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Sustainable management of natural resources via enhancing knowledge base: experiences from four Latin American countries

Michiko Iizuka, Research Fellow, UNU-MERIT
Fernando Vargas, Jakob Baumann (co-authors), UNU-MERIT

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Outline of presentation

- Motivation
- Theoretical review: NR & Policy intervention
- Conceptual framework: Institutional framework
- Country cases of new institutions
  - Chile
  - Colombia
  - Peru
  - Bolivia
- Findings from the case & Conclusion

Motivation

How can NR rich country develop?

- changing understanding of NR, particularly with regards to Technology and Institutions

What type of institutions and policy intervention are needed?

- changing debates on role of policy interventions

RQ1 : What type of institutional design would enable to link NRs to productivity enhancement through developing STI?
RQ2: What kind of consideration should be made to ensure above institutions to function?(in practice—and issues to be tackled)

• Examine case of LA countries in the 2000s using NR rent to finance Science, Technology and Innovation

Theoretical discussion on NR and development (1) Conventional understanding: NR is dead-end

Argument against NR	Cause	Consequence	Source
Dutch Disease	Strong NR Sector appreciate the local currency	Decline export competitiveness of other sector	Cordon & Neary 1982
Terms of Trade	Commodity	Easily replaced by other product/low income elasticity	Prebisch 1950 Singer, 1950, Sachs and Warner
Enclave	Lack of forward and backward linkages	Not creating value added nor employment	Hirschman, 1958
Corruption	Rent seeking behavior on access to the resources	Prevent effect and fair distribution of benefits across society and generation	Auty, 1990, 1993
Limited Technological/Knowledge development	Supplier dominated industrial activities	Technological development is dependent on other sector/no technological sophistications of own from this sector	Pavitt, 1984

Source: iizuka,2016

Theoretical discussion on NR and development (2): Argument against the NR curse

- **Methodological argument of previous studies (T of T)**
  - Choice of indicator/Period of study/ Analytical methods applied
  - Excluding other important factors: HR, Institutions & physical infrastructure

- **Fundamental/Conceptual argument**
  - Science and Technological development and knowledge associated with NR

Theoretical discussion on NR and development (3): Role of STI for NR : Argument against NR curse2

- **Historical Evidence: case studies (U.S., Australia, Norway, Finland) demonstrates importance of:**
  - Knowledge, technology and institutions to coordinate these relevant actors enable to diversify NR-based activities, increased knowledge intensity and productivity
    - Norway: School of Mines
    - Australia: Common wealth Scientific and Industrial Research organizations: CSIO/CSIR)
- **Local knowledge advantage?** (Perez, 1990, Marin et al, 2015, Iizuka, Soete, 2013)
  - NR create local specific conditions that may lead to competitiveness via STI

Norway: Deep sea oil: drilling and infrastructure

Australia: liquidify oil for easy transport (oil field having being far from port)

Theoretical discussion on NR and development (4): Institutions and policy interventions for for NR

- **'Investing in investing': Capacity building necessary before investing to make profit** (Arezki, Gylfason &Sy, 2012, Collier and Laroche, 2015, Collier, 2010 etc).
  - Long term growth in productivity is tightly related to the capacity to innovate, this also need coordinating across the related stakeholders for certain period of time (Benavente, Crespi, Figal Garone,&Maffioli, 2012).
  - Dealing with market failure that goes beyond macro economic stabilization-industrial policy
    - Information asymmetry
    - Invest in knowledge, Human resources
    - Coordination, system failure

Challenges need overcoming for NR

NR based development require appropriate institutions and policy interventions to overcome follow challenges (Collier, 2010, Ferranti et al, 2002, Humphreys et al, 2007, Dietsche, 2014). **:**

- Volatility of financial flows due to commodity prices
- Escaping from dependence on a few commodities (diversification)
- Enhancing productivity via increasing knowledge intensity of NR-based activities
- Creating linkages from the commodity based activities

But what kind of institutions enable to link NRs to developmental process?

