2015/16 KNOWLEDGE SHARING PROGRAM

Final Reporting Workshop

Key Policies for Developing S&T Human Resource in KOREA and policy suggestions for Costa Rica

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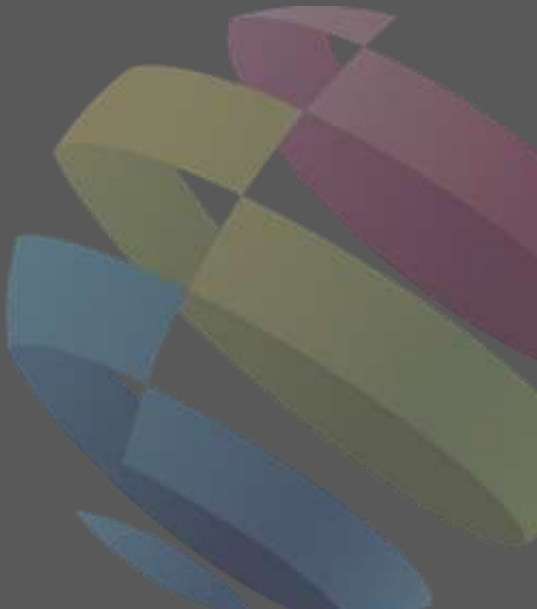7. KAIST (Korea Advanced Institute of Science & Technology)

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**2015/16
KNOWLEDGE
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PROGRAM**

Ⅰ. Korea's experiences

1. Key Strategies of Basic Plan for Enhancing Human Resource in S&T

System innovation of university education in science and engineering (Innovation of university management)	⇒	1. Encouraging specialization of university in science and engineering 2. Promoting competition and strengthening autonomy between universities and within university 3. Improving quality of human resource in science and engineering through innovation of education process
High-skilled human resources Development (Improving capability of research in university)	⇒	4. Fostering research universities of world class 5. Establishment of infrastructure for internationalization of research and education in science and engineering 6. Raising research ability of undergraduate and graduate students in science and engineering
Demand-driven human resource (Linkage of university-industry)	⇒	7. Establishment of system for promoting industry-university/government research institute linkages 8. Settling system of human resource by type of industry-university linkages 9. Enhancing continuing education and reeducation for human resource in science and engineering 10. Promoting industrialization of developed technology by industry-university linkages
Supporting welfare of science and engineering (Promoting sustainable utilization)	⇒	11. Forming research environment consistently and supporting improvement of welfare for scientists & engineers 12. Expanding entry of official position and promoting employment
Supporting infrastructure for science and engineering	⇒	13. Promoting understanding and expanding activity support for science and engineering 14. Establishment of infrastructure for information support of human resource

Source: Ministry of Science and Technology(2005)

2. Gap Between Forecast and Actual S&T Human Resource Demand

		2000	2010		Forecast Error	Percentage Error(%)
			Actual	Forecast		
		(A)	(B)	(C)	(B-C)	[(B-C)/B]x100
Whole	Natural science	187.8	316.1	230.0	86.1	27.2
	Engineering	559.1	1,032.4	833.2	199.2	19.3
	Medicine and Pharmacy	221.0	299.4	284.7	14.7	4.9
	Total	967.9	1,647.9	1,347.9	300.0	18.2
Professional bachelor (two year)	Natural science	39.6	36.5	49.6	-13.1	-36.0
	Engineering	159.1	189.4	302.8	-113.4	-59.8
	Medicine and Pharmacy	77.8	127.6	94.8	32.8	25.7
	Total	276.5	353.6	447.2	-93.6	-26.5
Bachelor	Natural science	113.4	207.5	126.5	81.0	39.0
	Engineering	321.9	655.4	358.7	296.7	45.3
	Medicine and Pharmacy	105.5	126.8	123.2	3.6	2.8
	Total	540.8	989.7	608.4	381.3	38.5
Master's degree & Ph.D.	Natural science	34.8	72.1	53.8	18.3	25.4
	Engineering	78.1	187.5	171.7	15.8	8.4
	Medicine and Pharmacy	37.7	45.0	66.6	-21.6	-48.0
	Total	150.6	304.6	292.1	12.5	4.1

