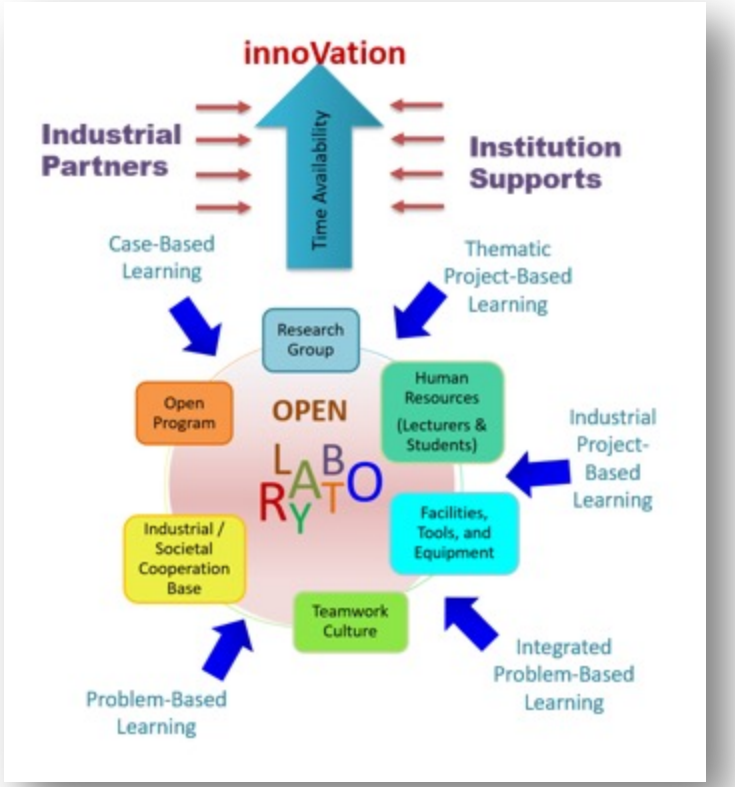
Konferensi Puncak Pendidikan Tinggi Indonesia (KPPTI) Tahun 2026
11-13 November 2026

Strengthening Polytechnics through Polytechnic 4.0 with Open Laboratory

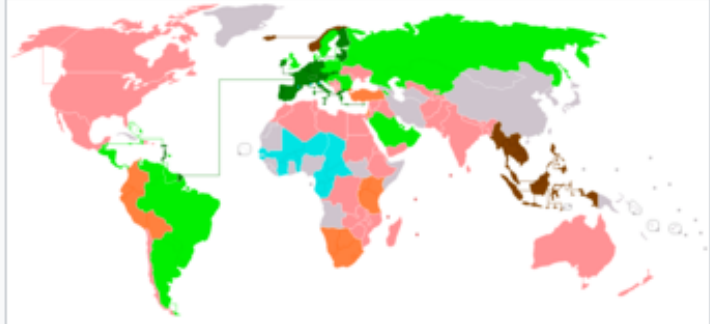


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Politeknik Elektronika Negeri Surabaya

Introduction

Global Phenomenon



Stages of economic integration around the World (each country colored according to the most integrated form that it participates with):

- Economic and monetary union (CSME/EC$, EU/€, Switzerland–Liechtenstein/CHF)
- Economic union (CSME, EU, EAEU, MERCOSUR, GCC, SICA)
- Customs and monetary union (CEMAC/XAF, UEMOA/XOF)
- Common market (EEA–Switzerland, ASEAN)
- Customs union (CAN, EAC, EUCU, SACU)
- Multilateral Free Trade Area (CEFTA, CISFTA, COMESA, EFTA, GAFTA, NAFTA, SAFTA, AANZFTA, PAFTA, SADCFTA)

V • T • E

- **Free Trade Area**

  A free trade area is an area that includes a trading block whose member countries have signed free trade agreements.