Existing institutions to deal with NR: NRF

Natural Resource Fund (NRF: one type of Sovereign Wealth Fund)

- Government owned fund whose financing is revenue derived from oil, gas or mineral sales at least one of the following objective of: saving for future generations, covering unexpected expenditures, earmarking resource revenues for specific expenditure items.—**Basically dealing with volatility**
- Became popular since the 1990s—many NRF are established to overcome Volatility of financial flows of commodity prices

Balancing Macro economics focused policy-is this enough to change the NR based country?

What type of institutions are necessary in effectively managing NR towards productive development? (RQ 1)

Design Criteria for Institutions to manage NRs for productive development

Static Design Criteria

- **Clear purpose of establishment**
  - *Policy statement clearly stating how NR income is used to invest in STI*
- **Rule based design**
  - *Clear rule exist and leaves limited scope for discretion and corruption*
- **Multiple stakeholder governance**
  - *Decision making is shared among multiple organizations*
- **System to ensure transparency**
  - *Disclosure of information on flow of funds*

Source: Collier & Laroche (2015), Coller & Venables, (2011) , Collier (2010), Hamilton& Ley, (2011), Humphreys and Sandbu(2007), Zahler, Bravo, Goya & Benavente, 2014

Dynamic Design Criteria

- **Develop mechanisms to monitor and evaluate activities**
  - *Correctional mechanism as well as policy learning opportunity*
- **Provision of institutional /managerial capacity**
  - *Whether intended activities were carried out and if so by which organization*
- **NRs are integrated in STI institutions: Policy Mix**
  - *Inter ministerial coordination as well as private-public coordination on using NRs for STI purposes*

Source: Crespi et al (2014), Crespi & Dutrenit (2014)

Methodology and information used in this study

- **Using "Design Criteria" for institutions to manage NRs toward productivity building as the reference point to compare following countries which recently introduced institutions to link NR resources to STRI:**
  - *Chile (2005) , Colombia (2009), Peru (2004) and Bolivia (2007)*
- **Use of secondary sources:**
  - *Legislations, national policy documents, documents from international organizations (i.e. OECD, IADB)*
- **Interviews with key informants**:
  - *Experts working in the area that crosses STI and mining sector*
  - *Interview and follow up questions*
- **Cross check with the informants & external sources**

