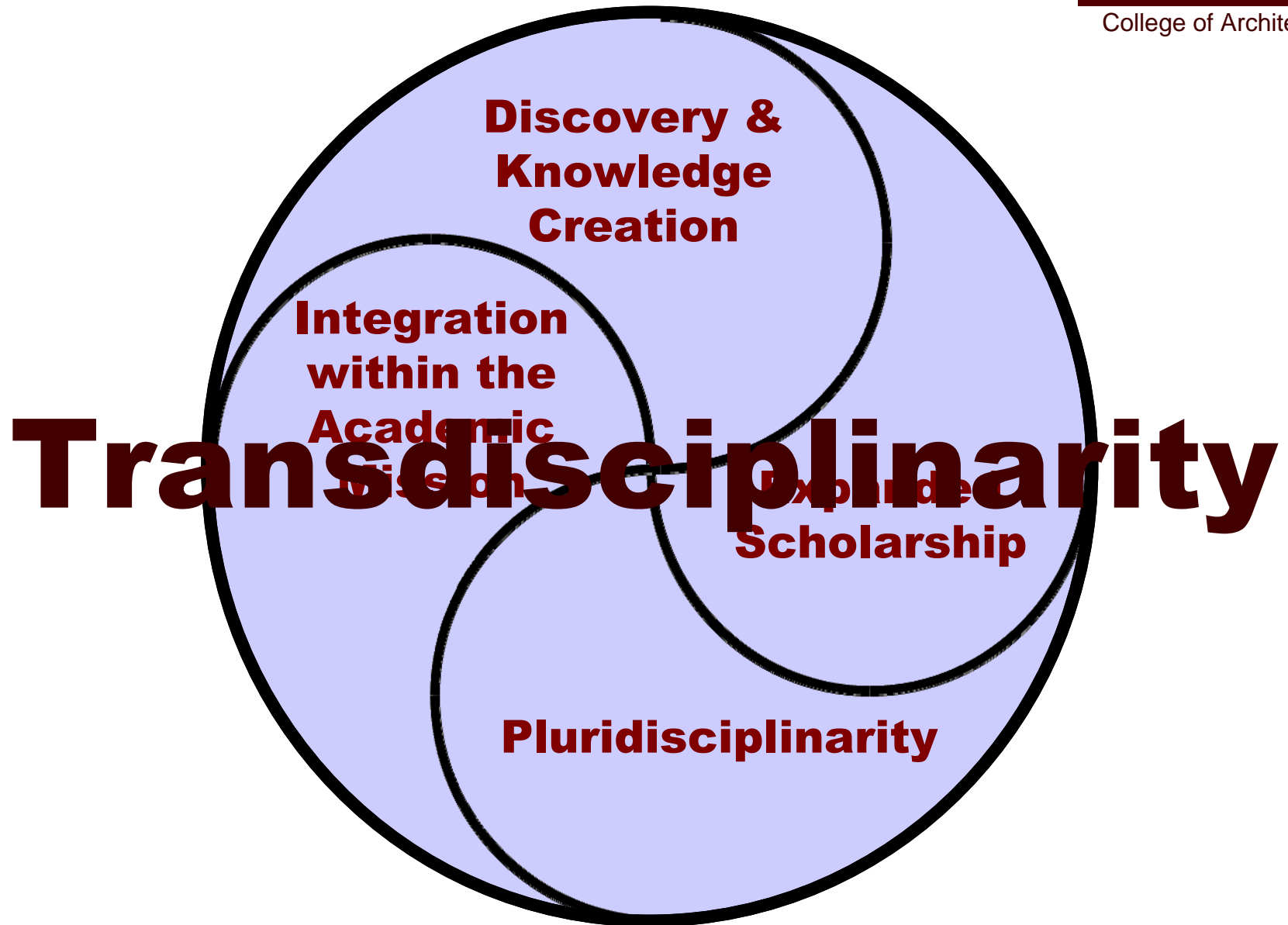


# Three Trends for **BES**:

**(2) A Transdisciplinary  
approach within academia**

*To support the delivery of integrated solutions for **BES**, it is necessary to implement an overarching **paradigm of transdisciplinarity within academia...***





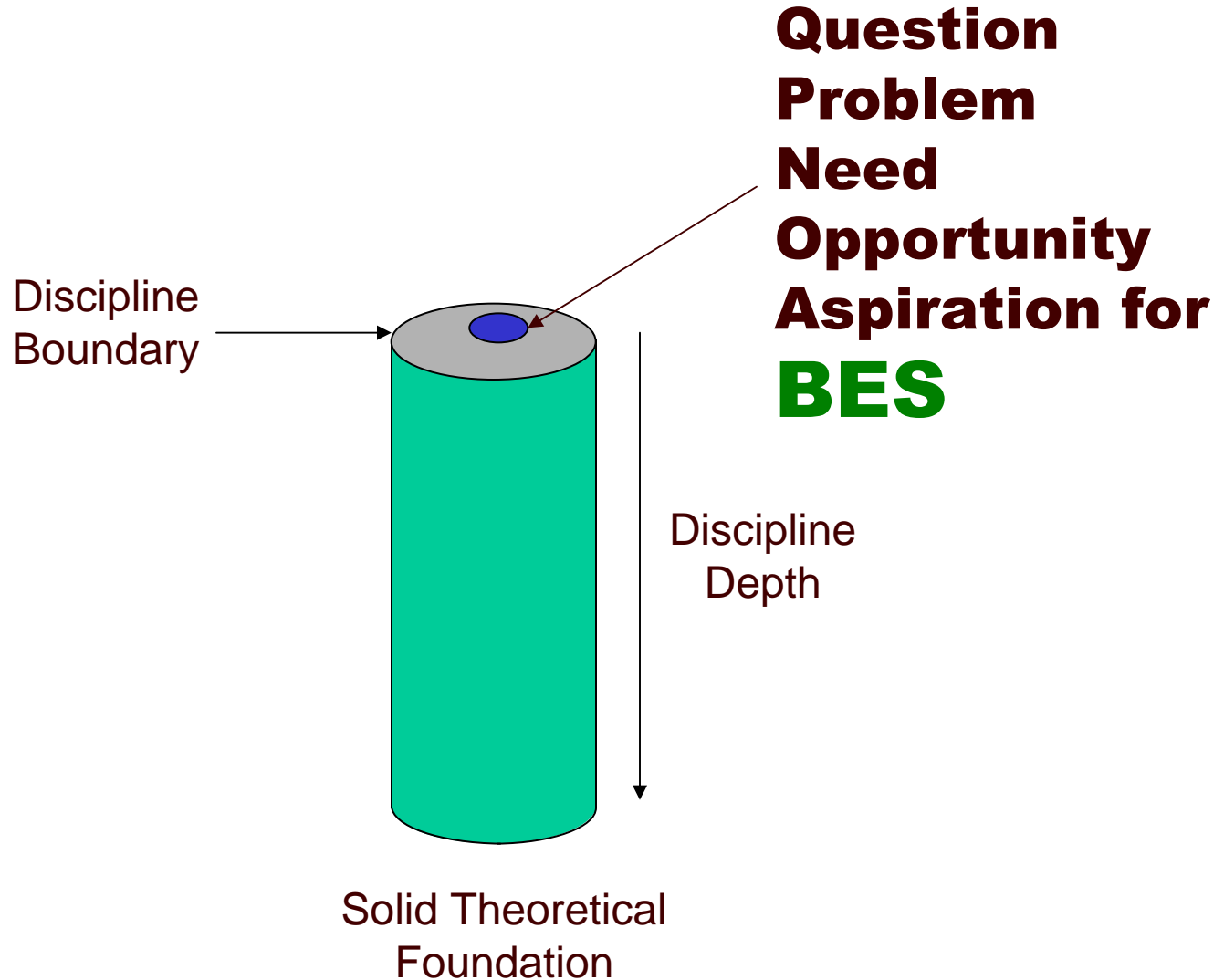
**First, *BES initiatives* need to follow a paradigm of pluridisciplinarity...**

**Disciplinarity,  
multidisciplinarity,  
interdisciplinarity,  
crossdisciplinarity, and  
transdisciplinarity** are like five  
arrows shot from but a single bow:  
**knowledge**