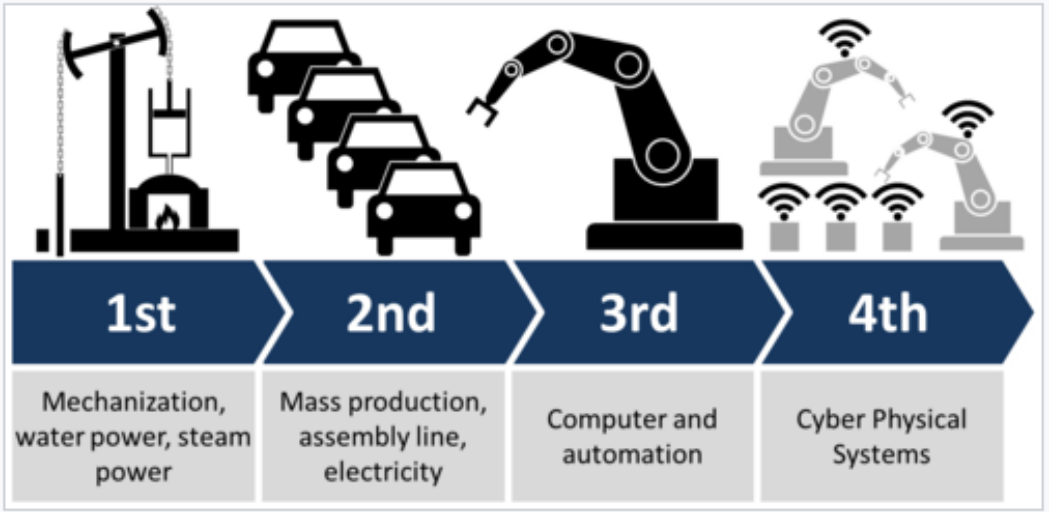
The agreement involves cooperation between at least two countries to reduce trade barriers - import quotas and tariffs - and to increase trade in goods and services with each other. If people are also free to move between countries, in addition to free trade agreements, it will also be considered an open border.

Introduction

Global Phenomenon

- **Industry 4.0**

  Industry 4.0 is the name given to the current trend of automation and data exchange in manufacturing technology. Industry 4.0 drives so-called "smart factories".

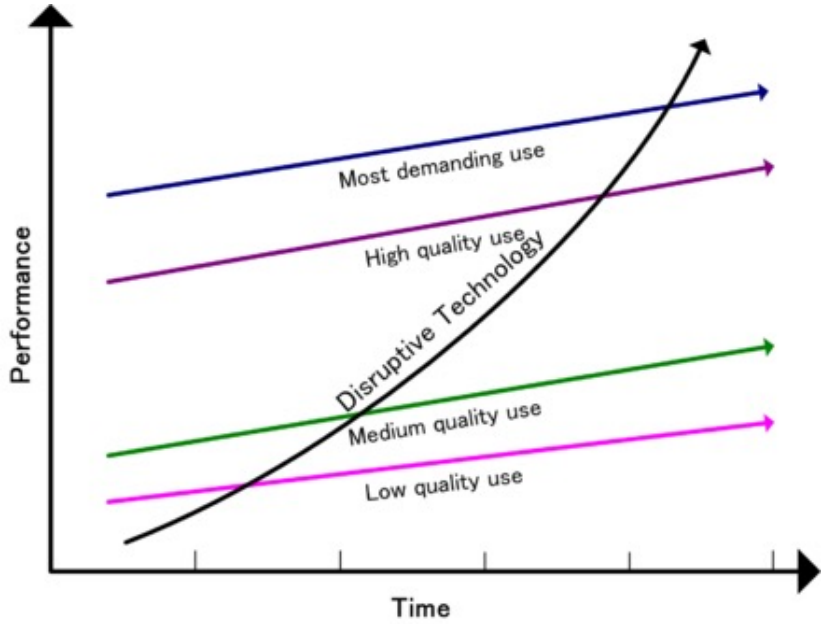


In a modular structured smart factory, cyber-physical systems monitor physical processes, create virtual copies of the physical world and make decentralized decisions. Through the Internet of Things, Cyber-physical Systems communicate and cooperate with each other and with humans in real-time both internally and across organizational services offered and used by value chain participants.

Introduction

- **Disruptive Innovation**

Disruptive Technology is an innovation that creates new markets and value networks and ultimately disrupts existing markets and value networks, displacing leading companies, products, and alliances in established markets.



Global Phenomenon

A disruptive process can take longer to develop than with conventional approaches and the risks associated with it are higher than those of more incremental or evolutionary forms of innovation, but once deployed in the market, it will achieve much faster penetration and higher rates. on the impact on established markets.