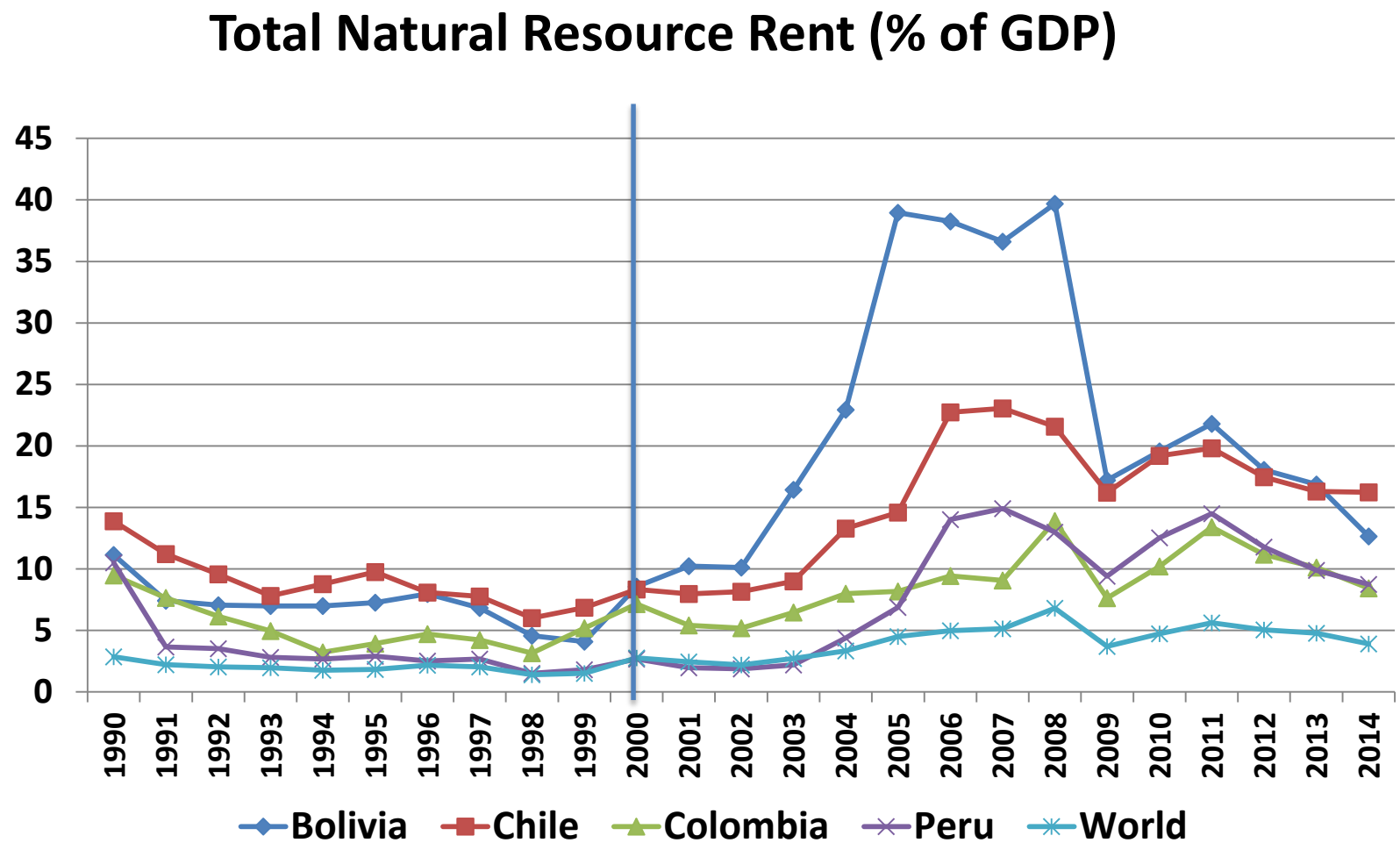
COUNTRY CASES

Cases: general information of 4 countries

2014	**Chile**	**Colombia**	**Peru**	**Bolivia**
Population (millions)	17.70	48.90	30.80	10.80
GDP growth (annual %)	1.89	4.55	2.35	5.40
GDP per capita (current US$)	14,520.0	7,720.0	6,594.4	3,150.5
Income group	High income: OECD	Upper middle income	Upper middle income	Lower middle income
Sectoral value added (% GDP)				
Agriculture	3.3	6.7	7.4	13.3
Industry	35.1	38.2	36.8	38.1
Services	61.5	55.1	55.8	48.6
year	*2014*	*2014*	*2012*	*2013*

Source: World bank Data, 2016

Cases: general information of 4 countries



Source: World bank Data, 2016

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Case 1 : Chile (1)

