Engineering Institute of Technology.

Phase 2: Research Practice (Designing and Executing Research): DEng Program: **Research Integrity, Safety, and Ethics in Engineering**

4 June 2026

Presenter: Emeritus Professor Akhtar Kalam

EIT EMERITUS PROFESSOR

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Introduction – Presenter

Emeritus Professor Akhtar Kalam

Emeritus Professor at Victoria University and EIT.
Academic Director and Chair of the Academic Board - Texila College Australia.
Director of Al-Kalam Educational Solutions.
Editor-in-Chief of AJEEE
Distinguished Professor/Adjunct Faculty in Australia, India, Malaysia and Oman.
He has published over 610 publications in his area of expertise and has written over 29 books.
Supervised 51 postgraduate research students to graduation, including 39 PhD's and 12 MEngs. Currently, 10 postgraduate research students (four PhD students at VU and six DEng students at EIT) are being supervised.
Public, University, and Motivational Lecturer.
Consultant for the electricity supply industries in Australia and overseas.
Assisted in change management plans for Universities and the higher education sector.

Education

The University of Bath, Bath, UK, D.Eng., Electrical Engineering
The University of Oklahoma, Norman, USA, MS, Electrical Engineering
Aligarh Muslim University, Aligarh, India, BSc. Eng., Electrical Engineering
St Xavier's College, Calcutta, India, Applied Science

Professional Society Activities

Australian Institute of Energy – Fellow
Engineers Australia – Fellow
The Institution of Engineers and Technology, UK – Fellow.
The Institution of Electrical and Electronic Engineers, USA –Life Senior Member.

"My vision is to provide exciting higher education science and engineering courses, research, consultancy and collaborate in development work of the industry and communities within Australia and beyond."

Agenda

1.	Session Objectives
2.	DEng Research Lifecycle
3.	Research Integrity Framework
4.	Human Research Ethics
5.	Engineering Safety
6.	Research Data Management
7.	Engineering Ethics Case Study
8.	Key Takeaways

Session Objectives

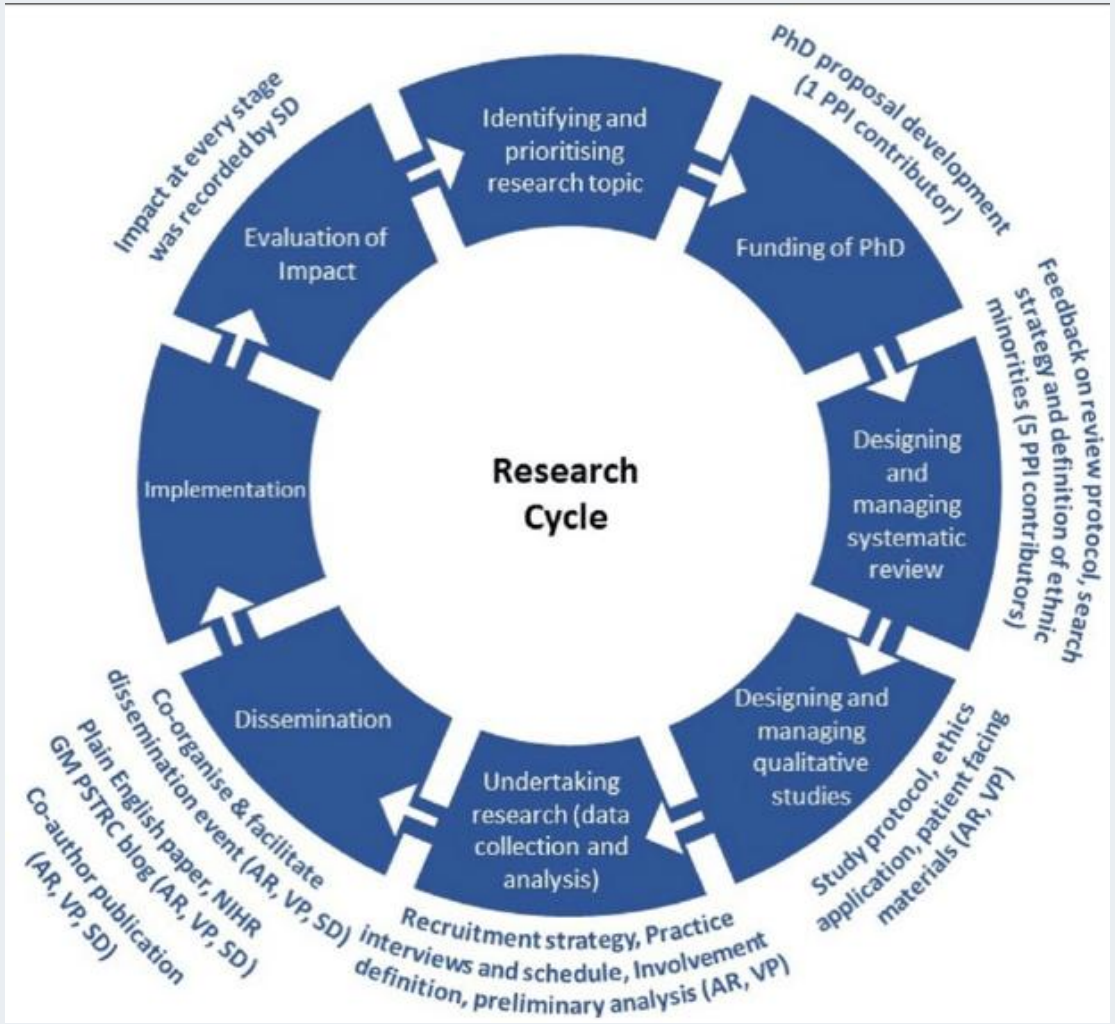
- Understand research integrity principles
- Examine ethics in engineering research
- Explore safety responsibilities

Why Research Integrity Matters?

- Trust in science
- Public accountability
- Research reputation

DEng Research Lifecycle

- Idea generation
- Proposal
- Ethics approval
- Data collection
- Analysis



What is Responsible Research?

- Honesty
- Transparency
- Accountability

Engineering Research Risks

- Human risks
- Environmental risks
- Technical risks

RISK MATRIX

RISK RATING KEY	LOW	MEDIUM	HIGH	EXTREME
	0 - ACCEPTABLE OK TO PROCEED	1 - ALARP as low as reasonably practicable TAKE MITIGATION EFFORTS	2- GENERALLY UNACCEPTABLE SEEK SUPPORT	3- INTOLERABLE PLACE EVENT ON HOLD

LIKELIHOOD ↓ / SEVERITY →	ACCEPTABLE LITTLE TO NO EFFECT ON EVENT	TOLERABLE EFFECTS ARE FELT, BUT NOT CRITICAL TO OUTCOME	UNDESIRABLE SERIOUS IMPACT TO THE COURSE OF ACTION AND OUTCOME	INTOLERABLE COULD RESULT IN DISASTER
IMPROBABLE RISK IS UNLIKELY TO OCCUR	LOW - 1 -	MEDIUM -4 -	MEDIUM - 6 -	HIGH - 10 -
POSSIBLE RISK WILL LIKELY OCCUR	LOW - 2 -	MEDIUM -5 -	HIGH - 8 -	EXTREME - 11 -
PROBABLE RISK WILL OCCUR	MEDIUM - 3 -	HIGH -7 -	HIGH - 9 -	EXTREME - 12 -

Australian Research Context

- National standards
- University policy

Research Integrity Framework

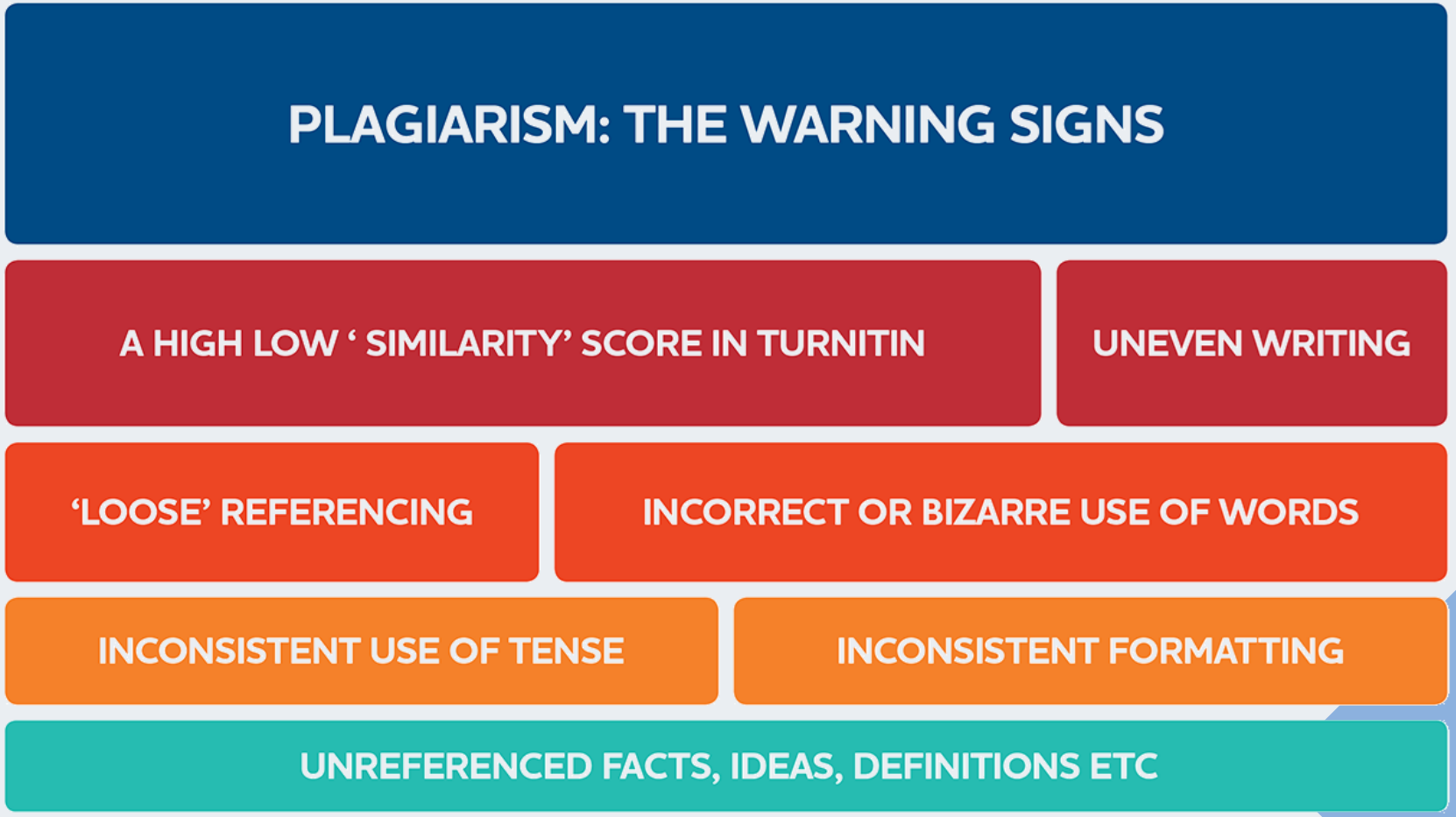
- Ethics
- Transparency
- Reproducibility