Higher Education Challenge

- Higher Education plays an important role in the development of a country.
- It is an indicator that a developed country must be supported by advanced higher education, both in quality and quantity.
- However, along with the rapidly changing world in the current era of globalization, it makes higher education having difficulties in reading global phenomena, so that it requires to proactively follow the new paradigm that occurred with the birth of the disruptive era where innovation is an important keyword for world change.

Altbach and Davis (1999) in his book "*Global challenge and national response: Note for an international dialogue on Internasional higher education*"

Higher education has changed over the past two decades and still has difficulty adapting to these changes, including:

- higher education is facing obstacles in increasing the number of students
- there are demographic changes
- demands for accountability
- thoughts on the social and economic role of higher education
- impact of new technology

The impact of globalization has changed the role of higher education

Traditional learning institution	→	Knowledge creation institution
Poor planning	→	Strategic planning
Competitive approach	→	Cooperative approach

Global Change & Polytechnic

Paradigm context between global change & higher education

For this reason, expertise-oriented Polytechnic institution is indeed required to become professional educationists who are always proactive and dynamic in following global changes

Polytechnic is Applied Education

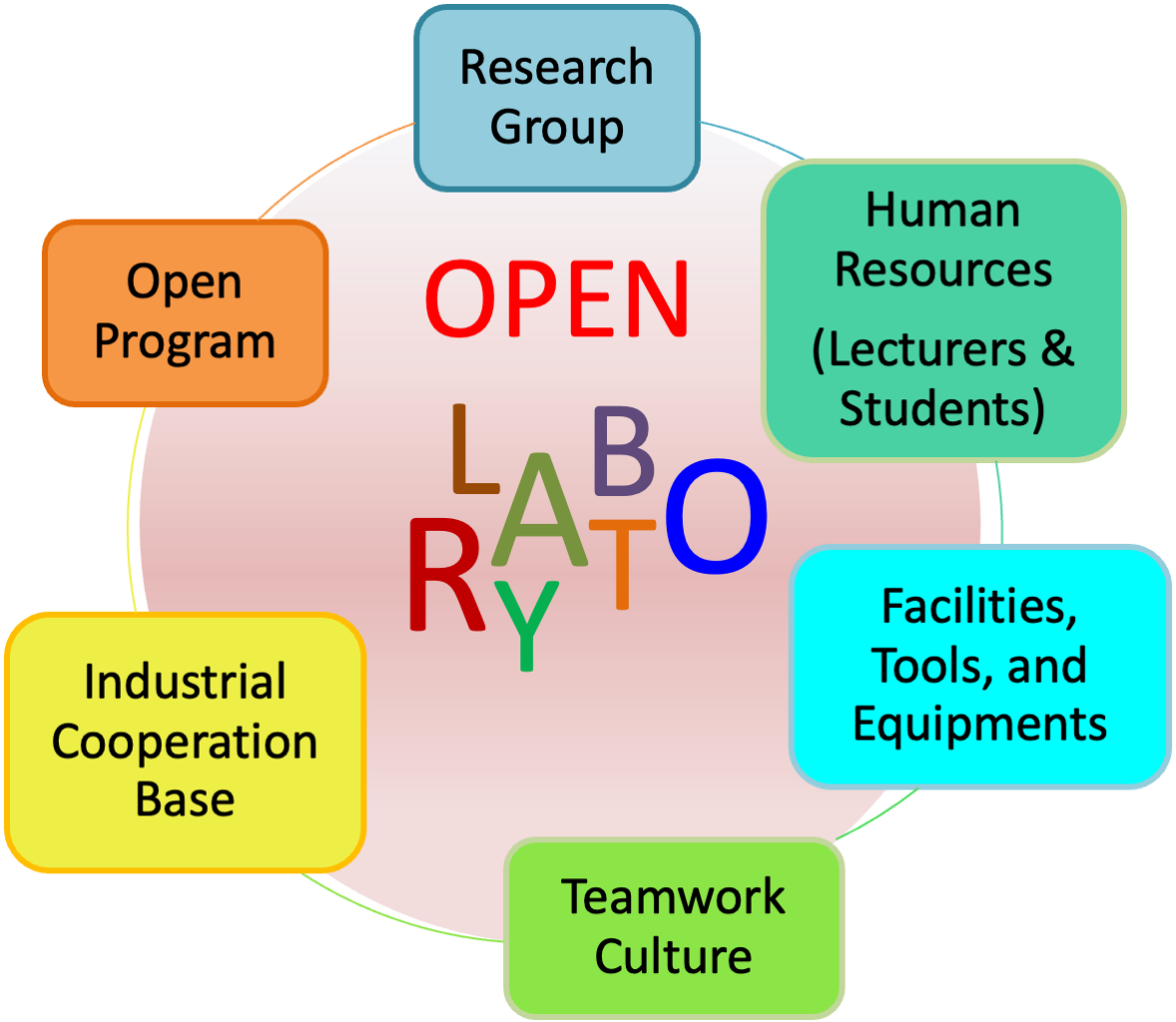
Polytechnic development becomes something important in the country because the educational model is designed to be close to the real world