3. PRIME Project
(University Restructuring Encouraging Program: 2016)

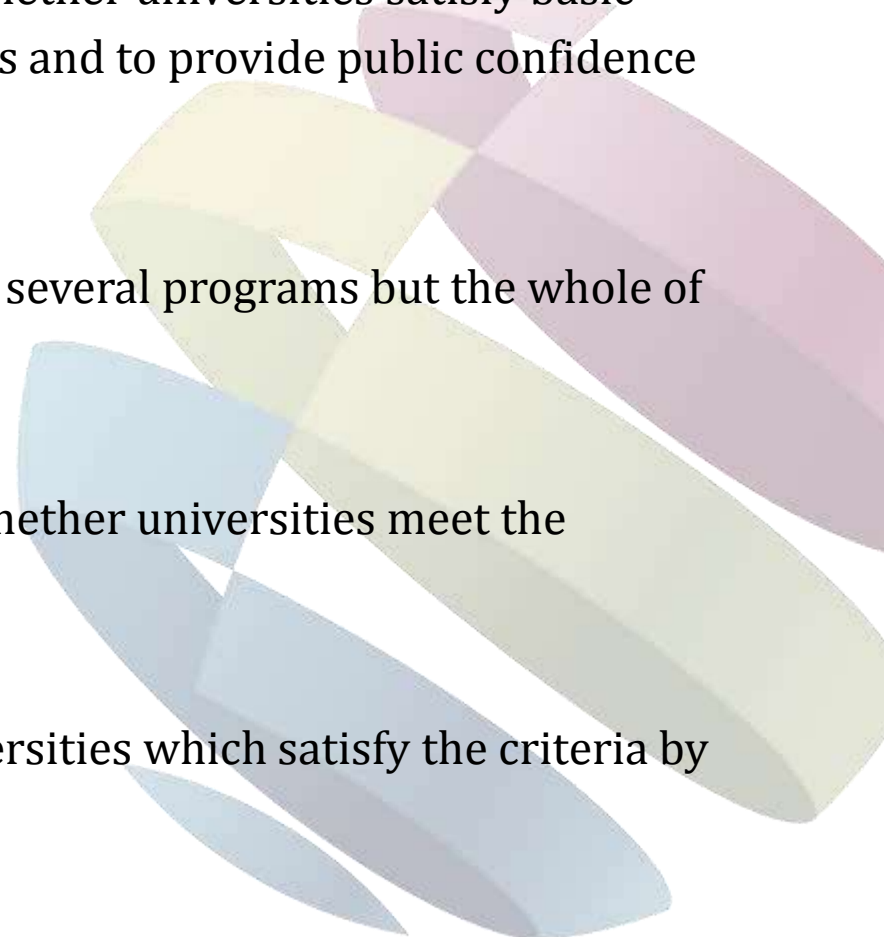| Project type	Leading university of social demand	Leading university of creative economy
Contents by type	Leading bachelor system quota-control to the center of social change and industry demand	Reorganization for human resource of specific areas (creative economy, future promising industries etc.)
Participation conditions	Entrance quota 10%(at least 100 students) or movement of more than 200 students	Entrance quota 5%(at least 50 students) or movement of more than 100 students
Support	Total 150 million dollar (9 universities or so) Average 15 million dollar per university maximum 30 million dollar	Total 50 million dollar (10 universities or so) Average 5 million dollar per university
Region division	Capital region / Non-capital region	Five region-divisions

4. Korean University Accreditation Institute (University Evaluation)

- providing the standards and guidelines for qualitative improvement of university

- promoting the development of university education

- performing the accreditation of university

- University Accreditation System

  - Accreditation: a system to determine whether universities satisfy basic requirements as educational institutions and to provide public confidence by making the results public

  - Accreditation subjects are not limited to several programs but the whole of institutional management.

  - Experts' opinions are used to confirm whether universities meet the accreditation criteria.

  - Social respectability is accorded to universities which satisfy the criteria by publishing the results.

** Joong-Ang Daily University Evaluation

- A private daily Journal independently evaluates competitiveness of universities

- It appraises most of colleges and universities with respect to various perspectives which industry and public are interested in and provides rankings of universities

- The evaluation of universities

  - encourage the competition among schools

  - improve education quality

  - effective response to social demand

- # Evaluation Index of Joong-and daily university ranking

Sector	Total score	Index	Sector	Total score	Index
Condition of education	150	Professor securement rate	Condition of education	150	Faculty rate of external career
		Class size			Ratio of foreign professor
		Rate of lectures of full-time professor			Foreign student rate of degree course
		Ratio of scholarship to tuition fee			Diversity of foreign student
		Ratio of education expense to tuition fee			Interchange student ratio
		Ratio of money paid to annual income	Faculty research	110	Average research funds of off campus per faculty in affiliation
		Ratio of donation to annual income			Average self-research funds per faculty in affiliation
		accommodation rate of dormitory			International journal's citation per paper
		Money for books per student			Paper of International Journal based on IF

Source: Joong-ang daily

■ Table – Index of Joong-ang daily university ranking

Sector	Total score	Index	Sector	Total score	Index
Faculty research	110	Publication of book or translation in humanities and social sciences	Endeavour and result of Education	80	Net employment rate
		Citation of book or translation in humanities and social sciences			Maintaining employment rate
		Publication of domestic paper in humanities and social sciences			Dropout rate
		Citation of domestic paper in humanities and social sciences			Entrepreneurship activity of graduate
		Ratio of education expense to tuition fee			Entrepreneurship education rate
		Technology transfer income per faculty in science and technology			Participation student rate of field placement
		University-industry cooperation income per faculty in science and technology			Participation rate of capstone design
Endeavour and result of Education	80	Net employment rate			Open lecture through Online

Source: Joong-ang daily

- Table – Index of Joong-and daily university ranking

Sector	Total score	Index
Reputation	60	Firm wants to hire new recruits of the University
		Faithful university to cultural and major education in business
		The university of excellent characterization or endeavoring
		Excellent education for student
		Recommended university for admission
		Wanted university for donation
		The university that has possibility of development through judgement
		The university that greatly contributes to country and society
		The university that greatly contributes to local society

Source: Joong-ang daily

5. BrainKorea21 PLUS

- Training human resource of master and Ph.D for innovation economy

- Supporting to creative new knowledge

- Enhancing role of university for improving creativity and originality

- Project plan and scale
  - Plan: 2013~2019 (7 years)
  - Project scale: In 2013, 252.6 million dollar(500 groups)

- Supporting Direction and Field

Type	Supporting Direction	Supporting Field
Global human resource	Enhancing ability of education and research in core fields for future development as global level	Type of fusion R&D for innovation economy
Specialized human resource	Training special human resource in high-value and practical affairs	First, supporting graduate around specific areas such as special equipment, information security etc.
Creative human resource	Creative core human resource each field	Selecting group and team

Source: BK21 PLUS homepage

- Evaluation and management system
  - Differentiation of evaluation index for project purposes by each type of plan
  - Reflection of qualitative indicator that can lead essential growth of project groups by evaluation territories
  - Training Master degree and Ph.D human resource through university-industry cooperation
  - In university headquarter, reflecting essential effort to evaluation for improving of quality in graduate's education and research

- Categories of evaluation

Type	Main evaluation index	Training global human resource	Creative human resource based on future	
			group	team
Education capacity	- Composition and management of education process - Employment and career path of graduate - Record of research of graduate - Education of globalization	23%	43%	45%
Research capacity	- Present condition and plan of research's globalization - Record of university-industry cooperation (science and engineering)	32%	42%	45%
Improvement of system and support	- Effort of system improvement for improving of research and education's quality in university - Support plan of project group	15%	15%	10%

Notice: Separate evaluation about overseas-colleague's evaluation(20%), application plan of inviting overseas scholar(10%) in Training global human resource.