**Disciplinarity** is concerned  
with the study of a research topic  
within only one discipline.

# Disciplinarity (cont.)



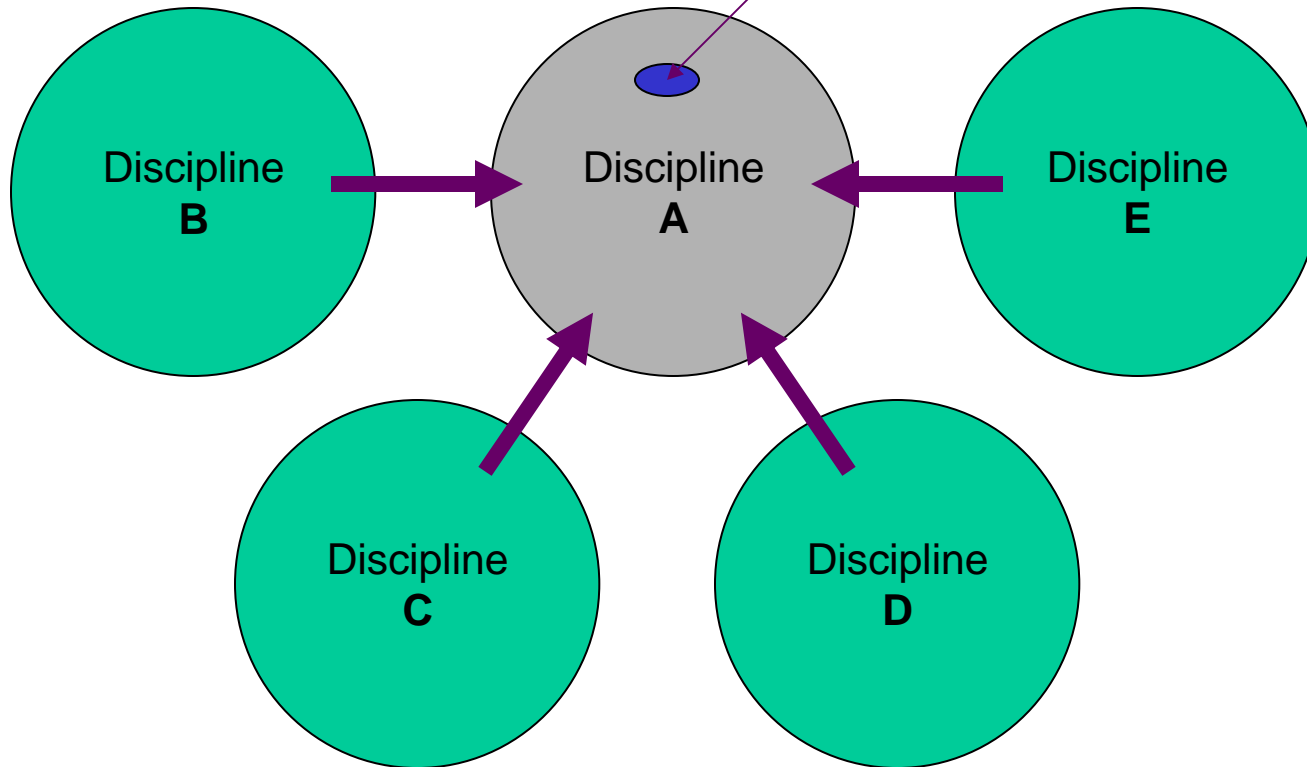
**Pluridisciplinarity** is concerned with the study of a topic, not in only one discipline, but in several at the same time.

(a)

**Multidisciplinarity** is with the study of a research topic within one discipline, with support from other disciplines, bringing together multiple dimensions, but always in the service of the driving discipline.

# Multidisciplinary (cont.)

**Question  
Problem  
Need  
Opportunity  
Aspiration for  
BES**



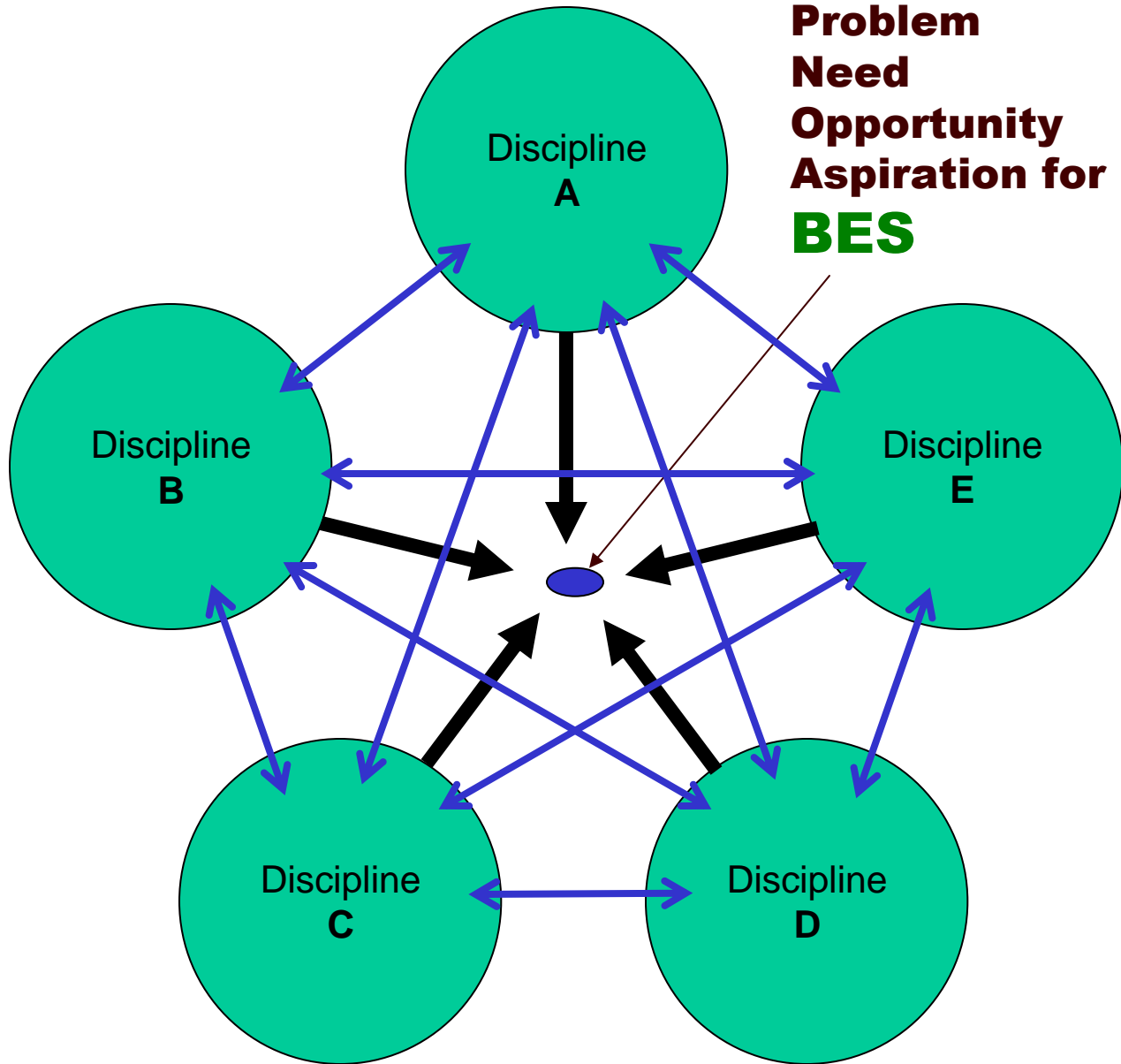


(b)

**Interdisciplinarity** is concerned with the study of a research topic within multiple disciplines, and with the transfer of methods from one discipline to another.

# Interdisciplinarity (cont.)

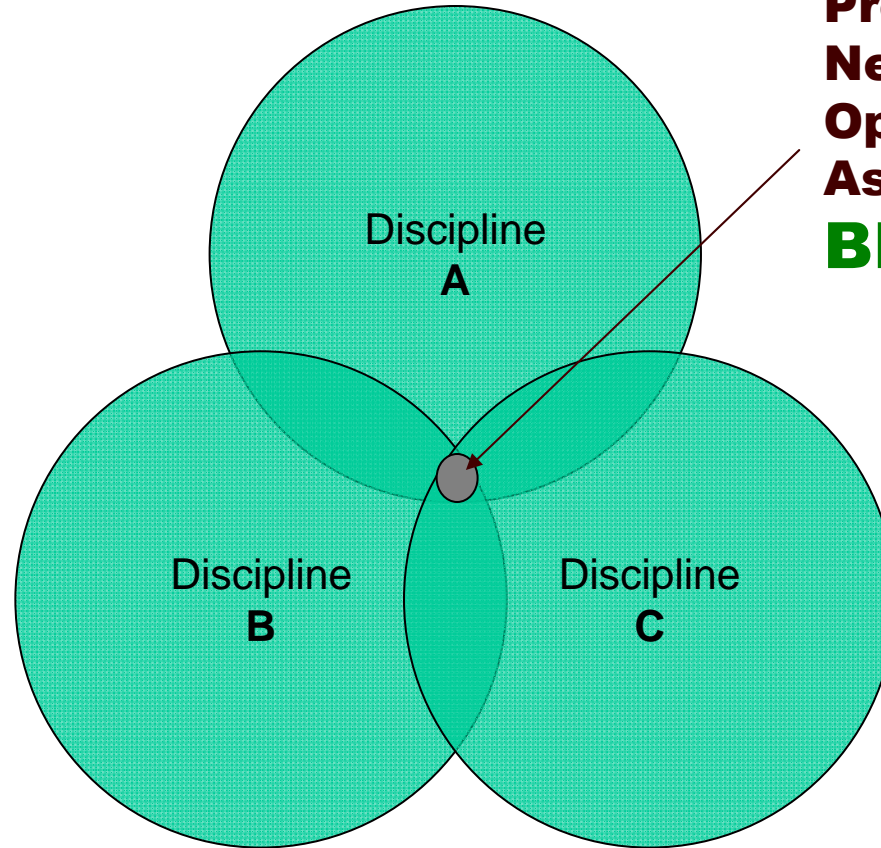
**Question  
Problem  
Need  
Opportunity  
Aspiration for  
BES**



(c)

**Crossdisciplinarity** is concerned with the study of a research topic at the intersection of multiple disciplines, and with the commonalities among the disciplines involved.