Principles of Research Integrity

- Honesty
- Fairness
- Respect

Research Misconduct Overview

- Fabrication
- Falsification

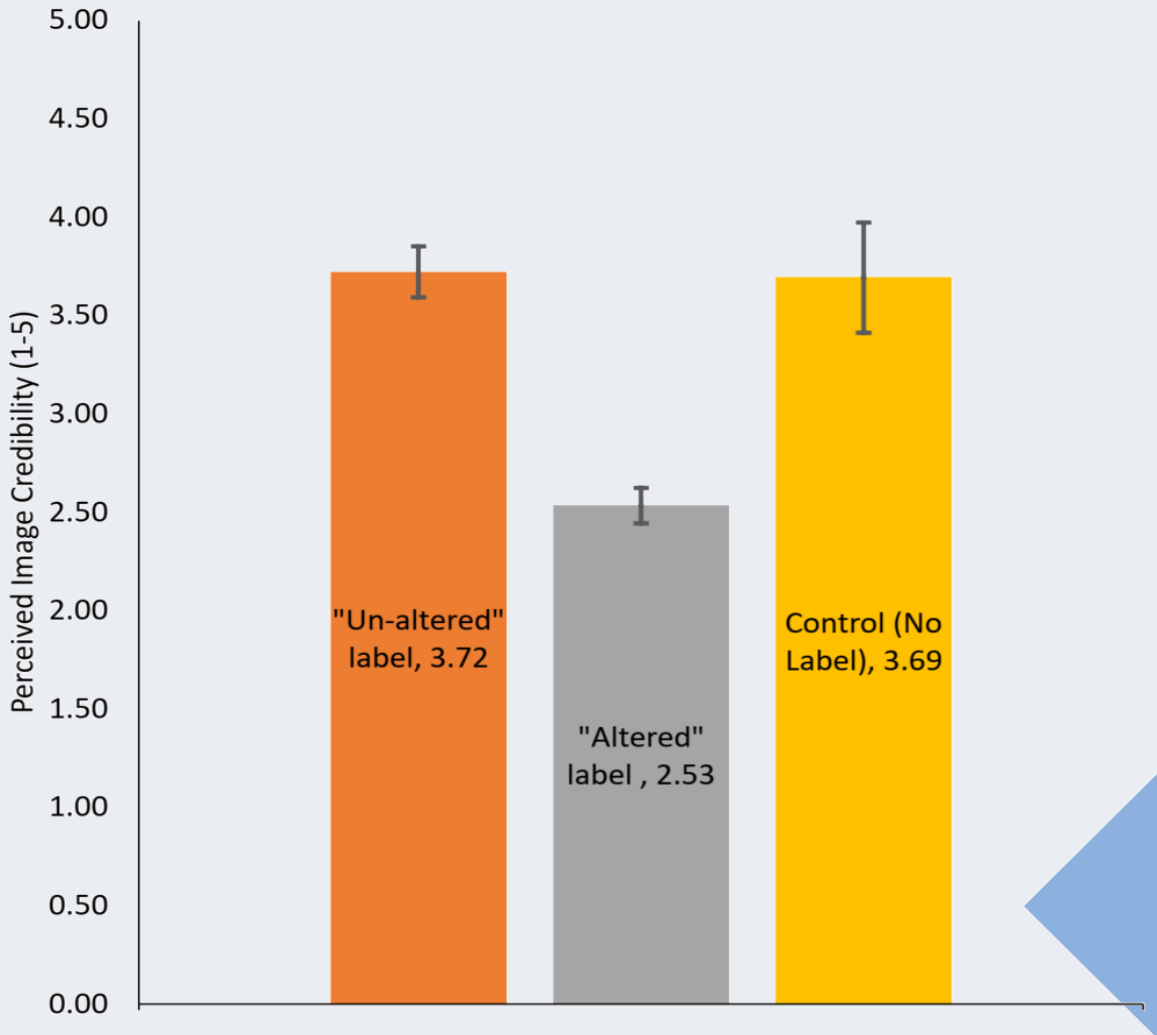


Fabrication

- Inventing results

Falsification

- Manipulating results



Plagiarism

- Text plagiarism
- Idea plagiarism

Questionable Research Practices

- Selective reporting
- Cherry picking

Duplicate Publications & Salami Slicing

Authorship Ethics

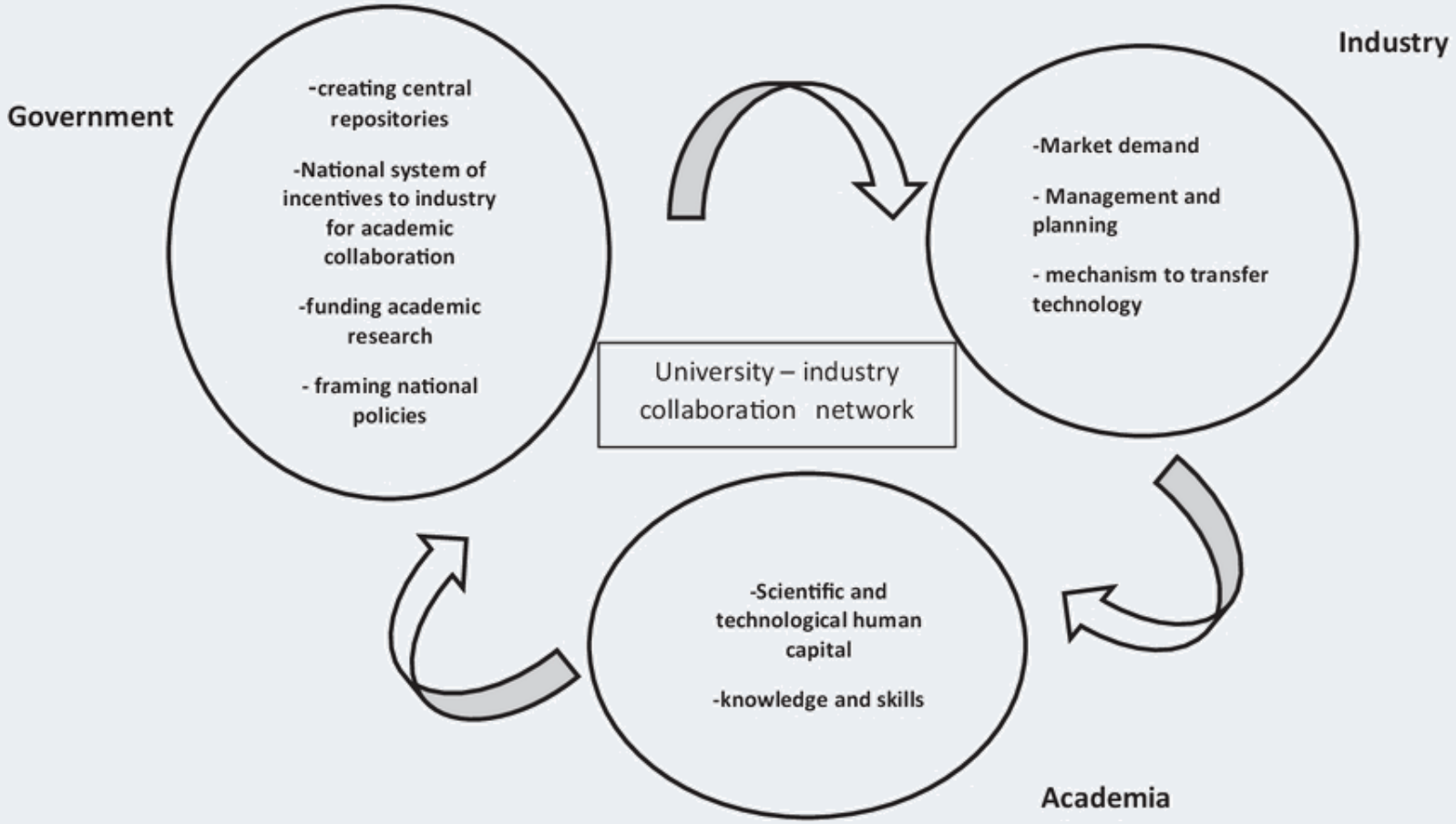
- Contribution criteria
- Order disputes

Collaborative Research

- Multi-disciplinary research teams
- Communication responsibilities
- Shared data ownership