Source: BK21 PLUS homepage

4. Korean University Accreditation Institute (University Evaluation)

- providing the standards and guidelines for qualitative improvement of university

- promoting the development of university education

- performing the accreditation of university

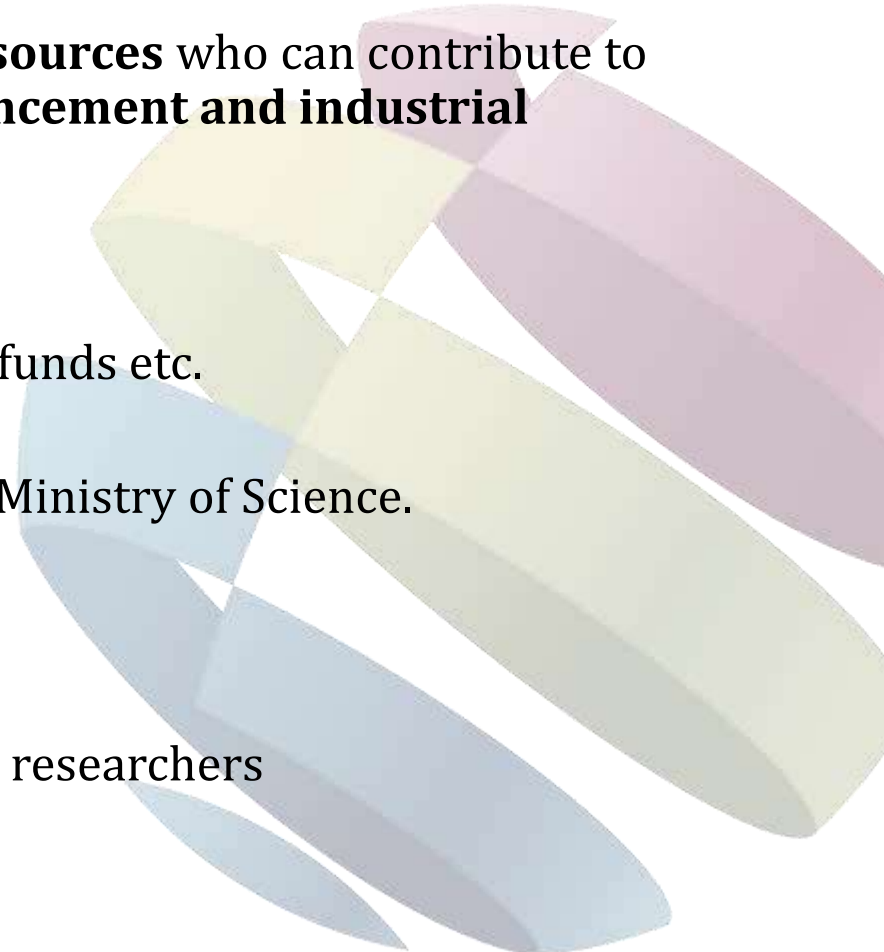# 6. Accreditation Board for Engineering Education

Features

- Outcomes-based
- Demand-driven
- Peer evaluation of the quality of education programs
- Separate commissions for engineering, computing and engineering technology
- Harmonized accreditation criteria and evaluation processes

Accreditation Commissions

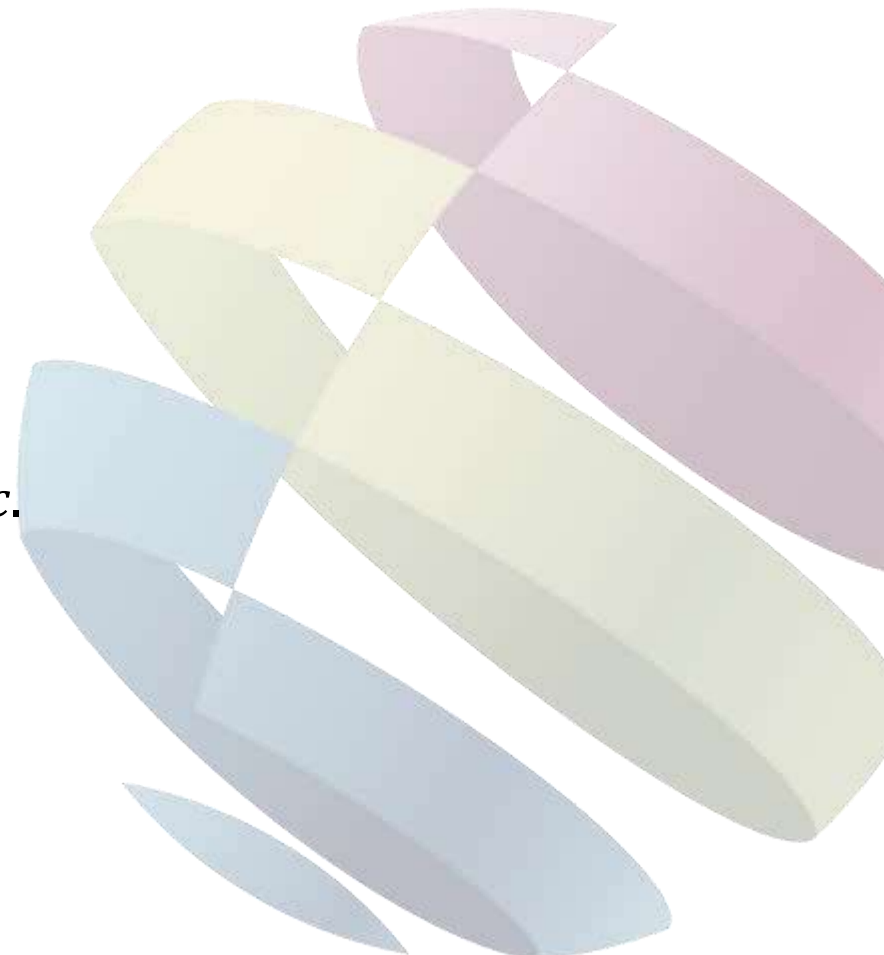| Key Facts	Engineering Accreditation Commission (EAC)	Computing Accreditation Commission (CAC)	Technology Accreditation Commission (TAC)
Year Established	1999	2004	2009
Number of Accredited Programs as of May 2012	527	50	20
Program Duration	4 years	4 years	2 years for associate degree, 3 years for bachelor degree
Number of Disciplines with Program Criteria	16 (+Non-traditional)	4	7 (+Non-traditional)