Polytechnics prepare their students to become members of the community who have professional abilities to apply, develop, and disseminate science and technology

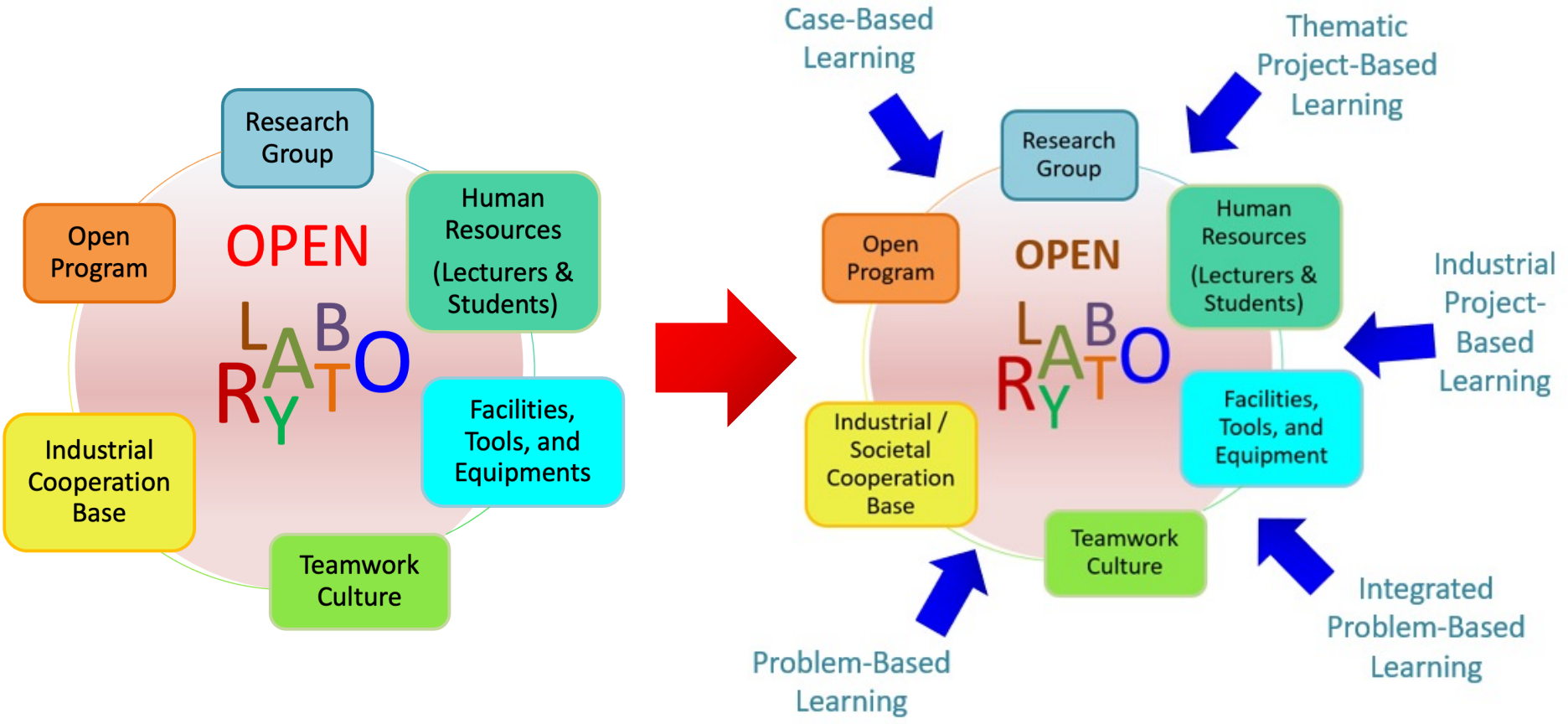
Polytechnic 3.0 vs Polytechnic 4.0

Dimension	Polytechnic 3.0	Polytechnic 4.0
1. Education	Skill-oriented Education	Skill Intelligence-oriented Education
2. Learning	Problem-based Learning	Interdisciplinary Problem-based Learning
3. Curriculum	Market need-inherited Curriculum	Industry Ecosystem-inherited Curriculum
4. Learning process	Guided Teaching	Guided Coaching
5. Values	Competitive Values	Cooperative Values