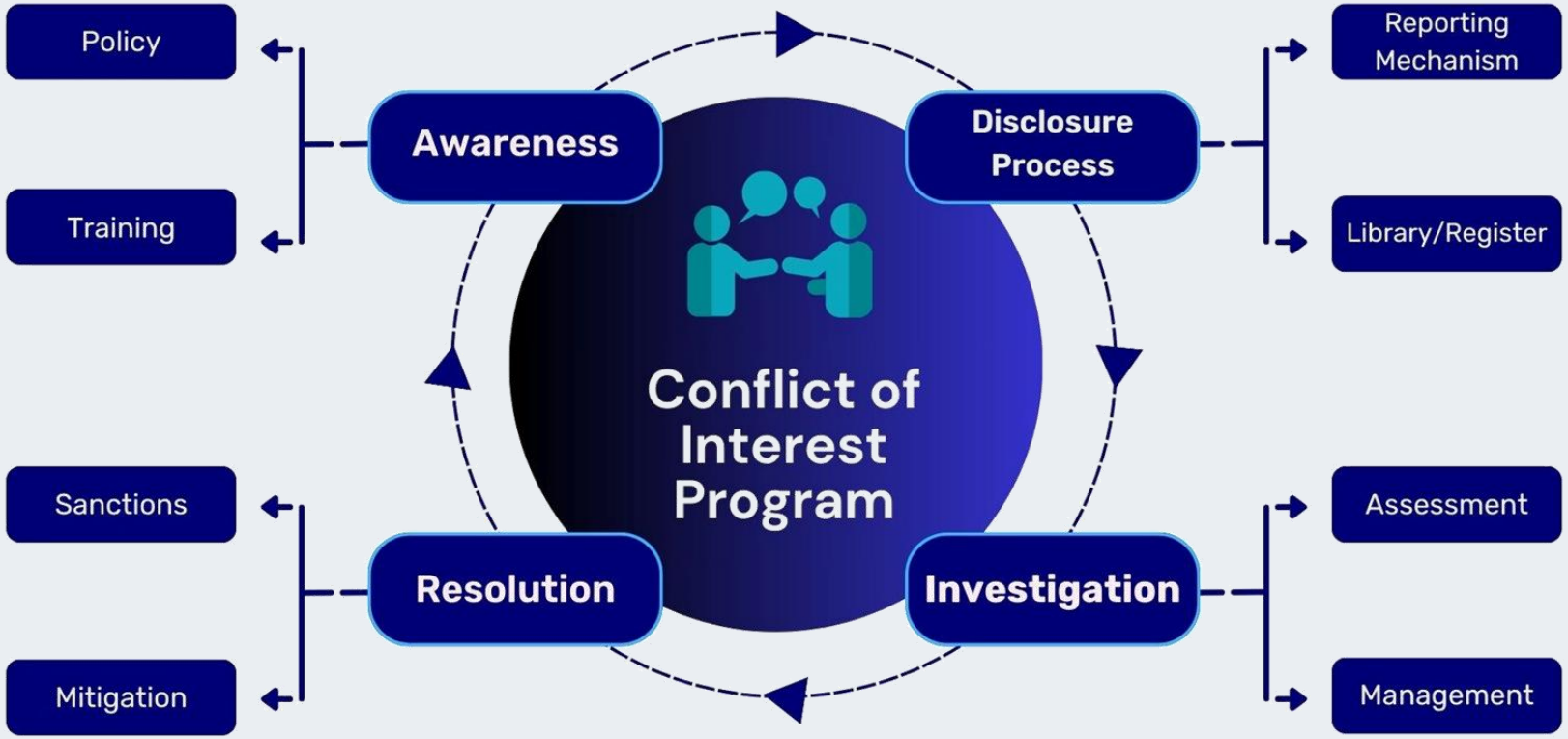
Industry Partnerships

- Sponsored research
- Confidentiality agreements
- Publication limitations



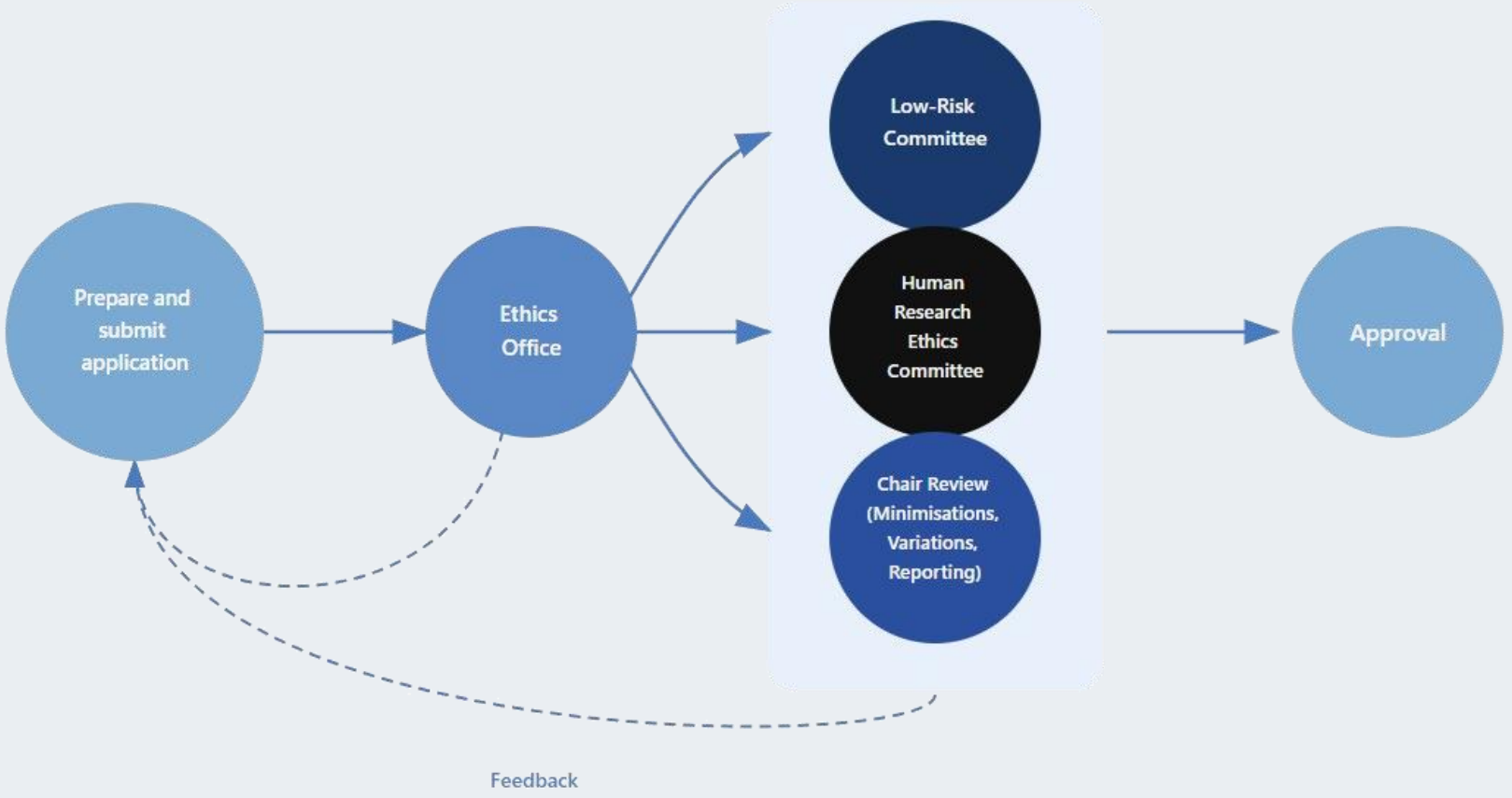
Conflict of Interest

- Financial conflicts
- Personal conflicts
- Professional conflicts



Human Research Ethics

- Human participants approval
- Risk minimisation
- Respect and dignity

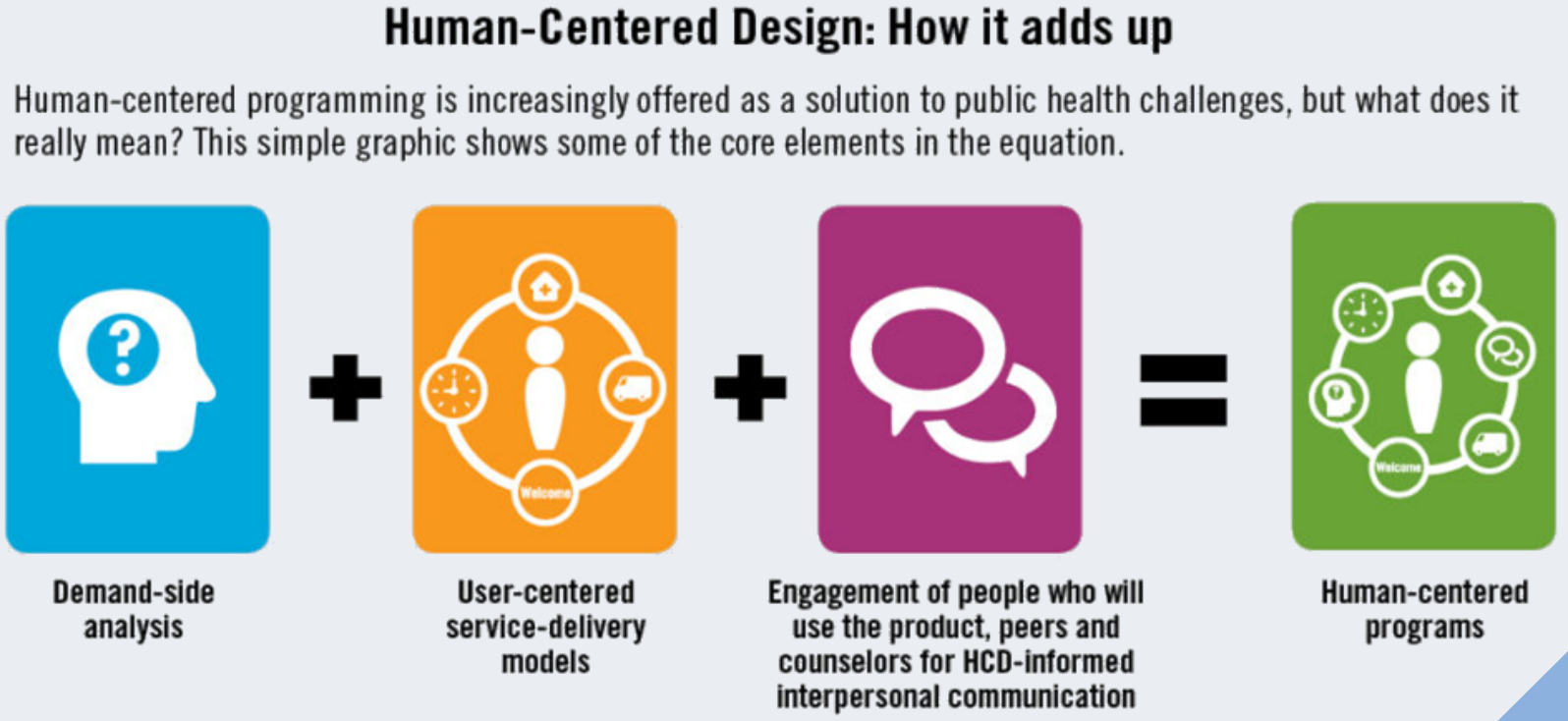


Informed Consent

- Voluntary participation
- Risks explained
- Withdrawal rights

Vulnerable Participants

- Children
- Elderly participants
- Cognitive impairment



Privacy & Data Protection

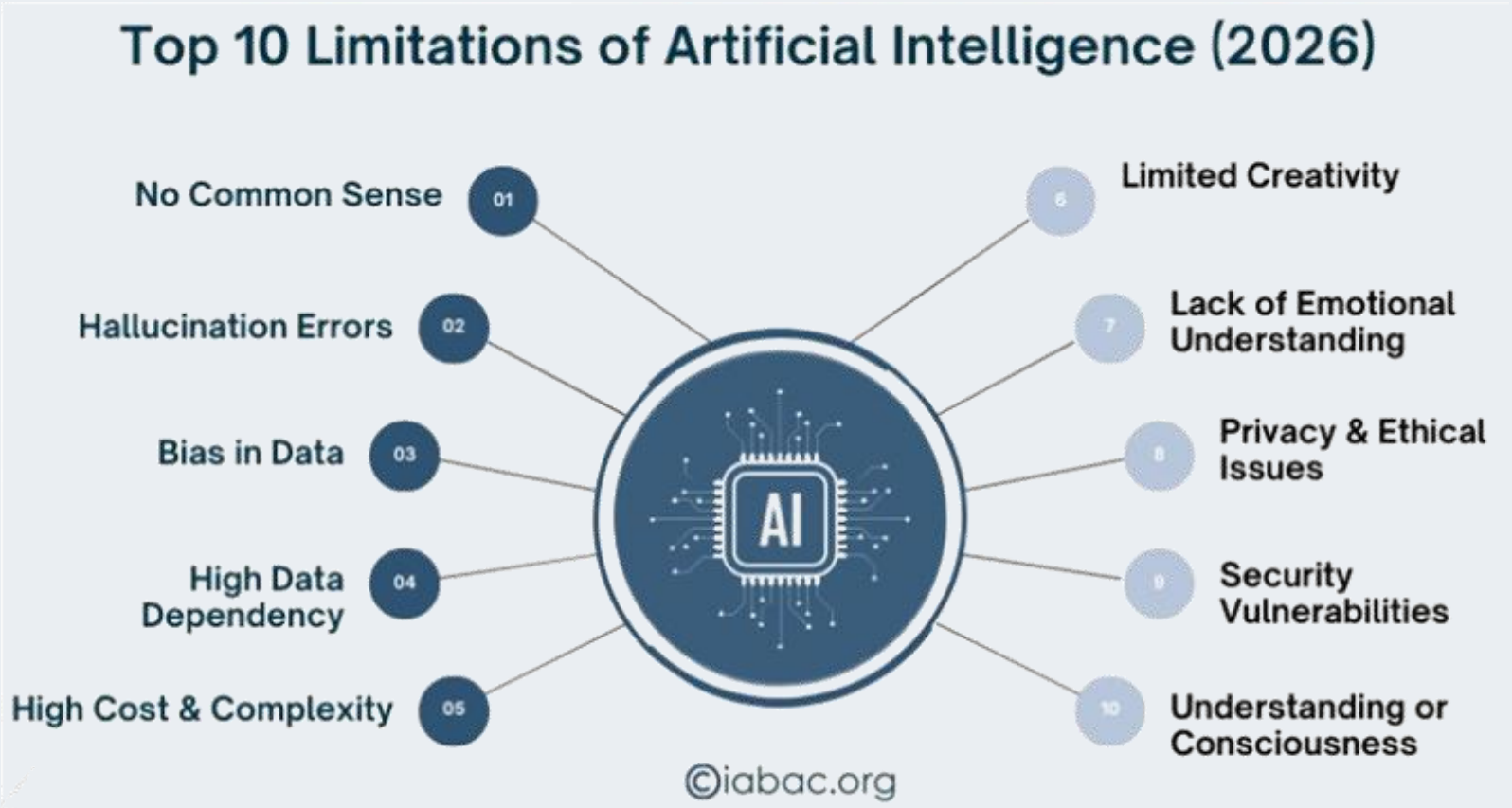
- Personal data protection
- Confidentiality
- De-identification