# Crossdisciplinarity (cont.)



**Question  
Problem  
Need  
Opportunity  
Aspiration for  
BES**

(d)

**Transdisciplinarity** is

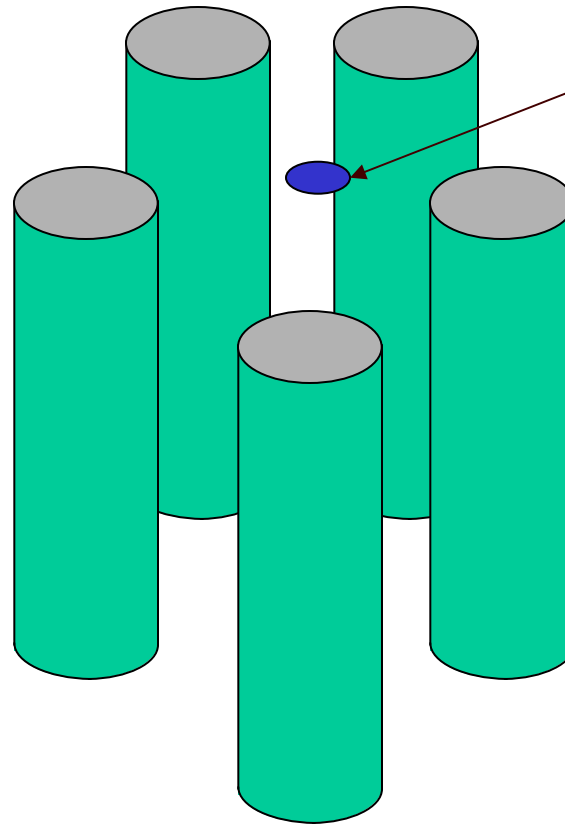
concerned, at once, with what is:

- ✓ *Between the disciplines*
- ✓ *Across the different disciplines*
- ✓ *Beyond all disciplines.*

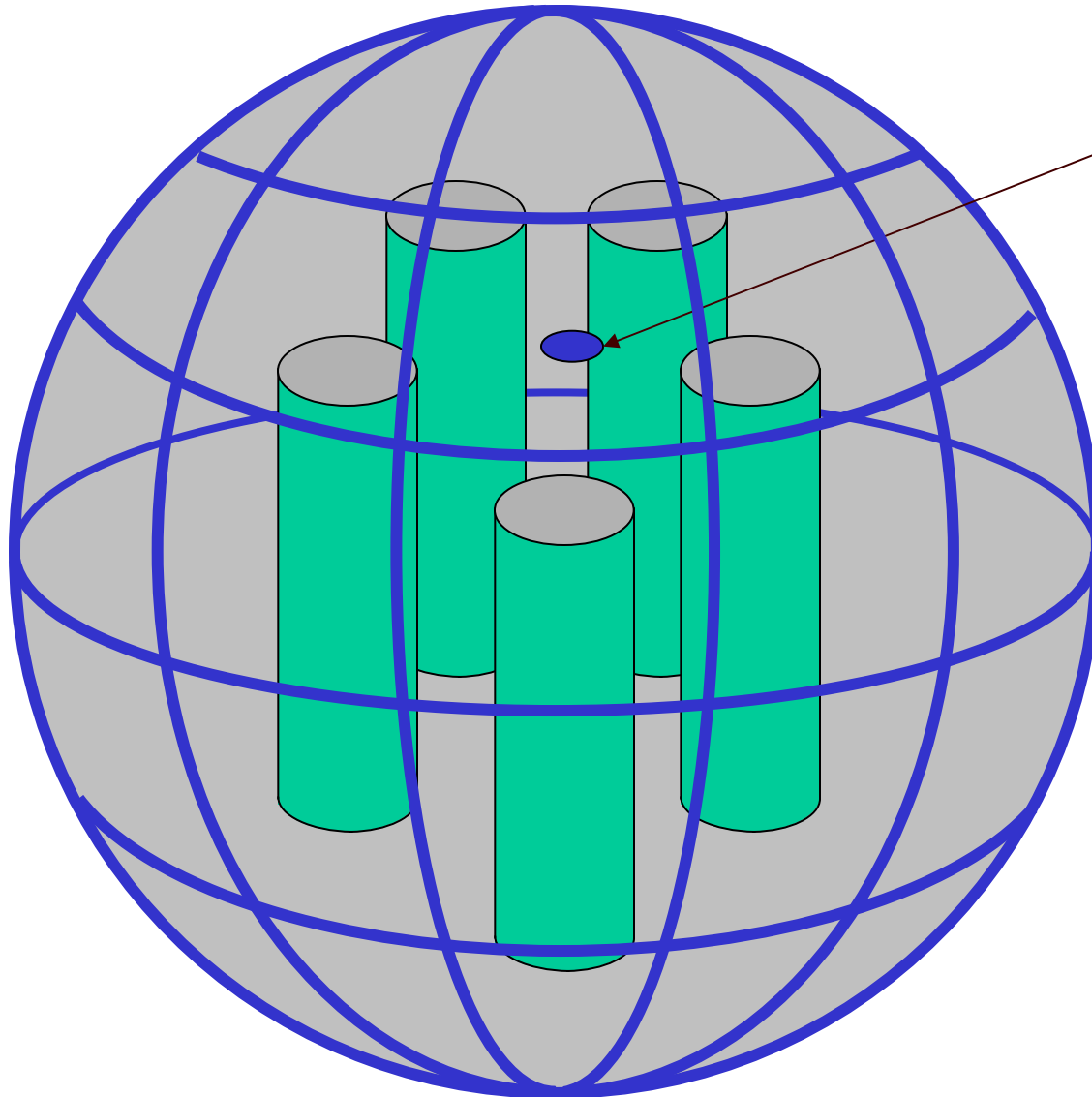
Its goal is the understanding of the present world under an imperative of unity of knowledge.

# Transdisciplinarity (cont.)

**Question**  
**Problem**  
**Need**  
**Opportunity**  
**Aspiration for**  
**BES**



# Transdisciplinarity (cont.)



**Question  
Problem  
Need  
Opportunity  
Aspiration for  
BES**

**Second, *BES initiatives* need to follow a paradigm of integration within the academic mission of higher education, built upon a foundation of transdisciplinarity...**



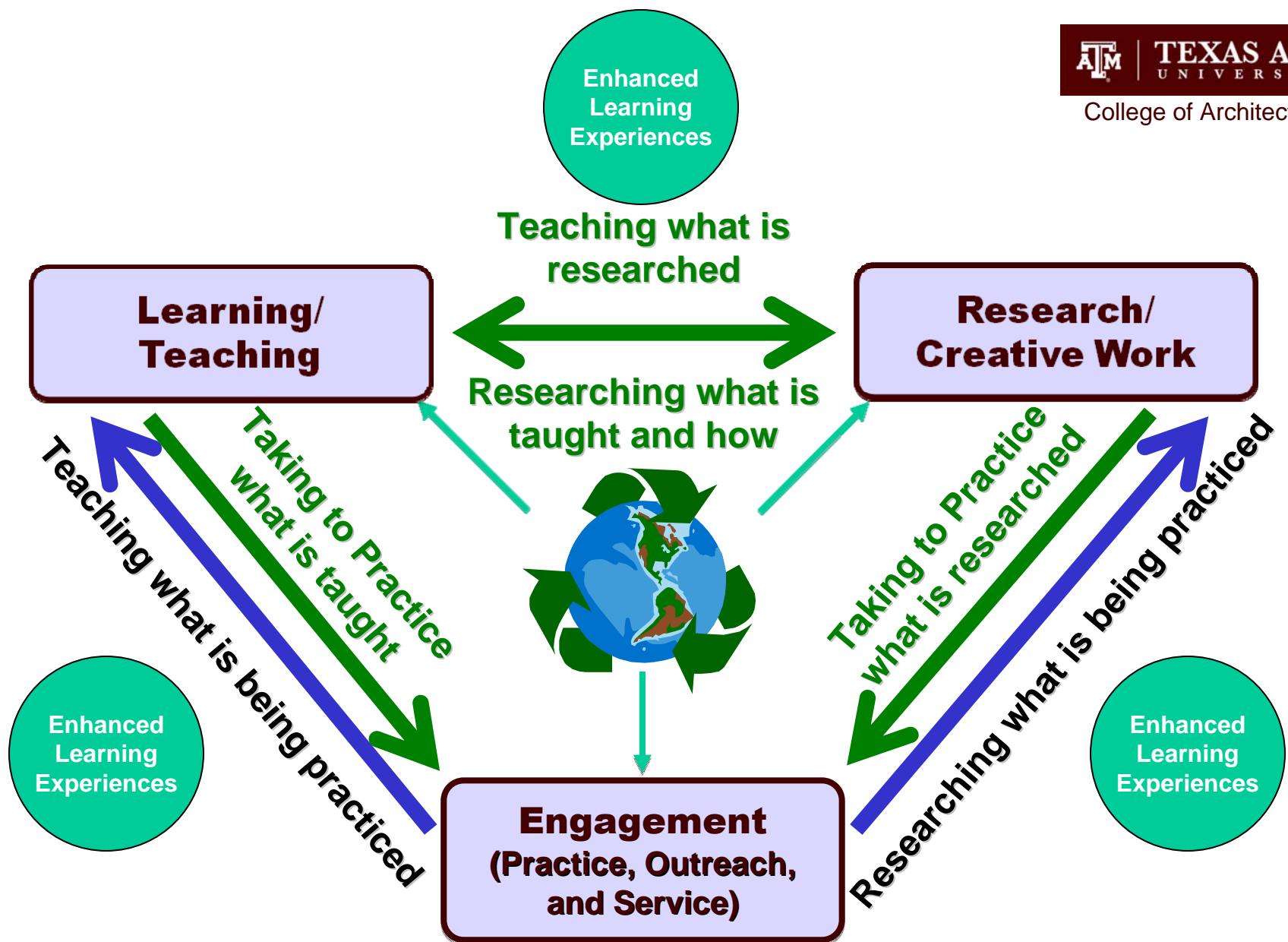
**Learning/  
Teaching**



**Research/  
Creative  
Work**

**Engagement**  
(Practice/Outreach/Service)

**Transdisciplinarity**



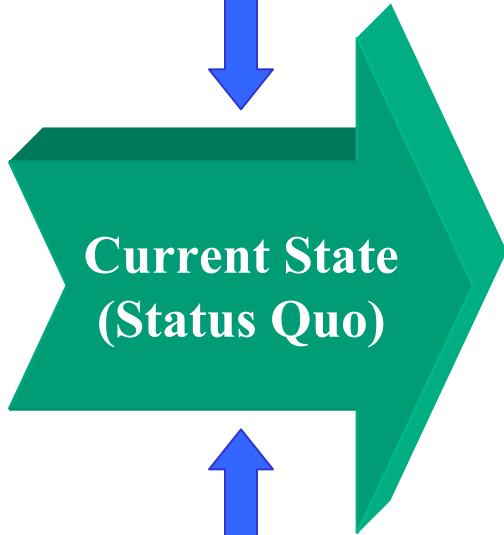
# Transdisciplinarity

Third, ***BES initiatives*** need to follow a ***paradigm of discovery and knowledge creation*** to move from the Baseline of what is, to a Vision of what can be, built upon a ***foundation of transdisciplinarity***...