Approach to Realize Polytechnic 4.0



Five Components in the Open Laboratory to support Comprehensive Learning



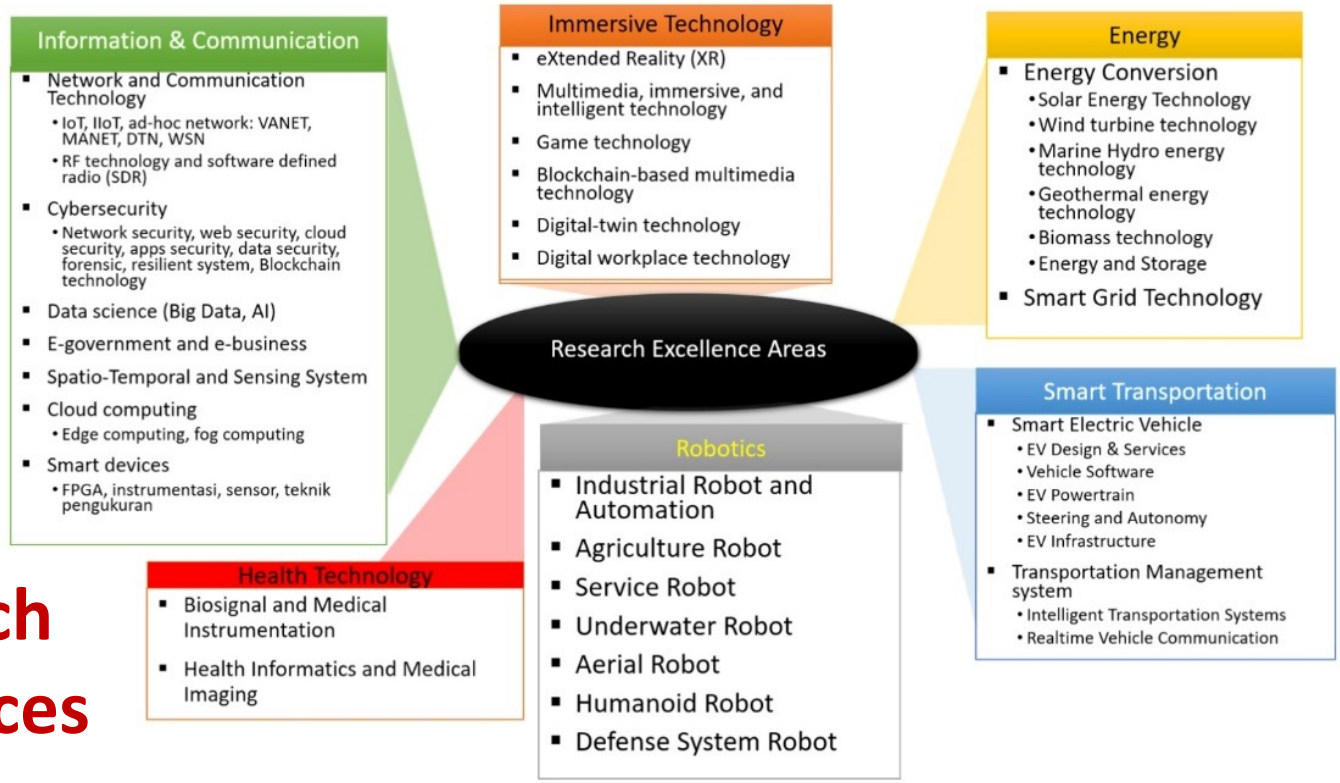
Polytechnic 4.0 Implementation