Data Security

- Encryption
- Access control
- Backup procedures

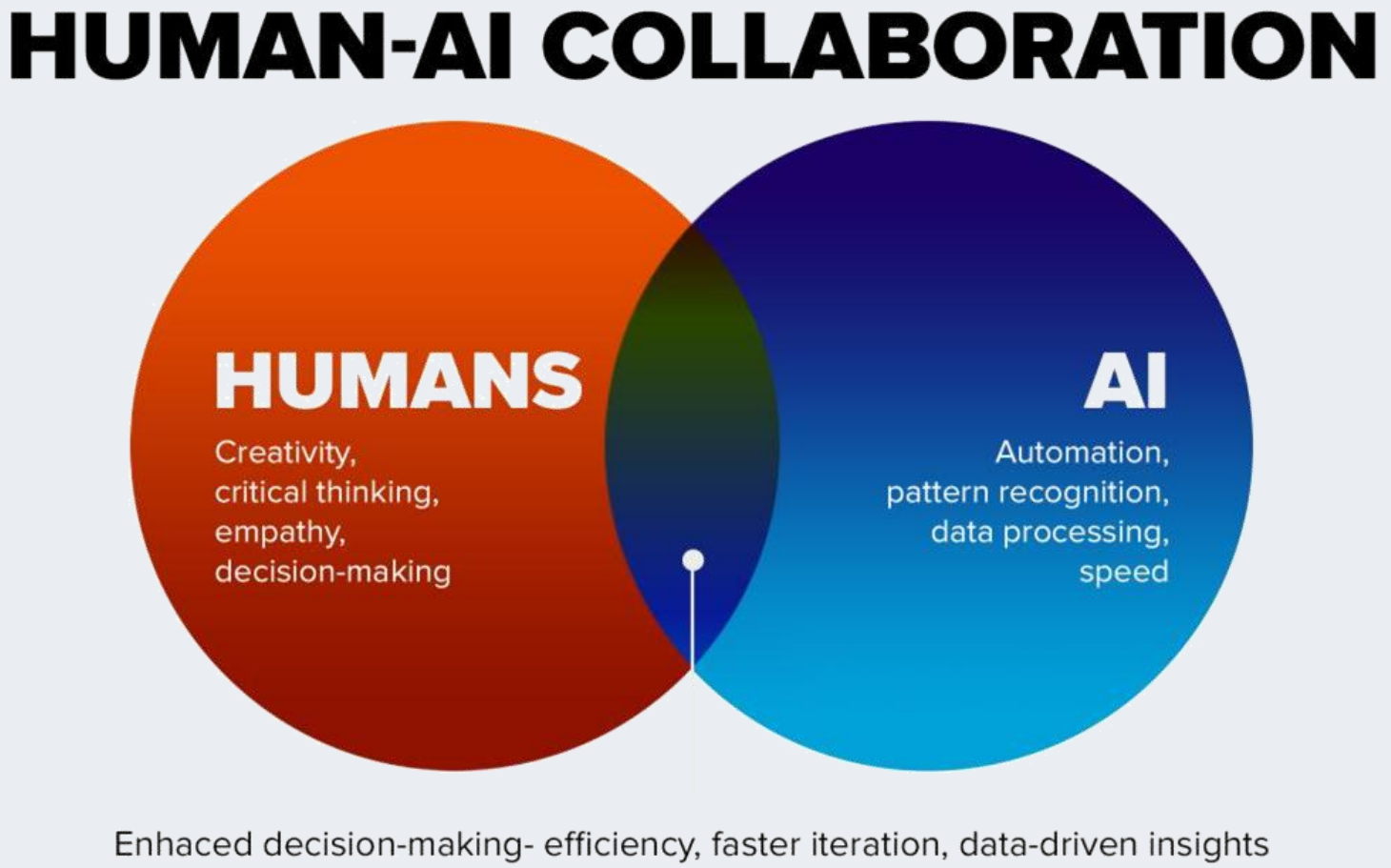
AI in Engineering Research

- AI-assisted design
- AI in experimentation
- Predictive systems



Responsible AI Use

- Bias management
- Transparency
- Human oversight



Generative AI Ethics

- Authorship concerns
- Disclosure requirements
- Hallucination risks

Laboratory Safety Culture

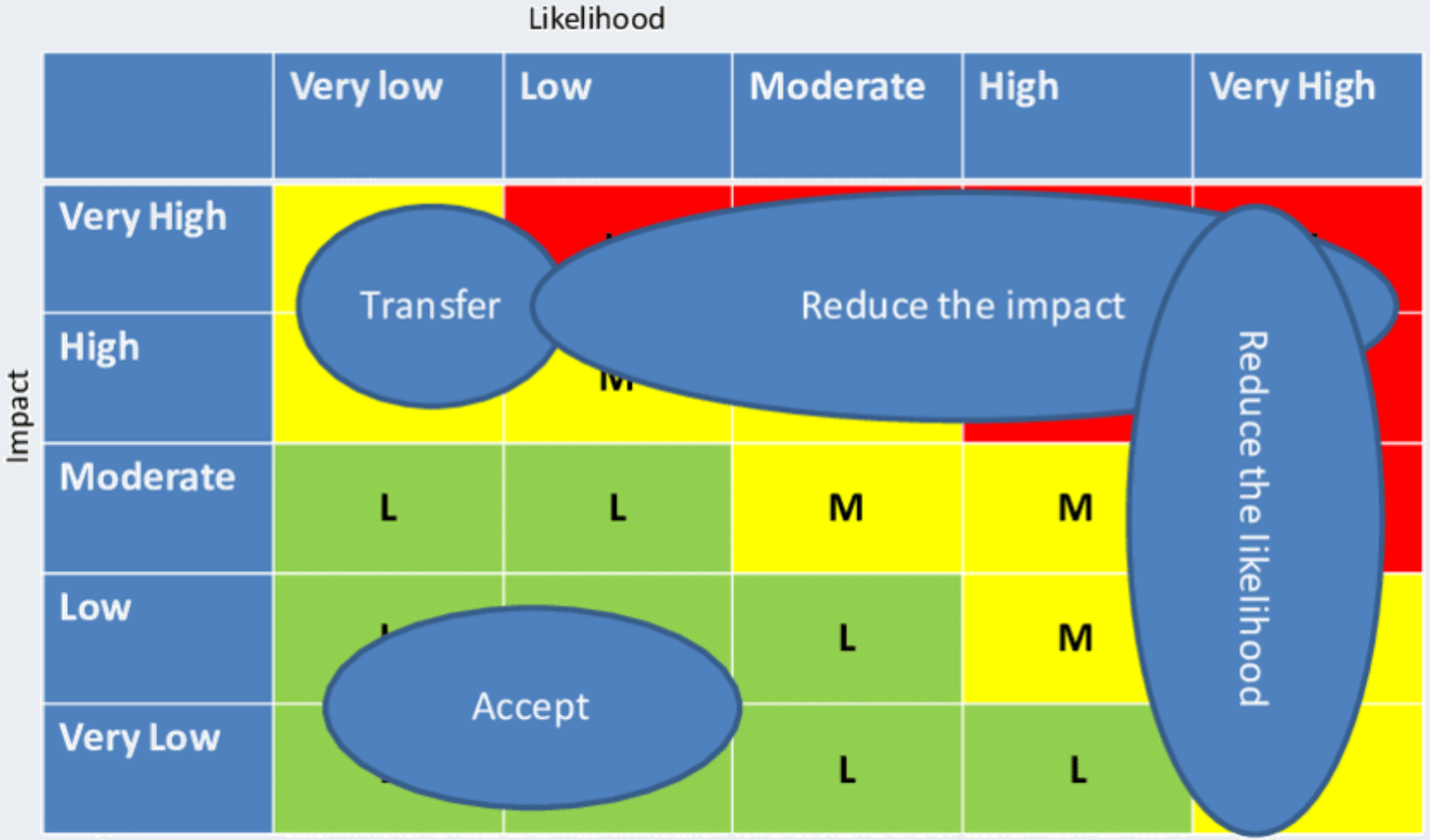
- Shared responsibility
- PPE
- Safety training

Engineering Safety

- **Electrical Engineering Safety**
  - Residual Current Devices (RCDs / GFCIs):
  - Interlocking Enclosures
  - Arc Flash Mitigation
- **Mechanical Engineering Safety**
  - Overload Clutches
  - Anti-Two-Block Devices
  - Interlocked Physical Guards
- **Civil and Structural Engineering Safety**
  - Tuned Mass Dampers
  - Base Isolation Systems
  - Breakaway Signposts
- **Software and Control Systems Safety**
  - Watchdog Timers:
  - Fly-By-Wire Flight Envelope Protection:
  - Burner Management Systems (BMS)