# From what is...

## DRIVERS

External Context



Current State  
(Status Quo)

Internal Context



Questions,  
Problems,

Needs,

Opportunities,

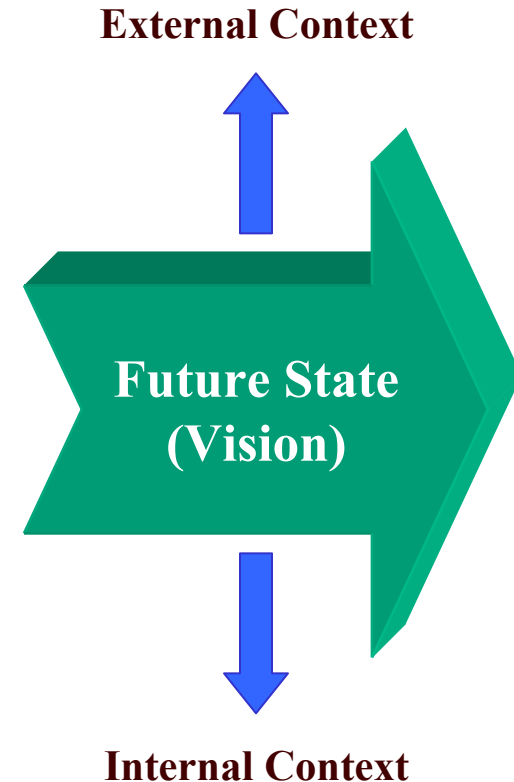
Aspirations...

# Transdisciplinarity

# To what can be...

## OUTCOMES

**Answers,  
Solutions,  
Satisfaction,  
Realization,  
Fulfillment...**

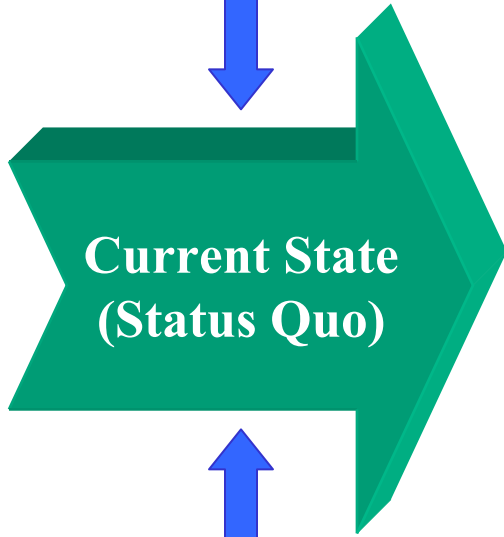


# Transdisciplinarity

# Through...

## DRIVERS

External Context



Current State  
(Status Quo)

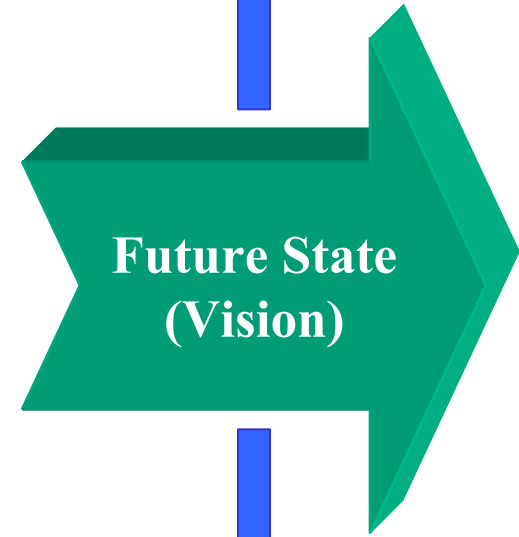


Internal Context

# RD<sup>4</sup>E

## OUTCOMES

External Context



Future State  
(Vision)

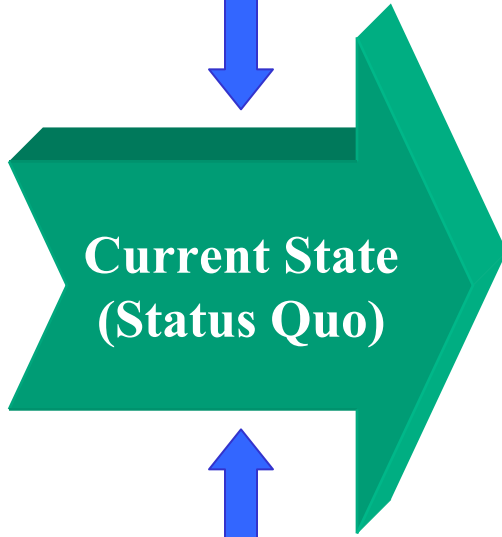


Internal Context

# Transdisciplinarity

# DRIVERS

External Context



Current State  
(Status Quo)

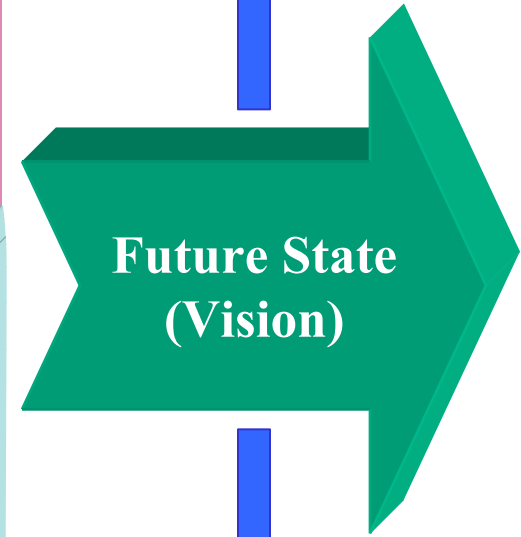


Internal Context



# OUTCOMES

External Context

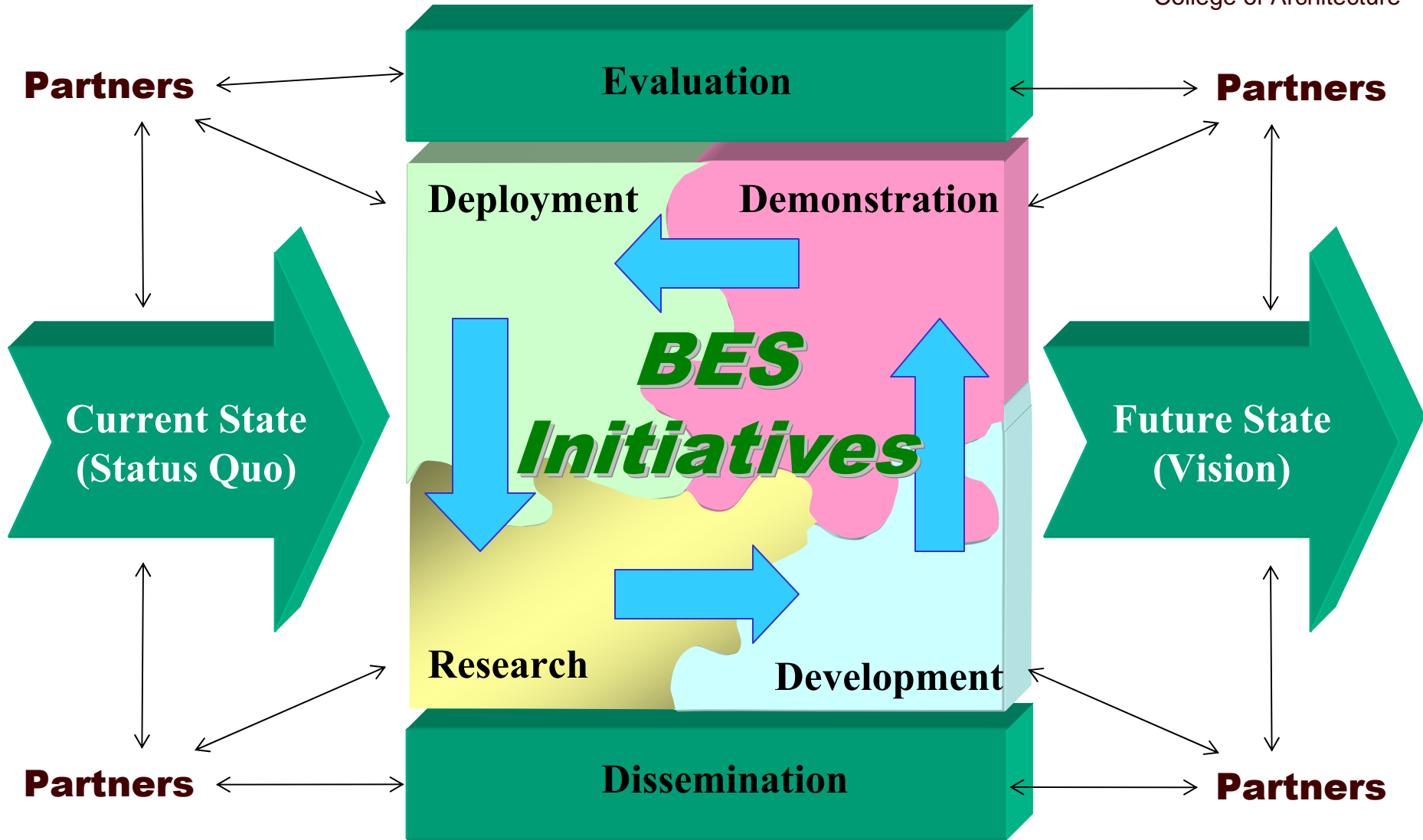


Future State  
(Vision)