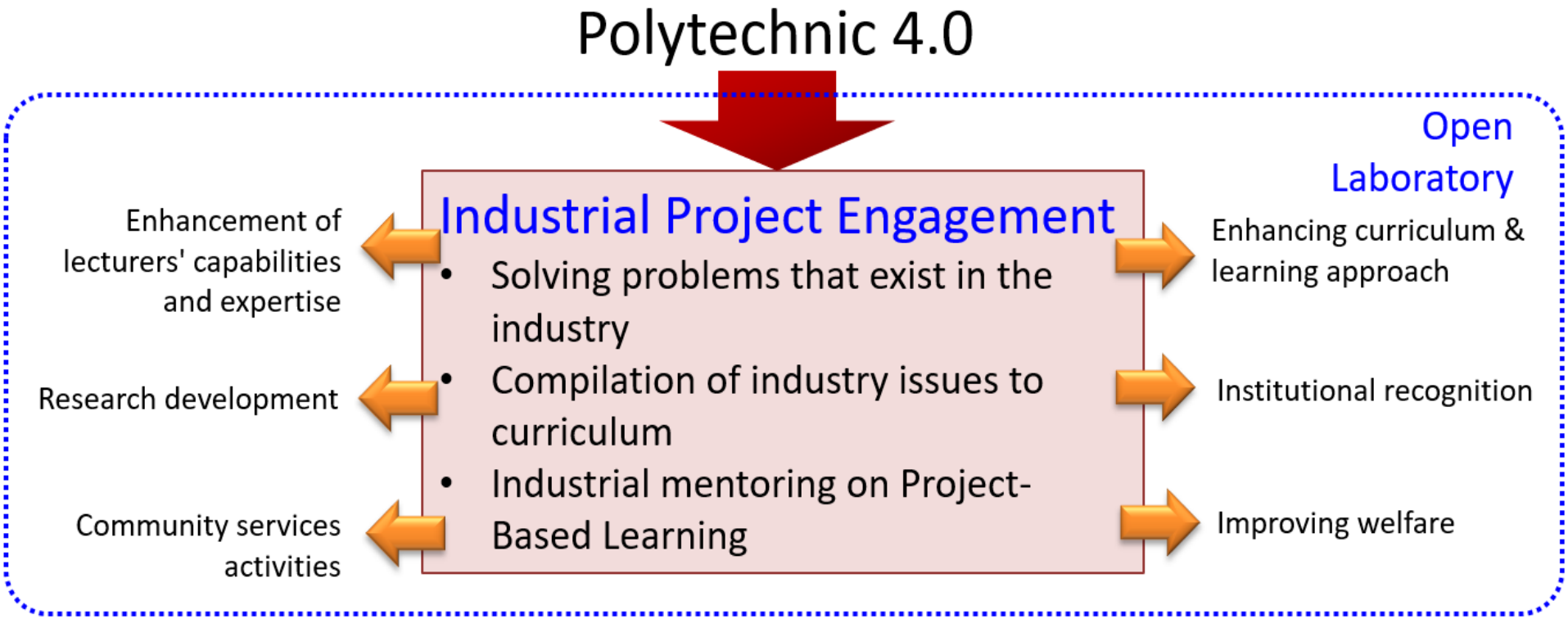
- Electrification for Vehicle & Transportation
- Energy Technology
- Robotics & Industrial Automation
- Food Security & Environmental Technology