Risk Assessment Methods

- Likelihood
- Consequence
- Risk matrix

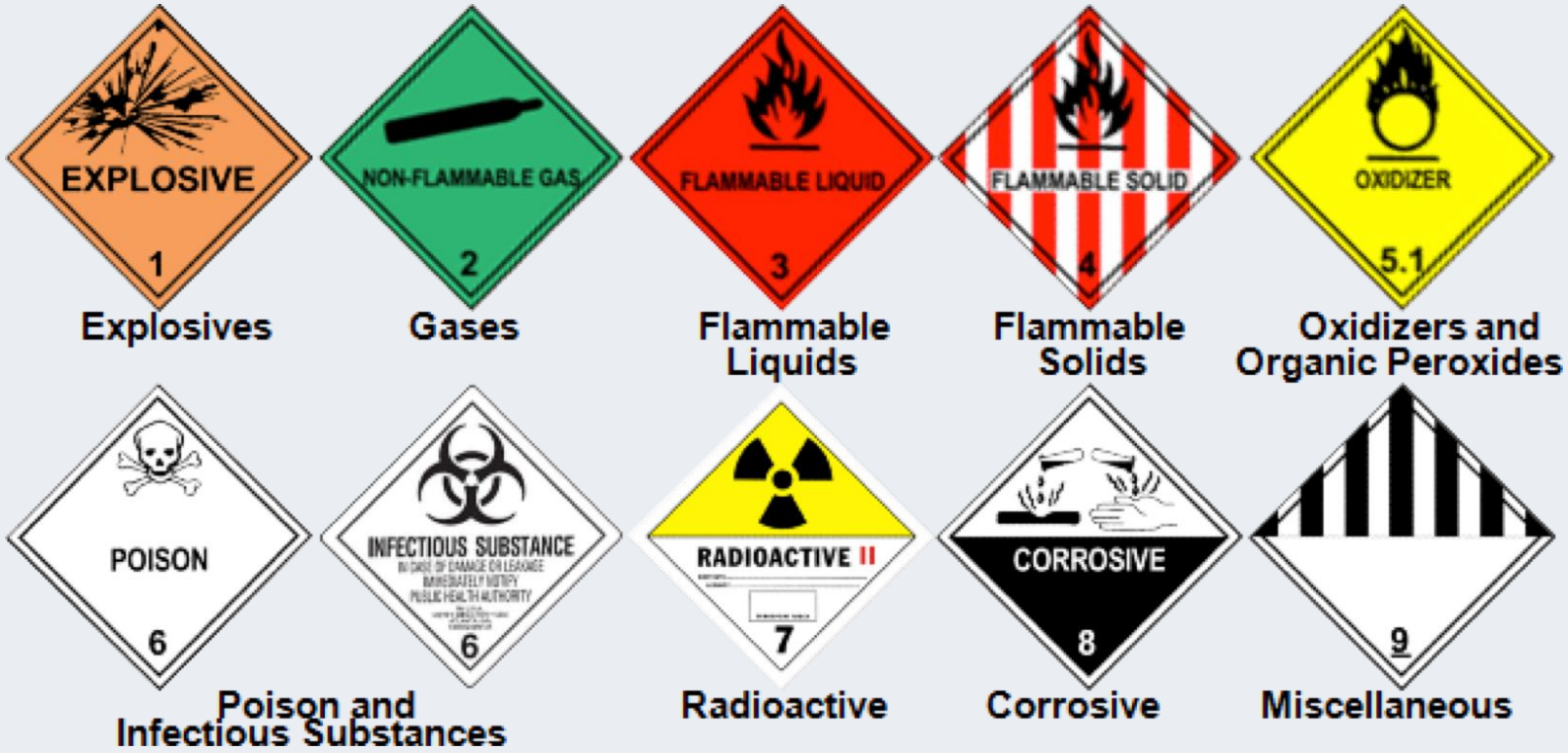


Electrical Safety

- Lockout-tagout
- Grounding
- Isolation procedures

Chemical Safety

- Safety data sheets
- Labelling
- Storage

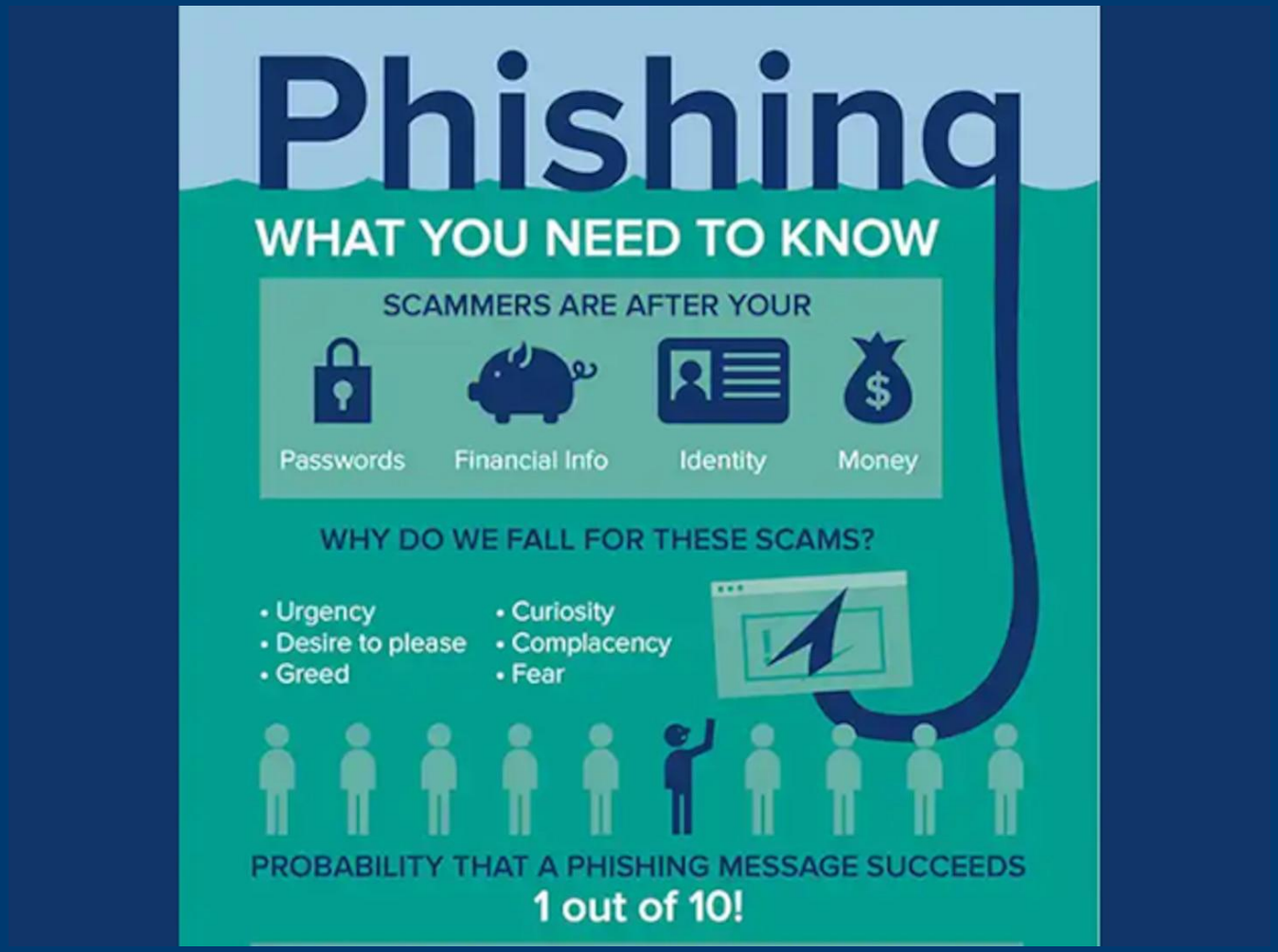


Fieldwork Safety

- Travel risks
- Environmental conditions
- Emergency communication

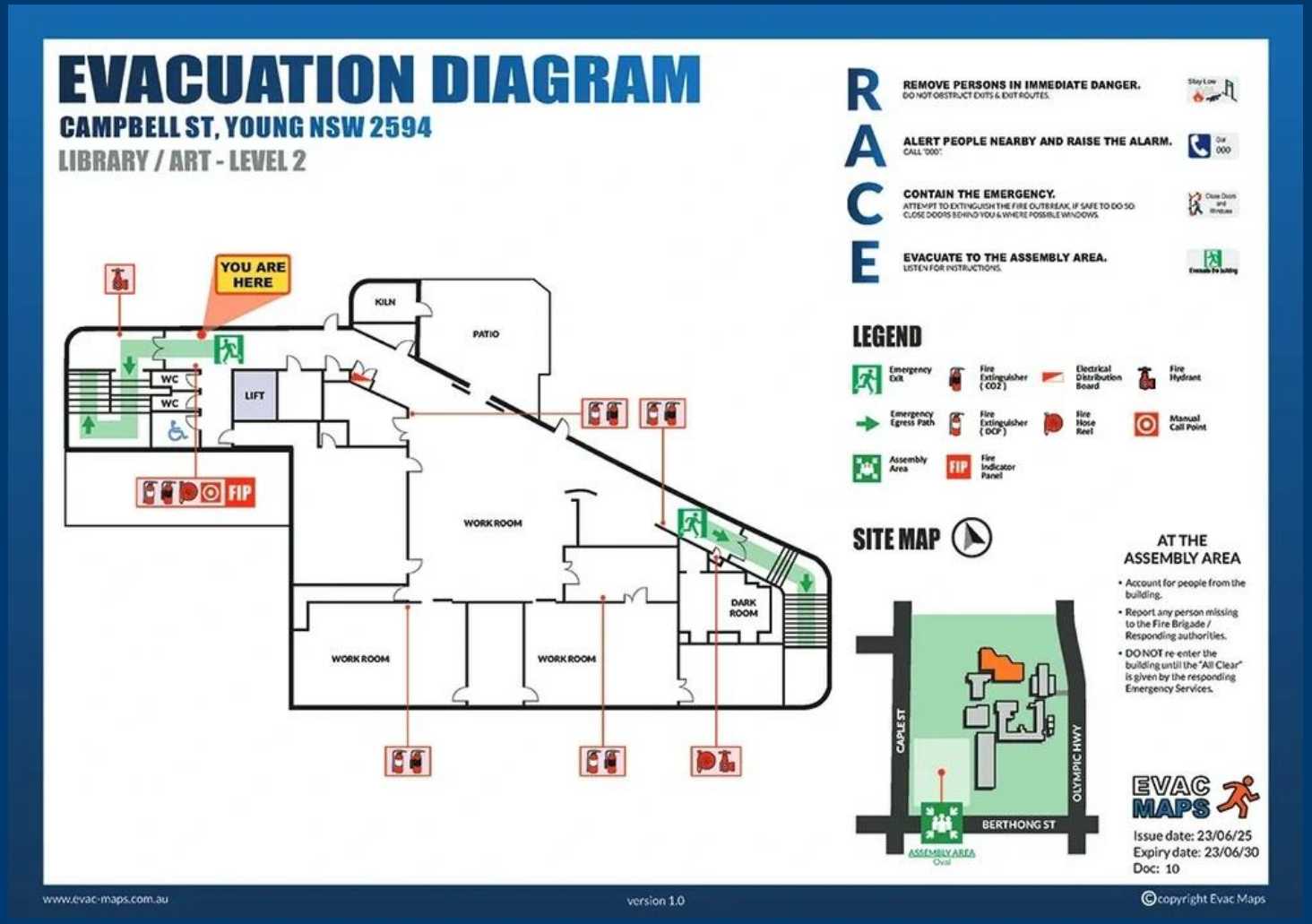
Cybersecurity Safety

- Research data attacks
- Password hygiene
- Secure systems



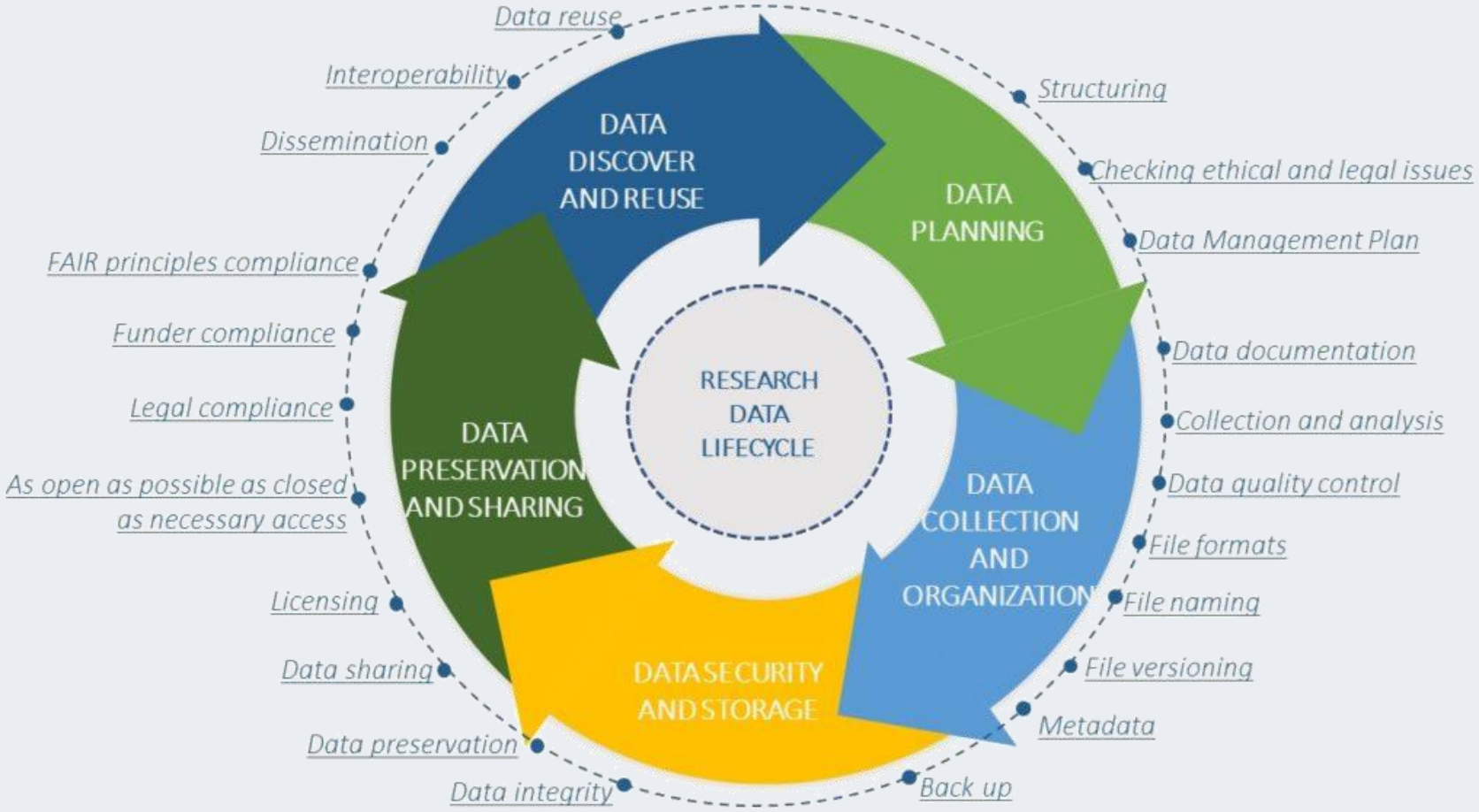
Emergency Preparedness

- Emergency plans
- Incident reporting
- Evacuation



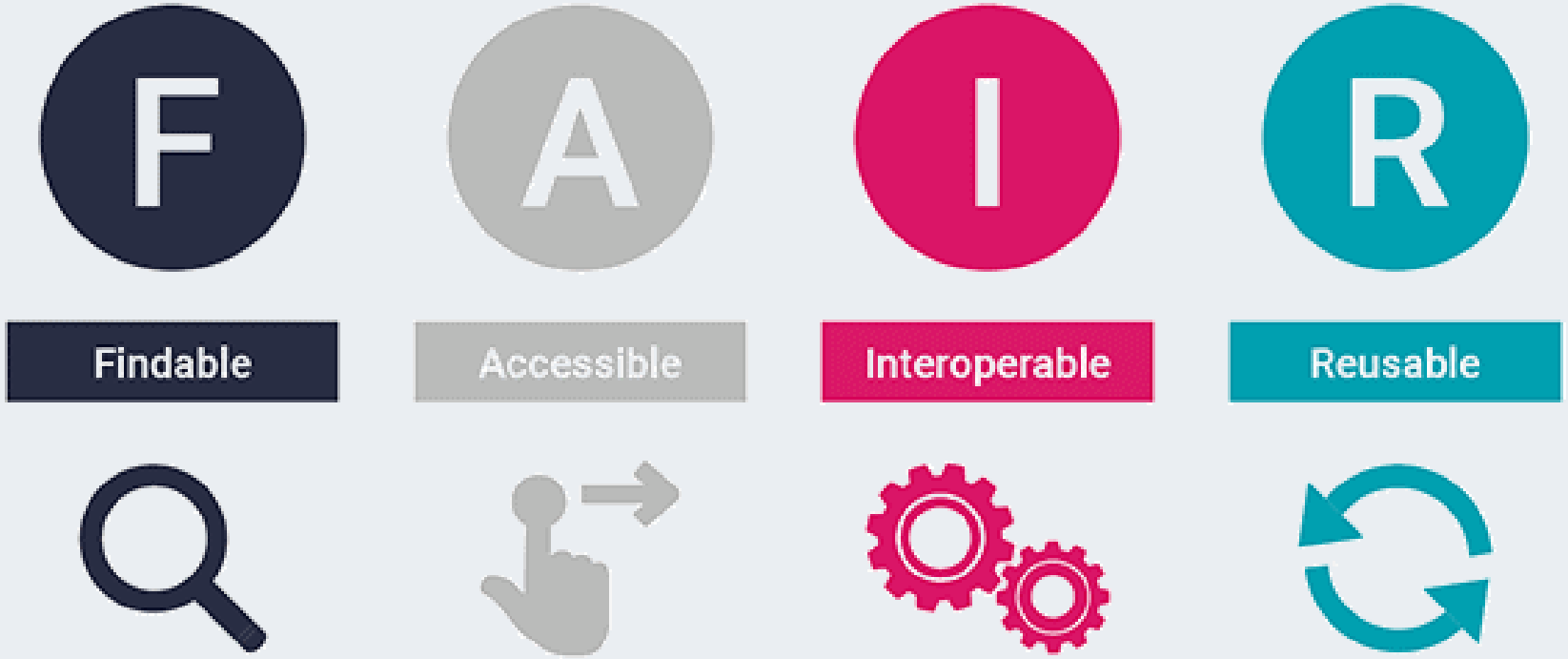
Research Data Management

- Collection plans