7. KAIST (1971~)

- Background
    - To develop high quality **human resources** who can contribute to **national strategic technical advancement and industrial development**.

- Governance
    - Flexible funding structure
        - Based on contribution, special funds etc.
    - Autonomous
        - "specialized" university under Ministry of Science.

- Initial support
    - Judiciary: Special law
    - Incentives: financial benefits
        - To attract students, professors, researchers

ANNEX:
Affiliated agencies of Ministry of Science, ICT and Future Planning

- 9 Semi-government agencies
  - S&T (2), ICT (4), post (3)
    - *Including KOFAC*

- Affiliated agencies
  - R&D agencies (13)
    - *Including KAIST, UST etc.*
  - Research institute (26)

- Others (7)
  - R&D

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Ⅱ. Policy
Recommendations

MINISTRY OF
STRATEGY
AND FINANCE

KDI Korea Development
Institute

Suggestion 1.
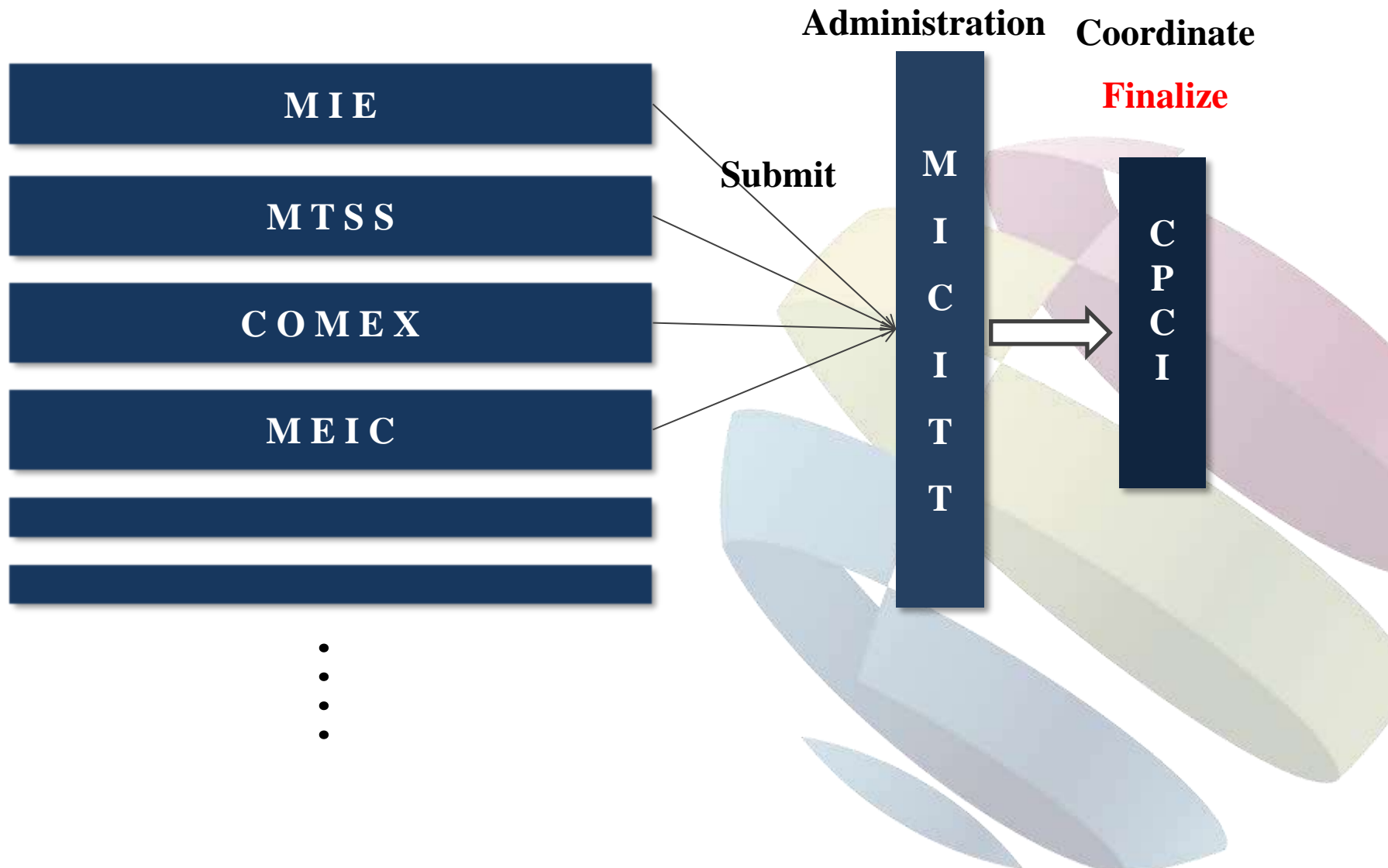# Set up the legislation & establish master plans

- The Government shall enact the law including master plans to support scientists and engineers systematically.