Research Institute

Research Excellences

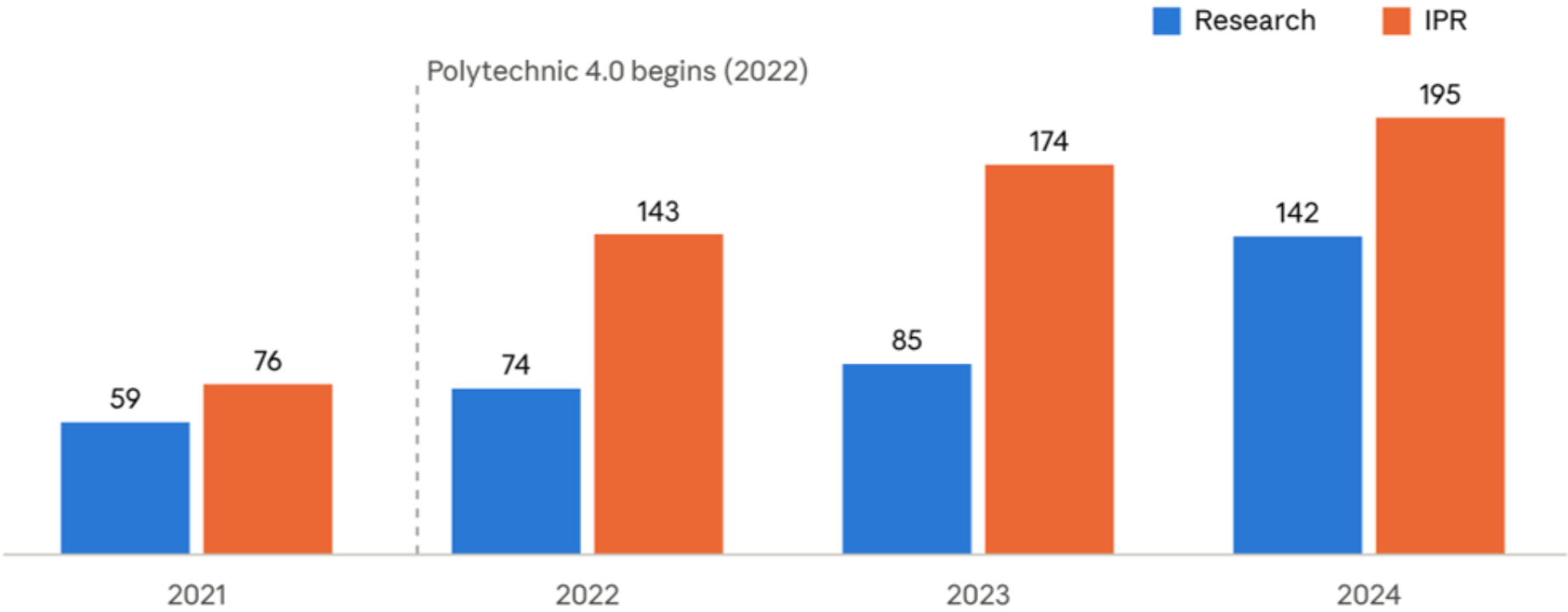


Implementation



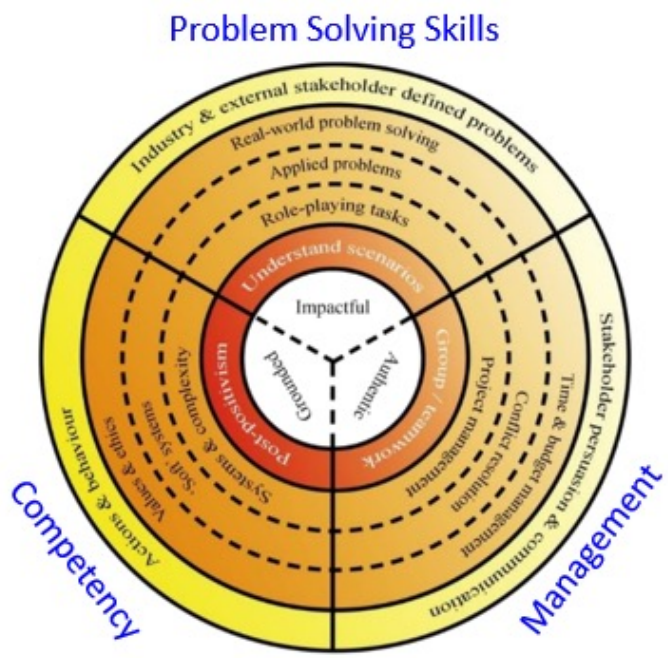
Industrial Partnership Model

Impact

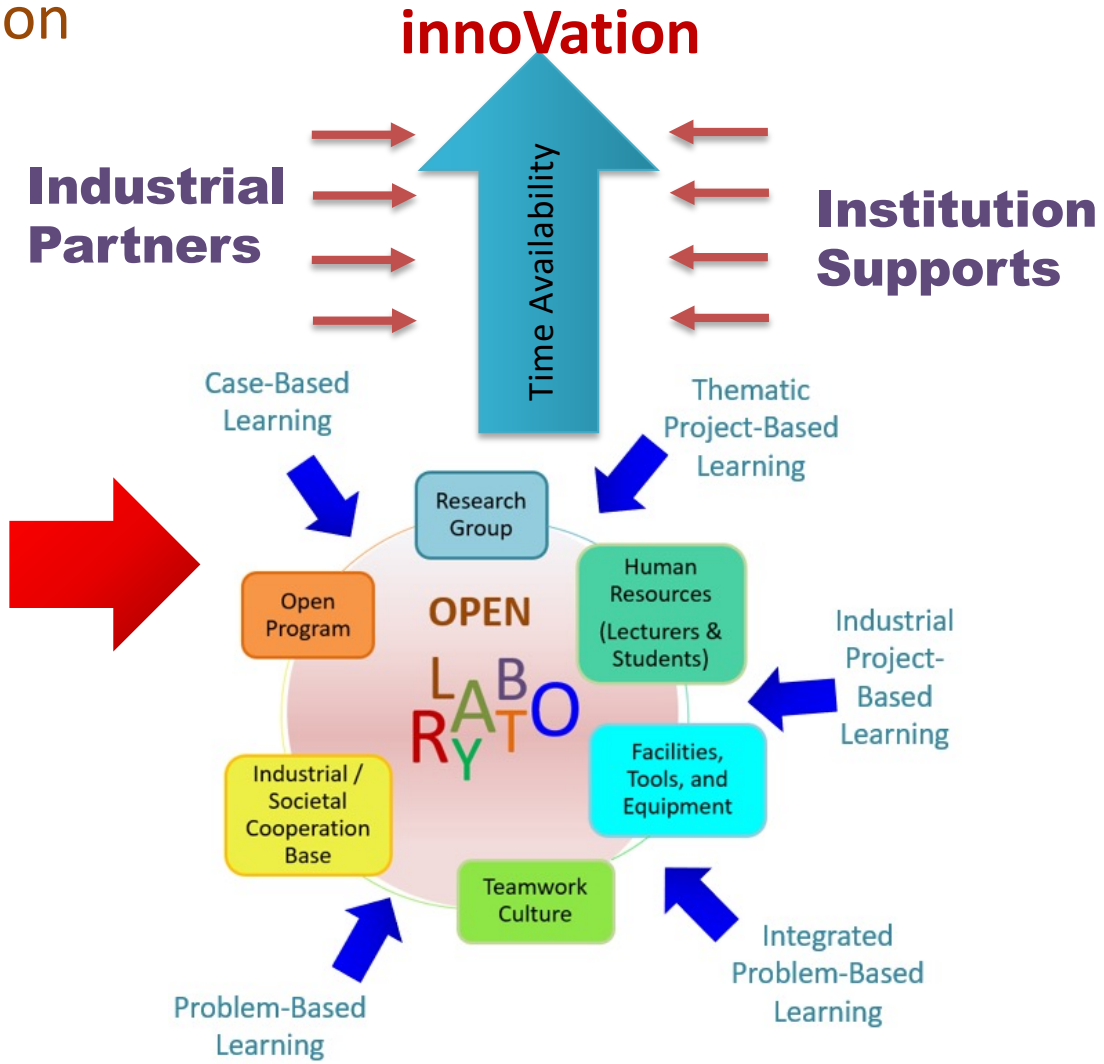


Annual research output and IPR (copyrights, patents, simple patents, industrial designs) at PENS, 2021–2024

Applied Educational Approach through Lab-Based Education



Source: Common Language of Sustainability for Built Environment Professionals—The Quintuple Helix Model for Higher Education, Journal of Energies, No. 13, No. 22, 2020



Conclusion

- Free trade, Industry 4.0, and disruptive innovation require polytechnics to transform.
- This paper proposed **Polytechnic 4.0**, which shifts polytechnics toward skill intelligence-oriented education, interdisciplinary problem-based learning, industry ecosystem-inherited curricula, guided coaching, and cooperative values.
- **Open Laboratory** operationalizes the paradigm by making laboratories hubs of people, facilities, research groups, teamwork, and industrial R&D.
- At PENS, **redefining** 78 laboratories into 45 research groups and 4 research centers, together with **Industrial Project Engagement**, coincided with research output rising 2.4-fold and IPR 2.6-fold from 2021 to 2024.