- Storage
- Retention



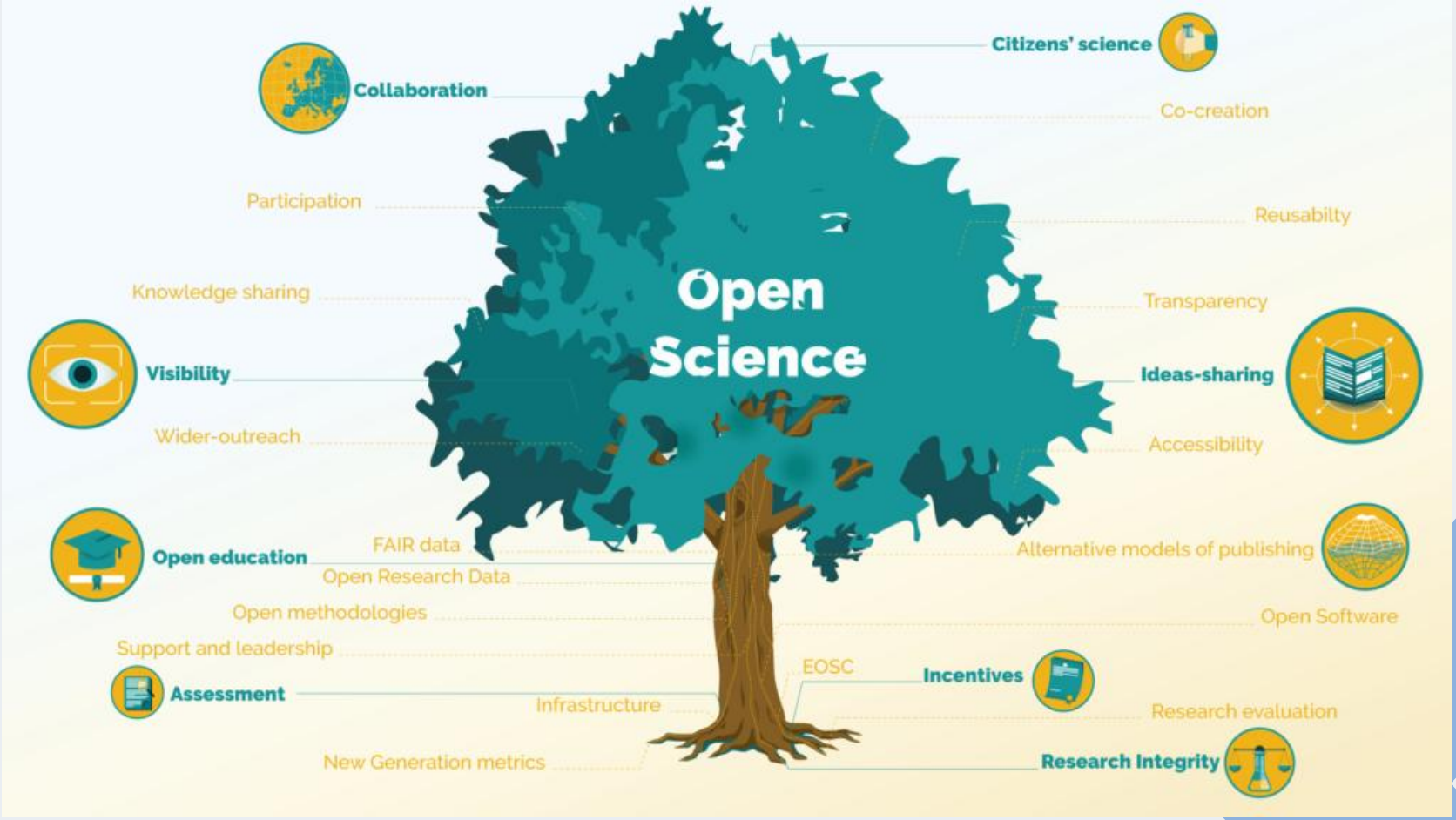
FAIR Data Principles

- Findable
- Accessible
- Interoperable
- Reusable



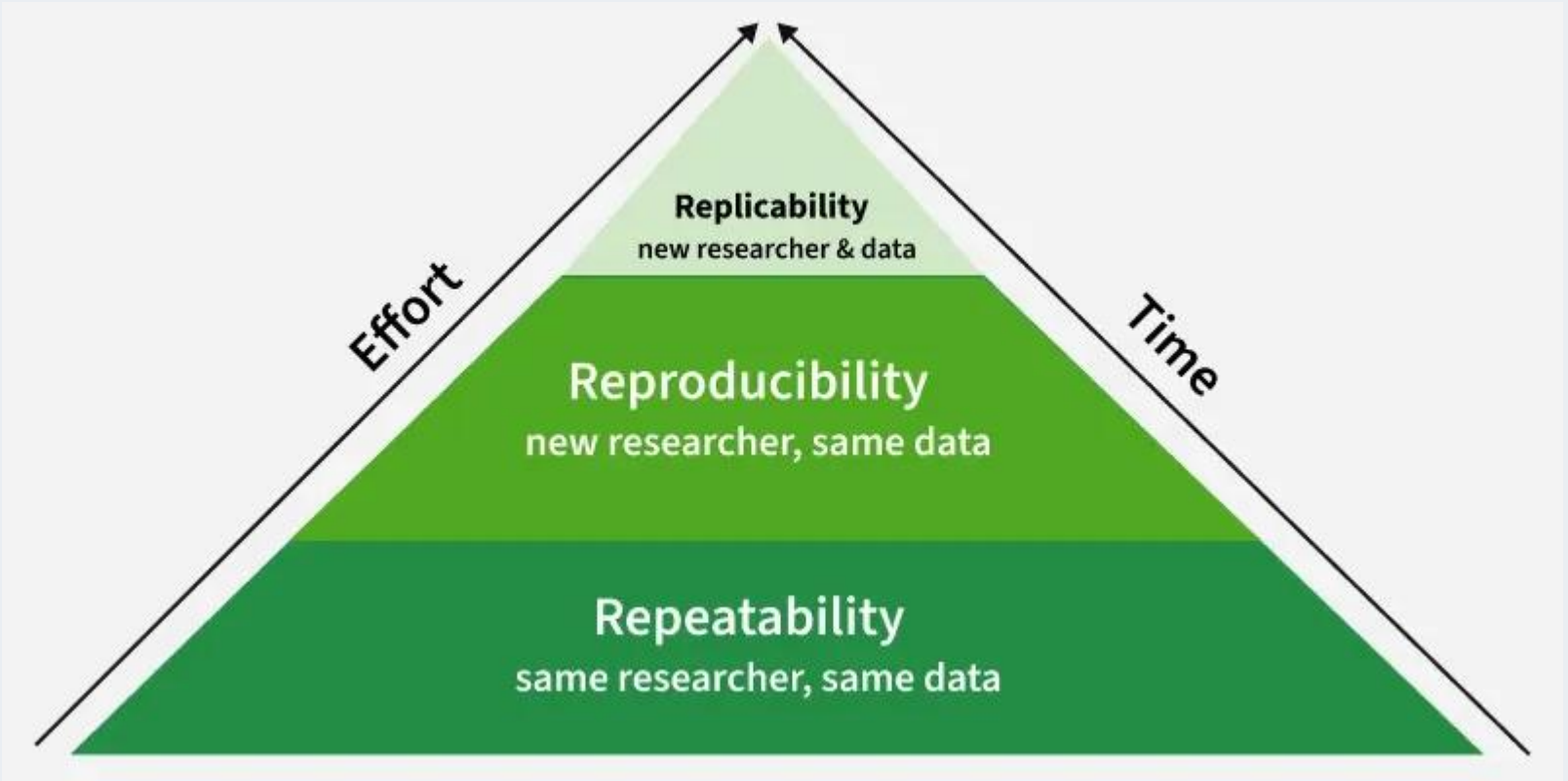
Open Science

- Open publications
- Open data
- Transparency



Reproducibility

- Repeatable methods
- Documentation
- Code sharing

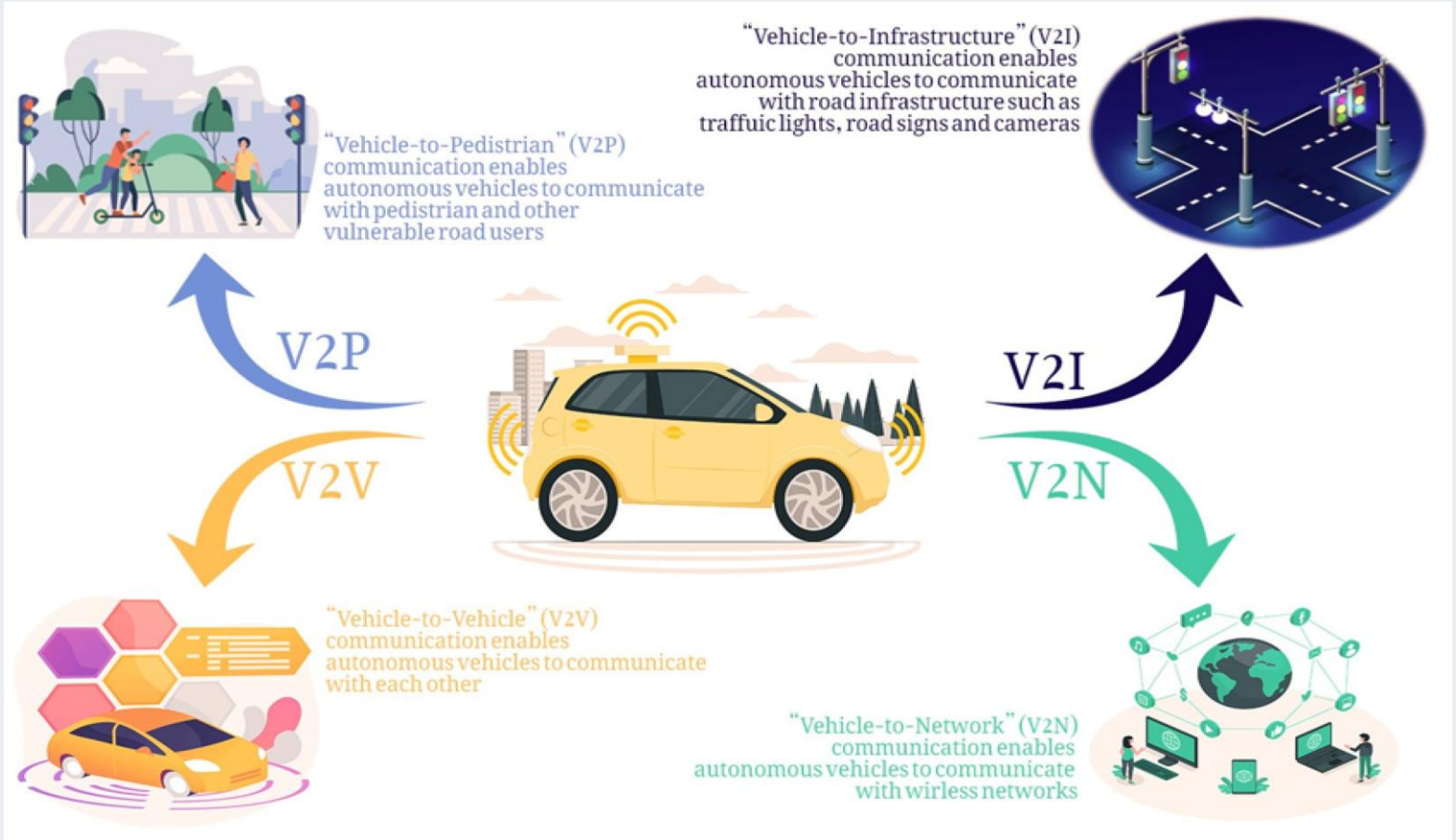


Hazard Identification

- Physical hazards
- Electrical hazards
- Chemical hazards

Engineering Ethics Case Study 1

- Autonomous systems failure
- Ethical responsibility

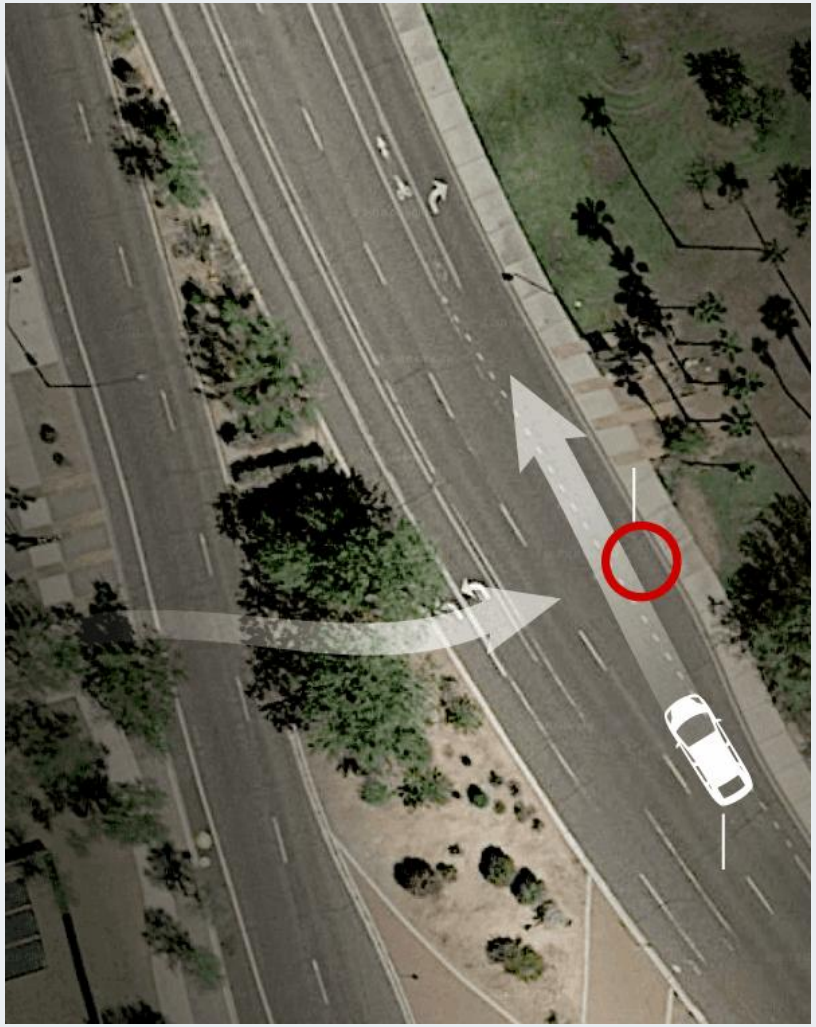


Case Study 1 - Executive Summary & The Incident

- **The Event:** March 2018, Tempe, AZ. An autonomous Uber test vehicle kills a pedestrian.
- **The Impact:** First pedestrian death by an AV; Uber halted all testing, settled out of court, and eventually sold its ATG division.
- **The Core Dilemma:** Balancing aggressive innovation timelines against public safety margins.

Case Study 1 - The Engineering Choices (Root Cause Analysis)

- **Software Blindspot:** The system lacked the data to classify a pedestrian wheeling a bicycle outside of a crosswalk.
- **The 1-Second Lag:** Engineers programmed a 1.2-second suppression delay to prevent "phantom braking" (sudden stops for harmless debris).
- **The Critical Flaw:** In a bid to make the ride smooth, engineers actively programmed the car to delay its own emergency response.