Internal Context

# Transdisciplinarity

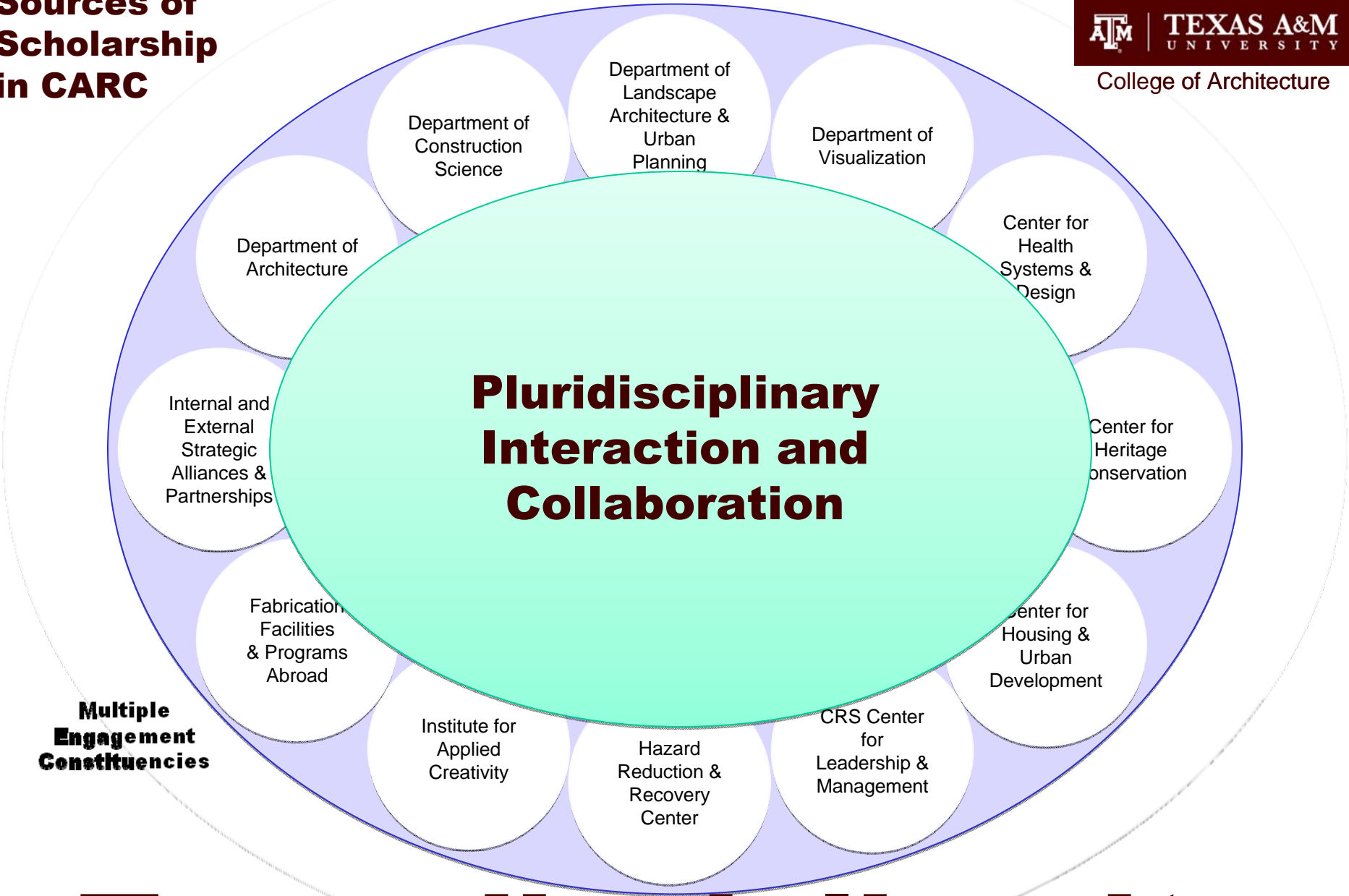


# Transdisciplinarity



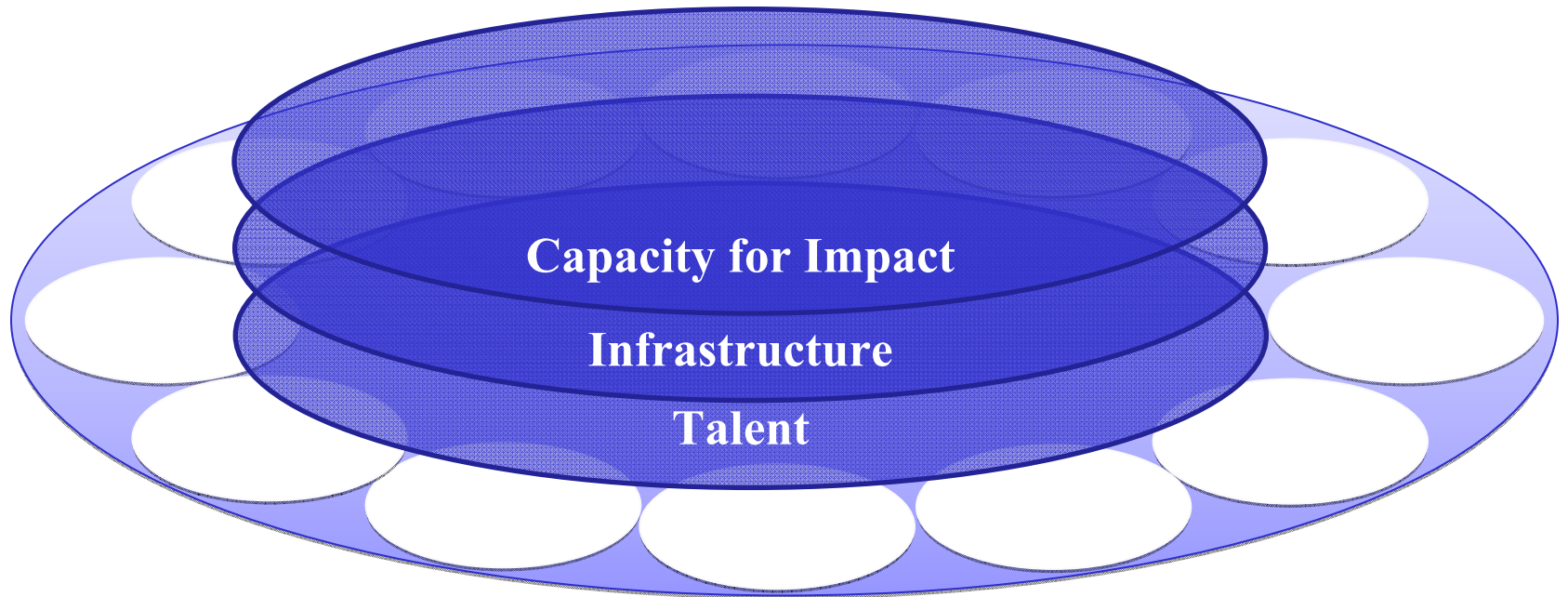
**Fourth, *BES initiatives* need to follow a *paradigm of expanded scholarship*...**

# Sources of Scholarship in CARC



**Multiple Engagement Constituencies**

# Transdisciplinarity



**Departments, Centers & Institutes, and  
Other Sources of Scholarship within the  
College (Well Rounded Foundation)**

# **Transdisciplinarity**

# Talent +

*(Development and Maintenance of Technical, Interpersonal, Communications, Leadership, Management, Thinking, Learning, and Technological Skills, Abilities, & Competencies)*