- Mitigate redundant investment and encourage collaboration among stakeholders including private sector
  - MICITT should prepare a guide to establish a guideline for mast plan (administrator agency)
  - Related ministries should submit the specific plan for supporting scientists and engineers
  - Presidential Council on Competitiveness and Innovation(CPCI) coordinates related policies and finalizes the master plan

Suggestion 1.
Set up the legislation & establish master plans

- Master plans may include following contents (examples)

    1. Develop a systematic approach to supply of S&T human resources which flexibly responses to the market demand

    2. Align the educational offers for S&T manpower with country's need

    3. Increase opportunities for scientists and engineers to participate in the public policy and R&D program

    4. Create the researcher support system based on evaluation & performance

    5. Expand exchanges of scientists and engineers between industry and academia

    6. Coordinate and collaborate the investment policies for integrated information system of science and engineering manpower

    7. Improve the quality of STEM & engineering education

Master Plan for Supporting S&T Manpower

Administration   **Coordinate**

Finalize

| MIE |
| MTSS |
| COMEX |
| MEIC |

Submit

MICITT

CPCI

Suggestion 1.
Set up the legislation & establish master plans

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Suggestion 2. Integrated information system for S&T human resources

- The GoC should increase investment and collaborate to enhance the integrated information system for scientists and engineers.

    - Strengthen the State of the Nation Program(PEN) which has been integrating information regarding S&T manpower

    - In the initial stage, building up information integration system requires great amount of investment and numerous good quality specialists

    - Collaboration among stakeholders and interactions with users are important
        - MICITT: S&T human resources development policy
        - MTSS: online employment system
        - CONARE(OLAP Observatory): demand & supply forecast, information collection & DB regarding HR development and working conditions

    - Need to obtain fund and technical support from information management institutes that has various experience to hackle the related problems
        - KISTI(Korea Institute of Science & Technology Information): under supervision of Ministry of Science, ICT and Future Planning

Suggestion 3. Efficient utilization of scientists and engineers

- Need to improve support system for efficient utilizing the S&T human capital in Costa Rica.

    - Increase appointment of scientists and engineers as public officials to response an increase of demand in both policy and research sectors.
        - ▶ decent jobs induce good quality human resources in S&T fields
        - - increase available entry and middle management positions for engineers & scientists (quota system may be considered)
        - - government , public agency, public research institutions
    - Improve the legal system related to appointment of scientists and engineers as public officials and researchers.
    - Expand open-competition employment or outsourcing of public official positions requiring experience in technical services
    - Introduce the customized personnel management systems to expand employment for public officials in technical post and develop capabilities.

Suggestion 4. Assessment of public universities and feedback

- Need to evaluate existing universities and release related information.
    - There are some efforts to align academic funding (FEES) to performance & quality but the GoC needs to encourage these efforts more actively.
    - Introduce competition system in public university to foster talented scientists and engineers continuously with respect to both research and teaching
    - Open all available information pertinent to university assessment.
        - faculty research & teaching performance, employment rate, drop out rate, salary, etc
    - Regularly hear the opinion of both public and private experts and refer to methods and standards of other countries for fair evaluation of university.
    - Release the results of assessment to the public to encourage universities to compete by differentiating supports and to response to the industry demand.
    - Provide detailed information to the primary and secondary students
    - MICITT should drastically increase the Incentive Fund which can be used to finance the project based funding for competent university
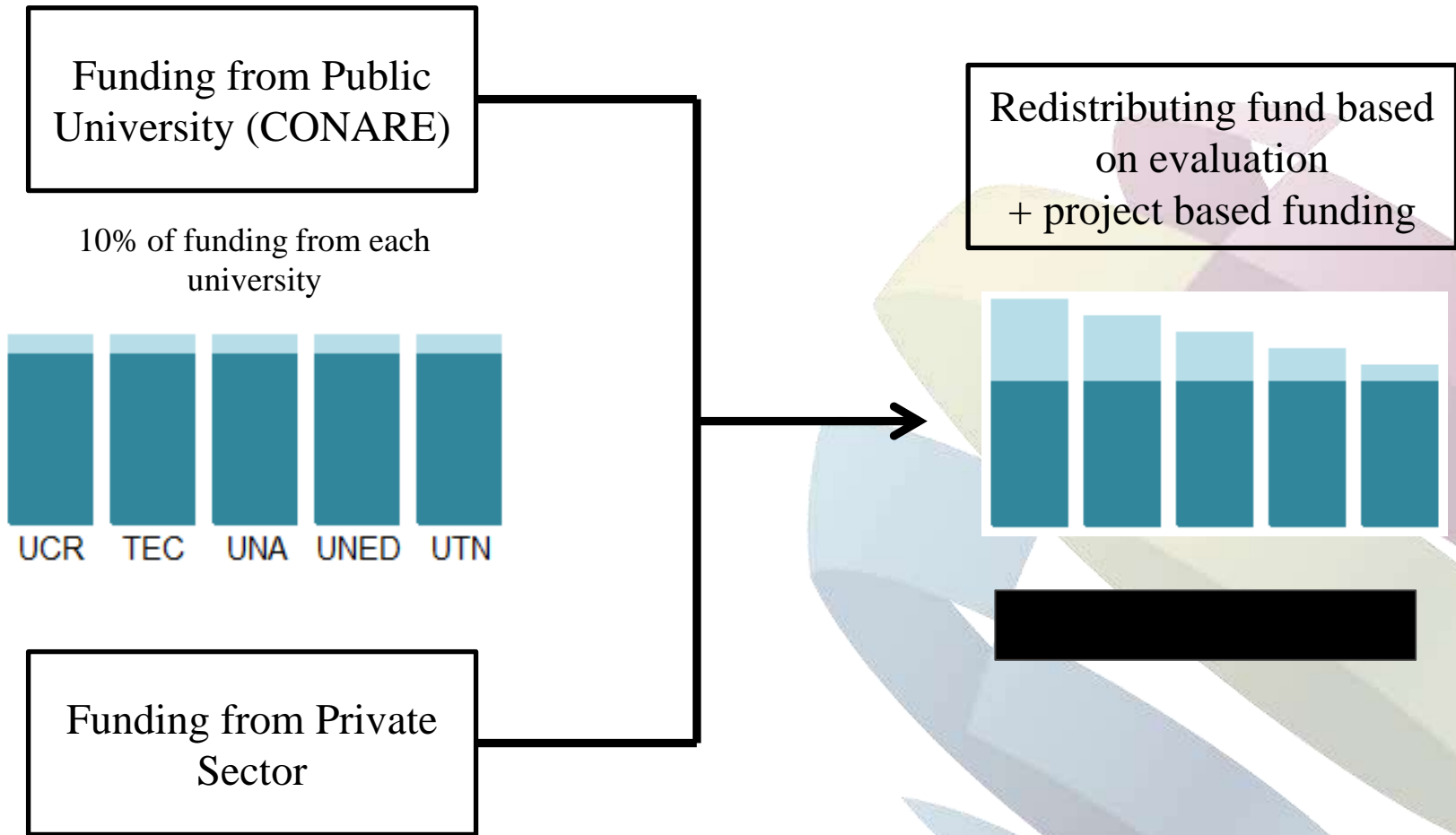
Suggestion 5. Incentive system for public universities