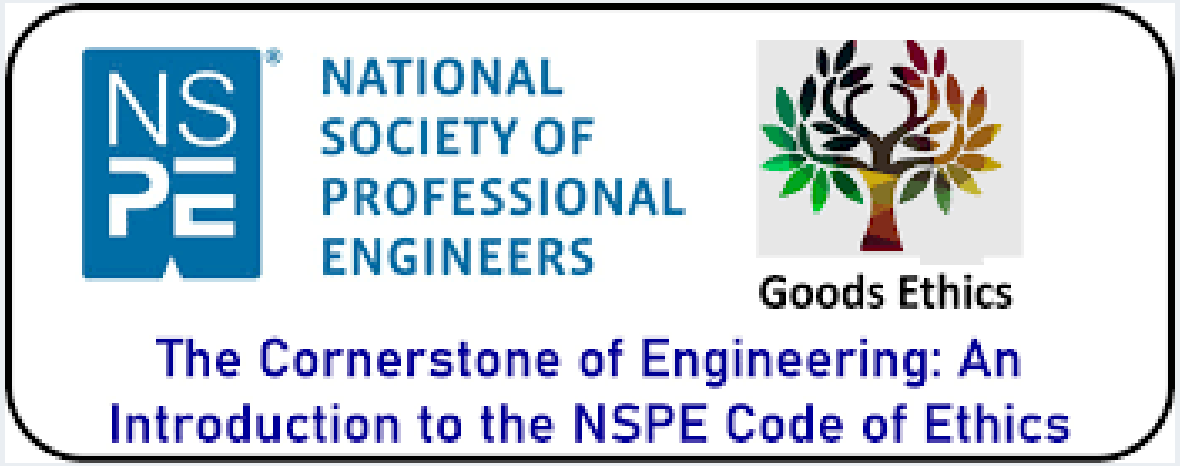


Case Study 1 - The Organizational Failure (Safety Culture)

- **Systemic De-scoping:** Uber disabled the vehicle's built-in Volvo crash-avoidance systems to prevent software conflicts.
- **Delegating Risk:** Management placed the entire safety burden on a single, low-wage safety driver.
- **Systemic Blindness:** The National Transportation Safety Board (NTSB) later ruled that Uber lacked an independent safety management system (SMS).

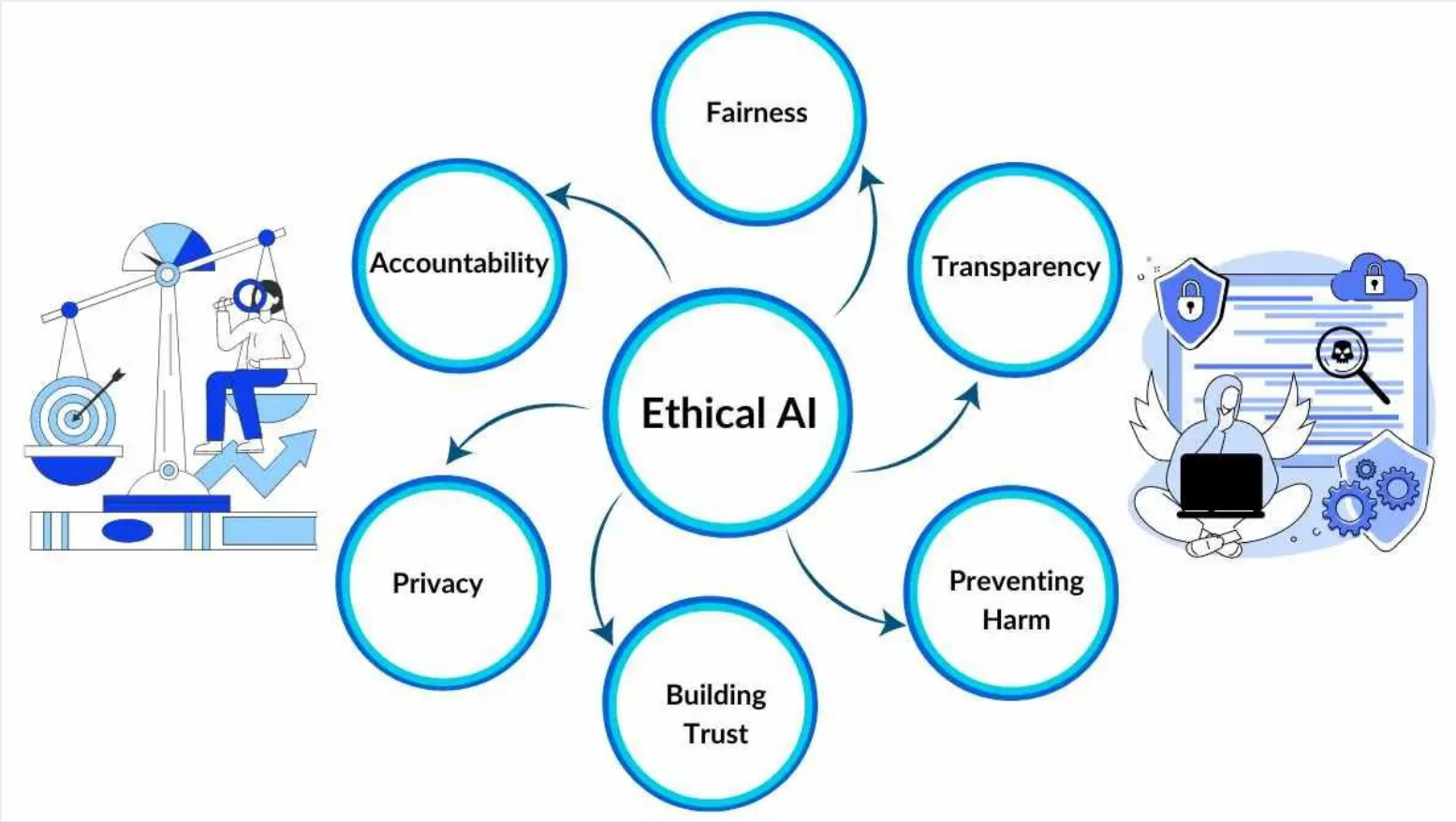
Ethical Framework: "The Problem of Many Hands"

- **Distributed Responsibility:** When dozens of engineers write fragments of code, who owns the fatal bug?
- **NSPE Code of Ethics Violation:** Engineers failed to hold paramount the safety, health, and welfare of the public.
- **The Takeaway:** Deferring safety to a manager's timeline or a teammate's module does not absolve individual professional liability.



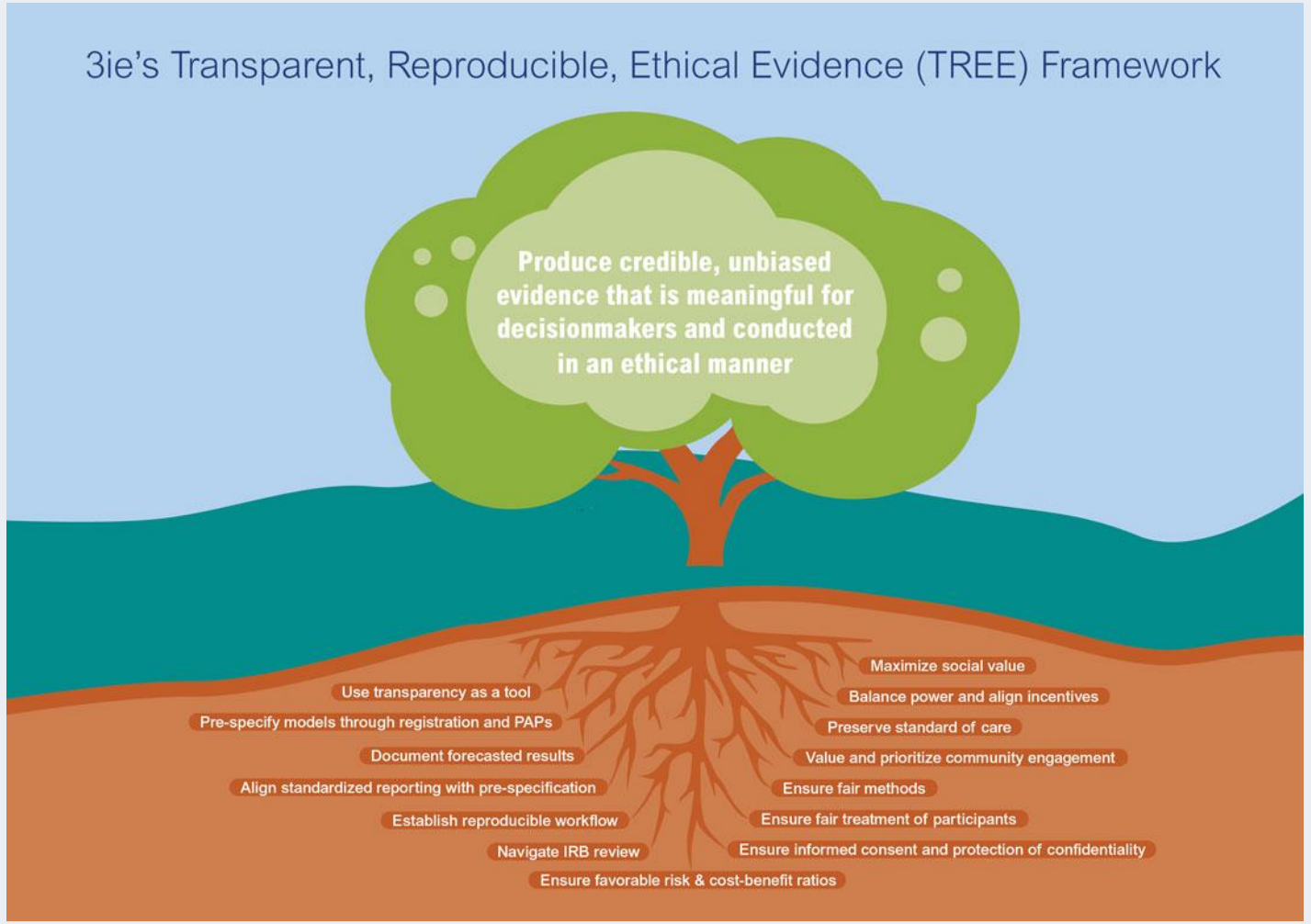
Engineering Ethics Case Study 2

- AI bias example
- Design decisions



Ethical Decision Framework

- Identify issue
- Analyse impacts
- Evaluate alternatives



Building Research Reputation

- Integrity
- Professionalism
- Networks

Key Takeaways

- Ethics matters
- Safety first
- Integrity always

Thank You!

Upcoming courses

Courses	Start Date
Doctor of Engineering (online) 36 months	20 July 2026
On-Campus – Doctor of Engineering 36 months Perth/Melbourne	27 July 2026

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6 August: Managing the DEng: Planning, Time, and Resources

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1 October: From Lab to Field: Translating Research into Real-World Engineering Applications

5 November: Resilience, Reflection, and the Doctoral Mindset

3 December: Building Your Research Identity: Patents, Publications, and Professional Pathways

Q&A

Contact Us:

Website
www.eit.edu.au

Email
webinars@eit.edu.au

Head Office
6 & 8 Thelma Street, West Perth
Perth, WA 6005

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Phone
Inside Australia: 1300 138 522
Outside Australia: +61 8 9321 1702