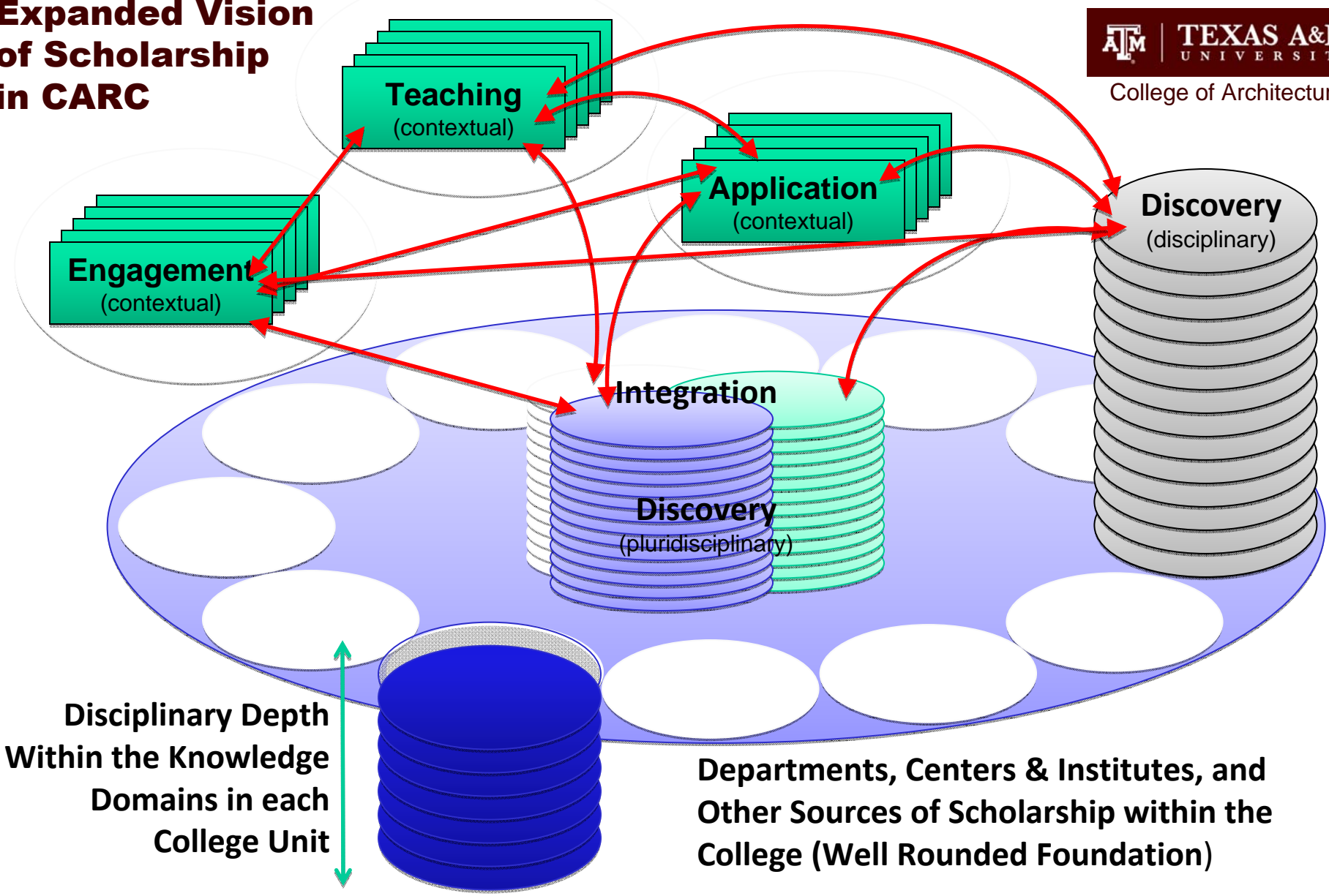
# Infrastructure =

*(Processes, Mechanisms, and Resource Base for Learning/Teaching, Research/Creative Work, Engagement, Integration, Discovery/Knowledge Creation, Pluridisciplinarity, and Expanded Scholarship)*

# Capacity for Impact

*(Individuals, Families, Communities, Organizations in the Public & Private Sectors, Society, and the World)*

# Expanded Vision of Scholarship in CARC

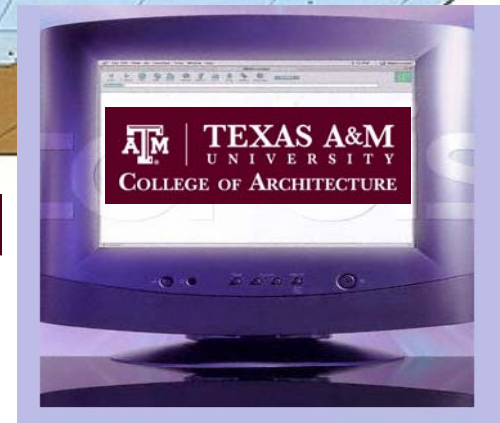


# Transdisciplinarity

# ... At a global scale...



# Through strategic alliances and partnerships... ... and...

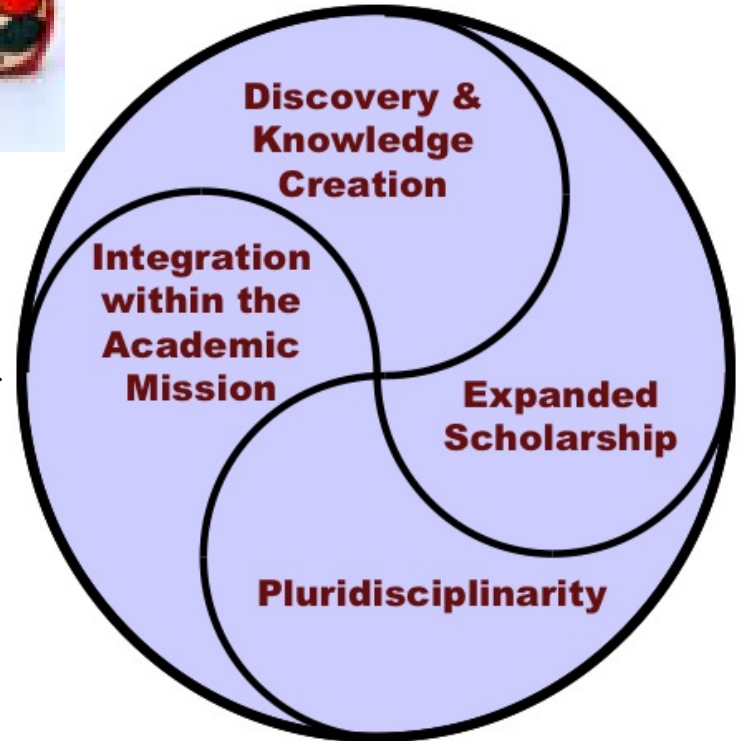
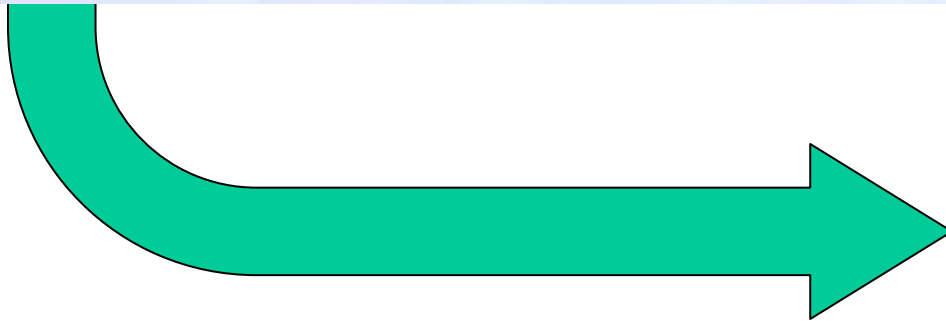
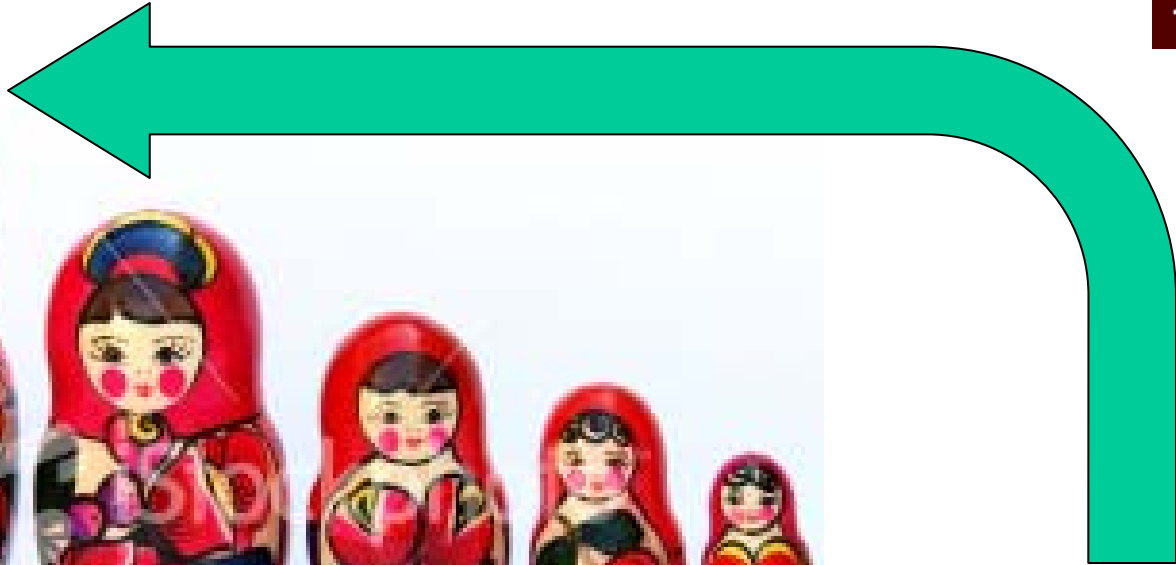


# Three Trends for **BES**:

(3) An **Evidence Based Design** approach within practice and academia

*To support the delivery of integrated solutions for **BES**, it is necessary to implement an **evidence based design** approach that will bring together practice and academia...*





# Definition

**Evidence-Based Design** is a process for the conscientious, explicit, and judicious use of current best evidence from research and practice in making critical decisions, together with an informed client, about the design of each individual and unique project.

Evidence-Based Design Is **Not A Product**;  
It Is **A Process**

# Evidence-Based Designers Must...

- Turn to new fields as sources of evidence
- Have meaningful collaboration with the client and users
- Use the best available credible evidence from A variety of sources
- Recognize and respond to the unique context of each project
- Apply critical thinking in interpreting the implications of the research on design decisions requires

# Evidence-Based Designers Must... (cont.)

- Use a chain of logic to link the research findings to the design
- Seriously consider relevant new information, once discovered
- Have a moral obligation to honor their sacred trust to protect public safety and health

# Objections to Evidence-Based Design

- Some objection by practitioners to the concept of designing with evidence might be based on fear
- **Evidence-based design** *does not mean:*
  - ... **Rigid rules and standards**
  - ... **Loss of creativity or the art of architecture**
  - ... **That architects must specialize**
  - ... **That the client will make all the decisions**

# The Case for Evidence-Based Design

- The practitioner's case for evidence-based design is **quality and competitiveness**
- The client's case for evidence-based design is **economy and improved outcomes**
- The profession's case for evidence-based design is **increased trust and credibility**

# What Do Evidence-Based Practitioners Do?

- They **answer** new questions...
- They **capture** data on completed projects...
- They **report** the findings from practice...