- Need to introduce budget incentive system based on evaluation and response to the industry demand
  - Under the supervision of CPCI
    - MICITT, Ministry of Education mainly implement new funding system
  - Encourage to invest in science and engineering fields and hire more faculties
  - Induce to response to the industry demand and increase the number of students who major in science and engineering
  - MICITT provides differentiated R&D fund based on education performance and faculty's research output
    (patents, publication, technology transfer, cooperation with industry, etc)
  - Introduce the competition among universities and S&T fields
  - Incentive fund based on both public and private resources
    (government's budget, industry's contribution, personal contributions , etc)

Incentive for reform in public universities

Funding from Public University (CONARE)

10% of funding from each university

Redistributing fund based on evaluation
+ project based funding

UCR   TEC   UNA   UNED   UTN

Funding from Private Sector

Suggestion 6. Strengthen the STEM education support institutes

- Need to strengthen the role of the Omar Dengo Foundation
    - Under the supervision of Ministry of Education, MICITT
    - Expand the role: ICT +STEM education support
- Consider establishing independent agency for STEM education
    - Under the supervision of MICITT, Ministry of Education
    - Funding from both public and private resources (+ MDB loan)
    - Cooperate with CONAIRE to develop mathematics, science and engineering curriculum and text books for primary and secondary education
    - Math & Science, ICT teacher education & re-training program
    - Youth camp for math, science and engineering fields
    - Emerging field education program (S/W education, program coding, etc)
    - International cooperation for STEM education

Foundation for STEM (STEM foundation)

Ministry of Education

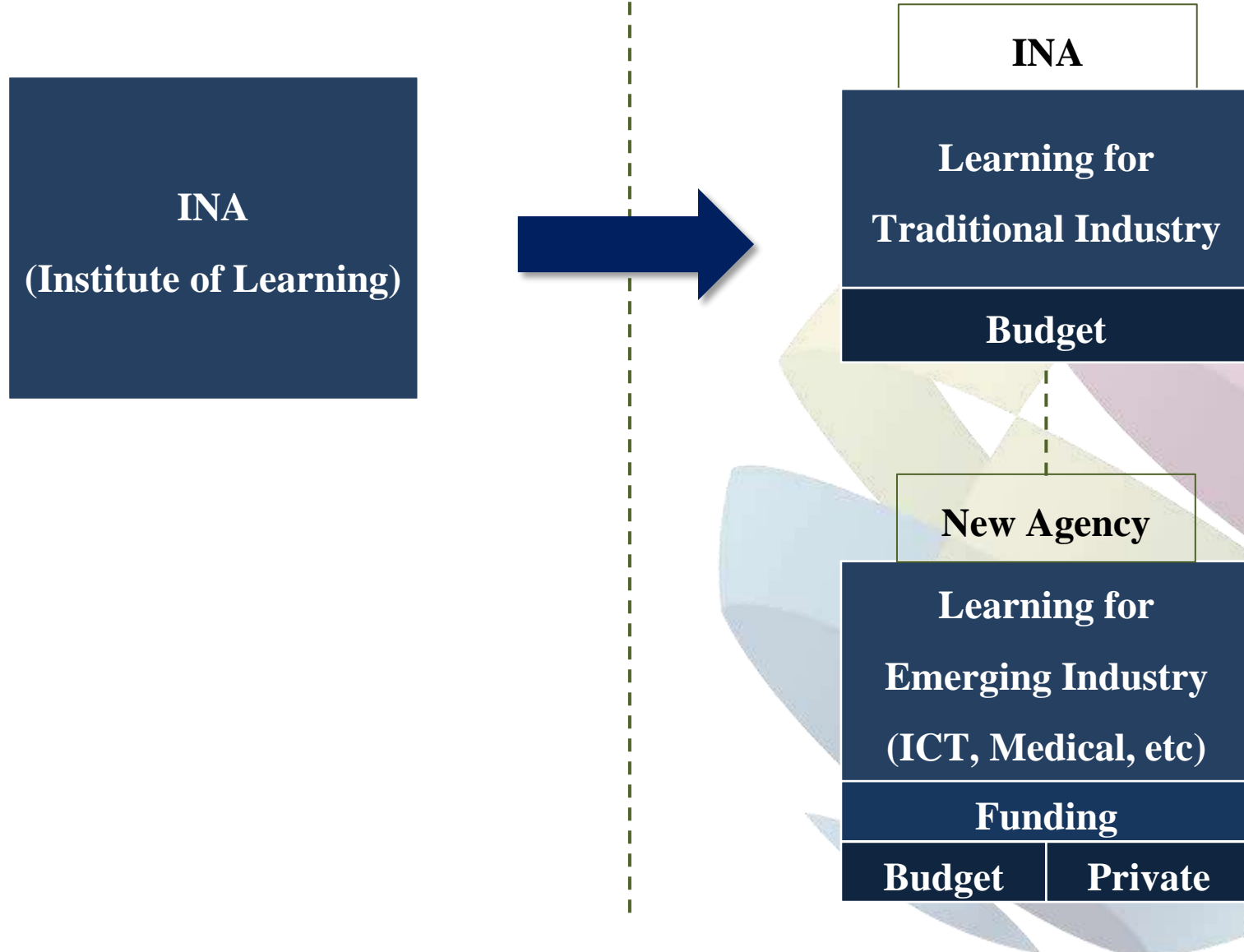**Ministry of S&T and Telecommunication**