# Level 1 Practitioners: Critical interpretation of Research

- Stay current with literature in the field
- Follow the evolving environmental research related to the physical setting
- Interpret the meaning of the evidence as it relates to specific projects
- Make judgments about the best design for specific circumstances
- Use design concepts based on benchmark reviews of other projects
- Produce work that advances the state of the art by developing tangible examples of improved design



# Level 2 Practitioners: Hypothesis and Measurement

- Hypothesize the expected outcomes of design decisions
- Measure the results
- Employ new design methods
- Understand the research and interpret the implications
- Be able to connect the decision to a measurable outcome
- Resist the temptation to report success and downplay failure

# Level 3 Practitioners: Unbiased Reporting

- Report results publicly through writing or speaking
- Share information beyond the firm or client team
- Subject methods and results to scrutiny from others

# Level 4 Practitioners: Peer Review

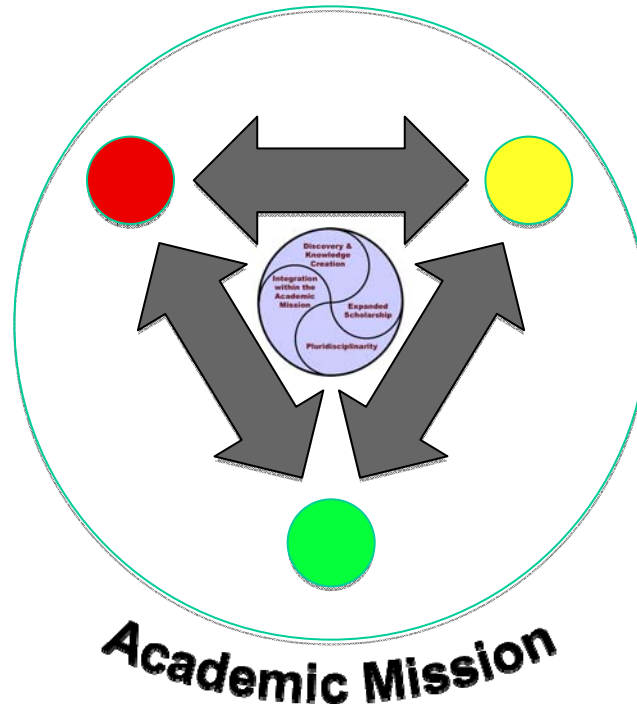
- Publish their findings in peer-reviewed journals
- Collaborate with academic social scientists
- Subject their work to the highest level of rigorous review

# An Evidence-Based Practice...




- Focuses on the Project on the Desk
- Invests in Building a Broad Database
- Follows a:
  - ... **Niche-Focused Expertise** Model
  - ... **Diversified Generalist** Model
  - ... **Client-Driven Response** Model
  - ... **Promotional Market-Driven** Model
  - ... **New Line of Business Strategic** Model

**In closing, a general  
framework for BES**

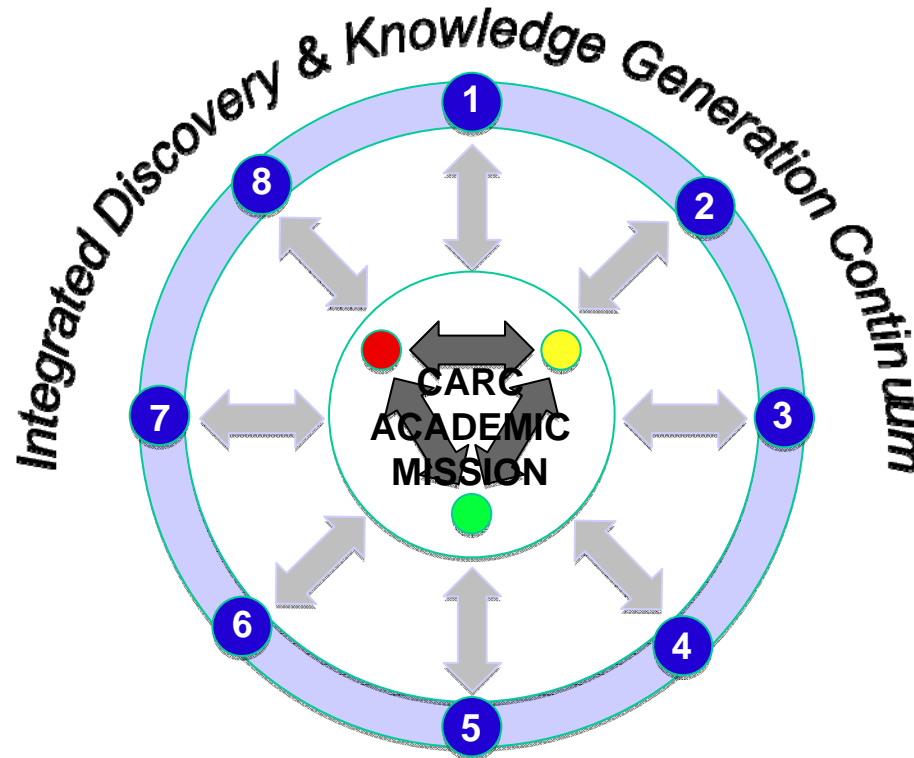
# It begins with...



## CARC Academic Mission:

-  Learning/Teaching
-  Research & Creative Work
-  Engagement (Practice, Outreach, & Service)

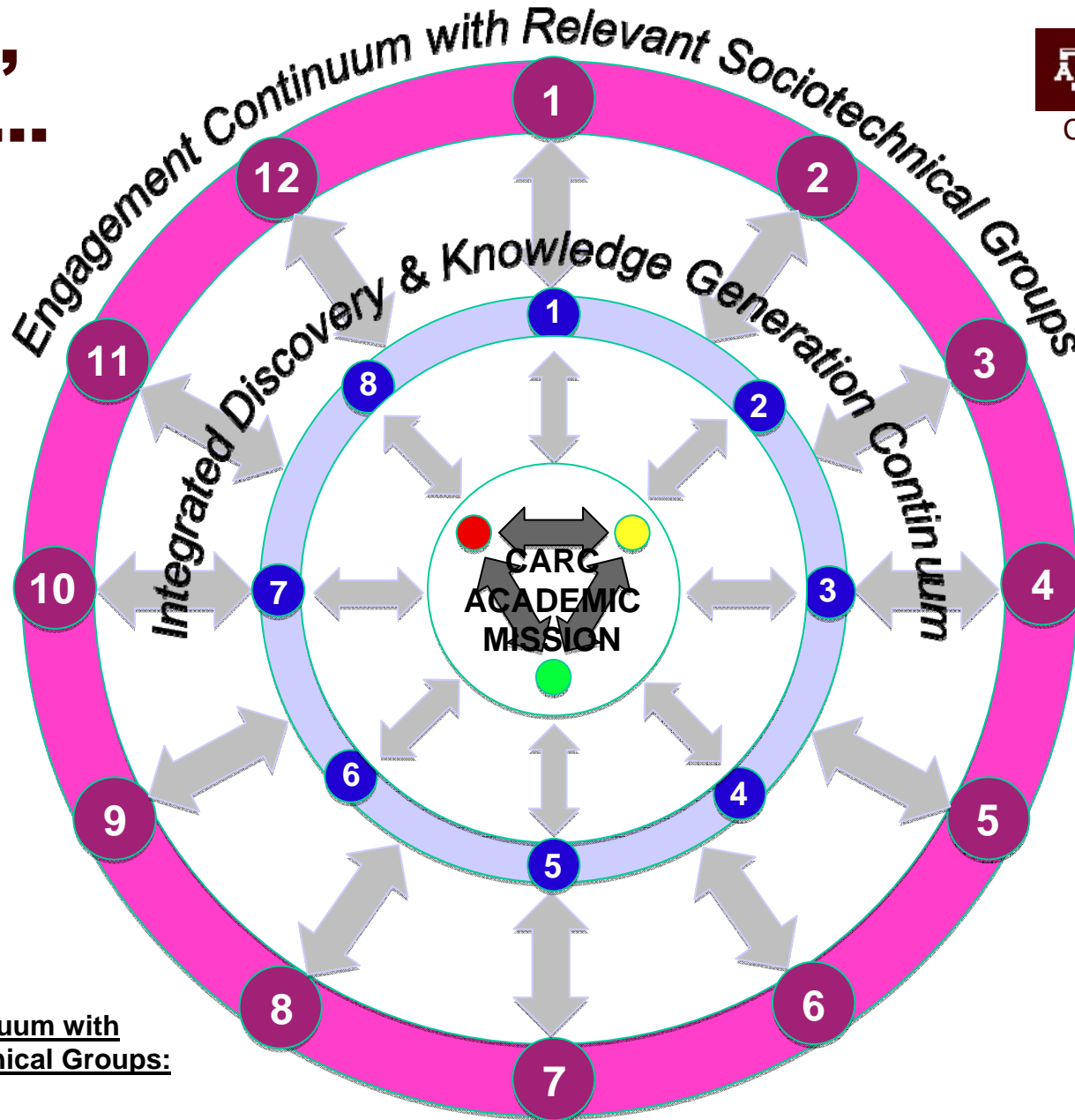
# Embedded within...