STEM Foundation

Funding: Public + Private

Suggestion 7. Reform Institute for Learning (INA)

- INA needs to introduce more flexible employment and training system to catch up with technology progress and ever-changing market demand
  - Separately manage the training department for emerging industry
  - Flexible employment of qualified faculty (contract based)
  - MICITT needs to strengthen collaboration with INA
- In the long run, the GoC may introduce new vocational training agency for emerging industries
  - Under supervision of CPCI
  - Flexible education system focusing on market demand and technology innovation
  - Concentration on investment and education program for emerging industry labor demand (ICT, medical device, nano-tech, pharmaceutical industry, etc)
  - Elastic faculty employment and exit system
  - Flexible education curriculum and evaluation/feedback system
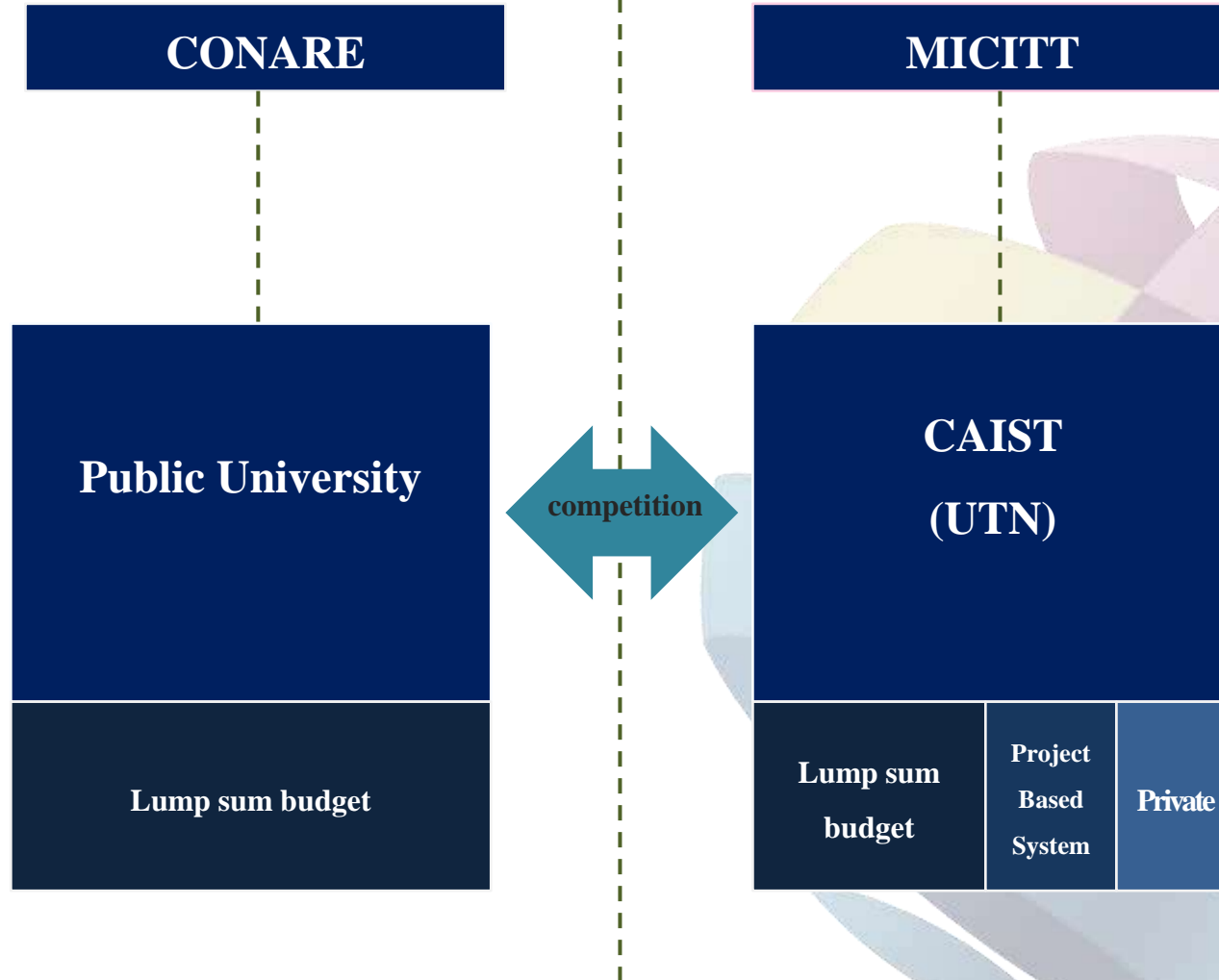 - Implement industrial consignment education (paid by private firm)
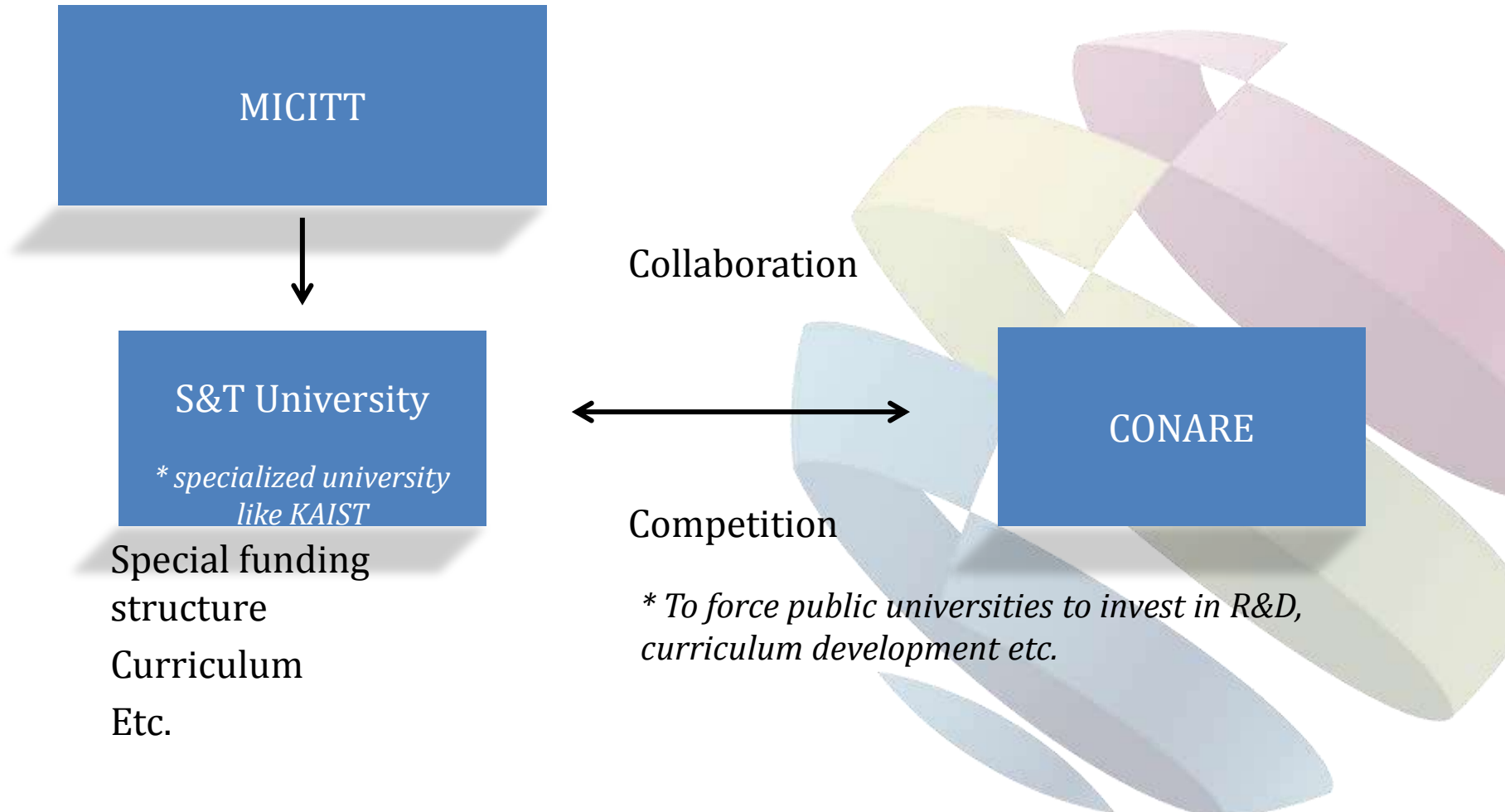
INA Restructuring (in the long run)

INA
(Institute of Learning)

⟶

INA

Learning for
Traditional Industry

Budget

New Agency

Learning for
Emerging Industry
(ICT, Medical, etc)

Funding

Budget	Private

Suggestion 8. Costa Rica Institute of Science & Technology(CAIST)

▪ Need to start a innovative Science & Technology specialized college

- The GoC may consider separating S&T public university (example: UTN) from CONARE to increase R&D funding and enhance the entrepreneurship
- In the long run, the GoC may build up a new S&T university under supervision of MICITT with the MDB funding and partnerships with KAIST
- Encourage competition between public universities & CAIST
- Top priority on Industry-University cooperation and performance based incentive system for both faculty and staff group
- Elastic faculty employment and exit system
- Diverse funding resources (example)
  - Lump sum funding from government : 50%
  - Project based funding from government: 30%
  - R&D project from private firms: 20%
- Invite both Costa Rican talent abroad and foreign engineers

Public university vs CAIST

New system :
Autonomous agency affiliated with MICITT

MICITT

S&T University

specialized university like KAIST

Special funding structure

Curriculum

Etc.

Collaboration

CONARE

Competition

To force public universities to invest in R&D, curriculum development etc.

Thank you