## Integrated Discovery & Knowledge Generation Continuum:

- (1) Benchmarks & Baselines; (2) Visions & Desired Outcomes; (3) Research; (4) Development; (5) Demonstration; (6) Deployment; (7) Dissemination; and (8) Evaluation...

# In turn, within...



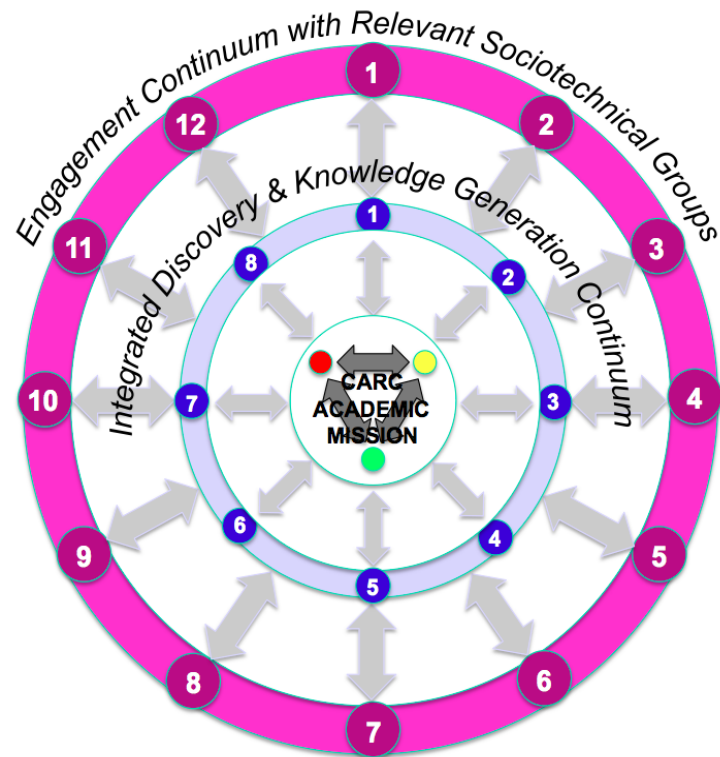
**Engagement Continuum with Relevant Sociotechnical Groups:**



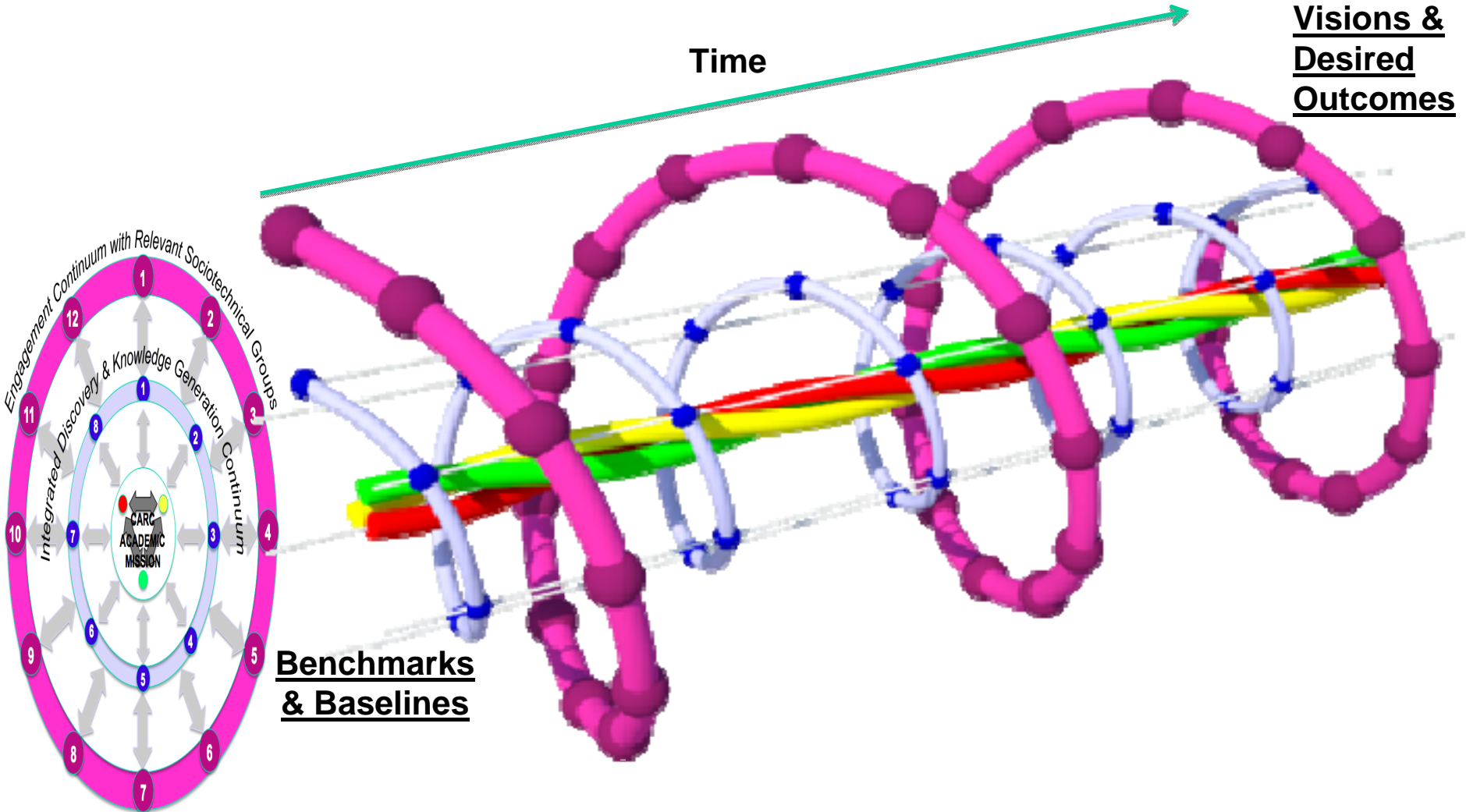
- (1) Building science investigators; (2) Social science investigators; (3) Land & real estate development specialists; (4) Planning & AE design specialists; (5) General contractors & specialty subcontractors specialists; (6) Facility managers specialists; (7) Communities of Interest; (8) Policy/Code-makers; (9) Utilities/Service providers; (10) Building equipment, products, and materials manufacturers; (11) Financial institutions; and (12) Educational institutions...



# Creating over time...

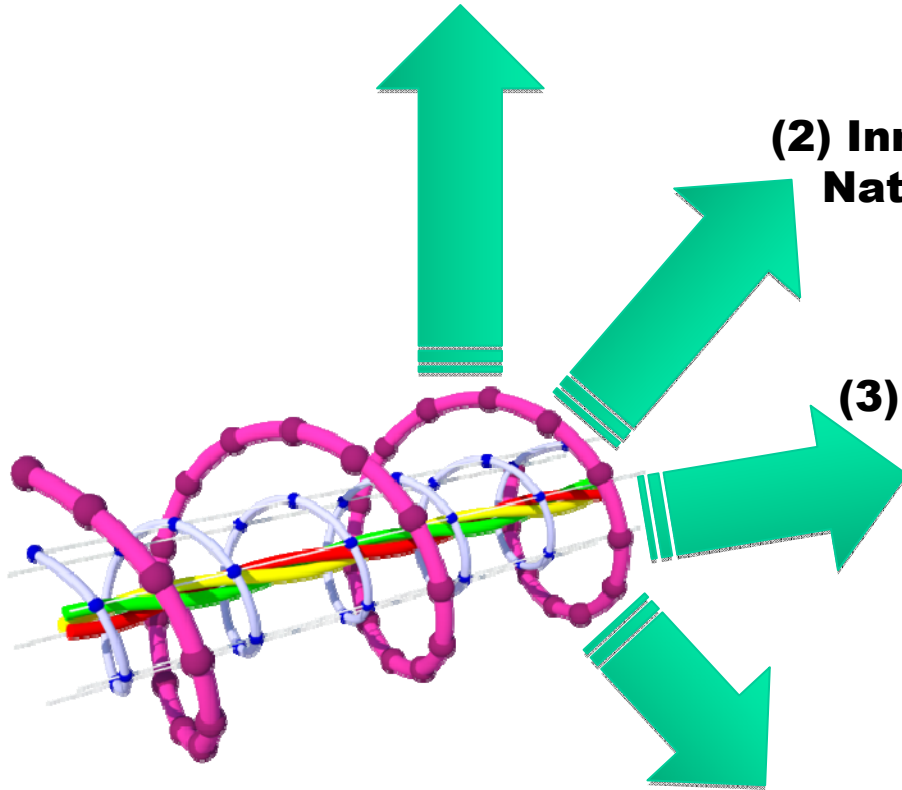


# Creating over time...



# Leading to...

**(1) Innovative Sustainable Products for the Natural, Built, and Virtual Environments**



**(2) Innovative Sustainable Processes for the Natural, Built, and Virtual Environments**

**(3) Innovative Sustainable Business Models for the Delivery of Innovative Products and Processes for the Natural, Built, and Virtual Environments**

**(4) Innovative Barrier Breakers, Obstacle Removers, and Enablers for the Implementation of Innovative Sustainable Products, Processes, and Business Models for the Natural, Built, and Virtual Environments**

**... To provide a higher quality of life for people (individuals, families, & communities), and a higher quality of place (natural, built, & virtual), where they live, work, learn, heal, play, interact, and more...**

**Thank you...**

**Kia Ora**

---

**Dr. Jorge A. Vanegas**  
**Dean,**

**Sandy and Bryan Mitchell Master Builder Endowed Chair,  
Director, Center for Housing and Urban Development (CHUD), and  
Professor, Department of Architecture  
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