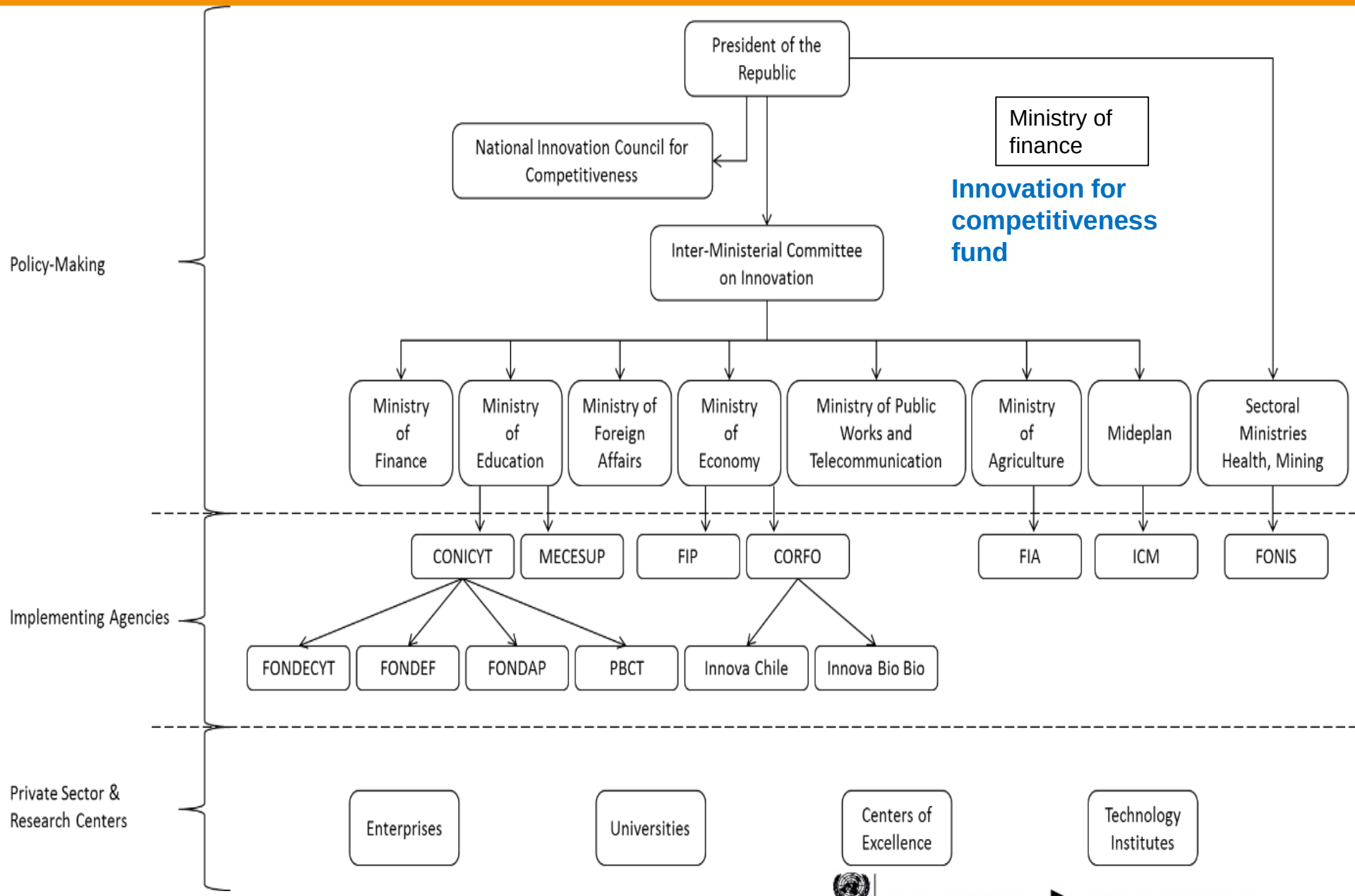
Background

- **Chile has NRF since 1987: controlled volatility but limited impact on productivity**
  - Successful in keeping volatility of NRs away but unsuccessful in creating a ground to diversify economy, enhance productivity &increase knowledge intensity
  - Resource boom actually increased the dependency on copper despite earlier efforts in diversify its economy

- **2000s onwards**
- Economic policy gradually starts to shift towards allowing more policy intervention to take care of market failure and coordination failure in more systemic manner shifting from demand side approach to more supply side approach(Crespi and Dutrenuit, 2014).

Case 1 : Chile (2)

- **Law No. 20097 (2006):** takes progressive royalties from copper production(in volume) to be used for innovation.
- **Fund for Innovation for Competitiveness (FIC) (2005) & National Innovation and Development Council(CNID*)** established by **presidential decree no 1408 (revision no. 177, 2015)** in 2005 to design long-medium term STI strategy, monitor and evaluate & private-public platform to advice President
- **CMI (Inter ministerial Council)** chaired by Ministry of Economy established in 2007 to execute over FIC and inter-ministerial coordination (Separated due to OECD policy review)
- **Implementation agencies (CORFO, CONACYT etc)** specialized agency to monitor fund applicants
- **Regional Development Agency (ARDP)** regional agency established in 2006-7, responsible for strategic planning at regional level, coordination with other regional and national bodies.



Source: OECD, 2014

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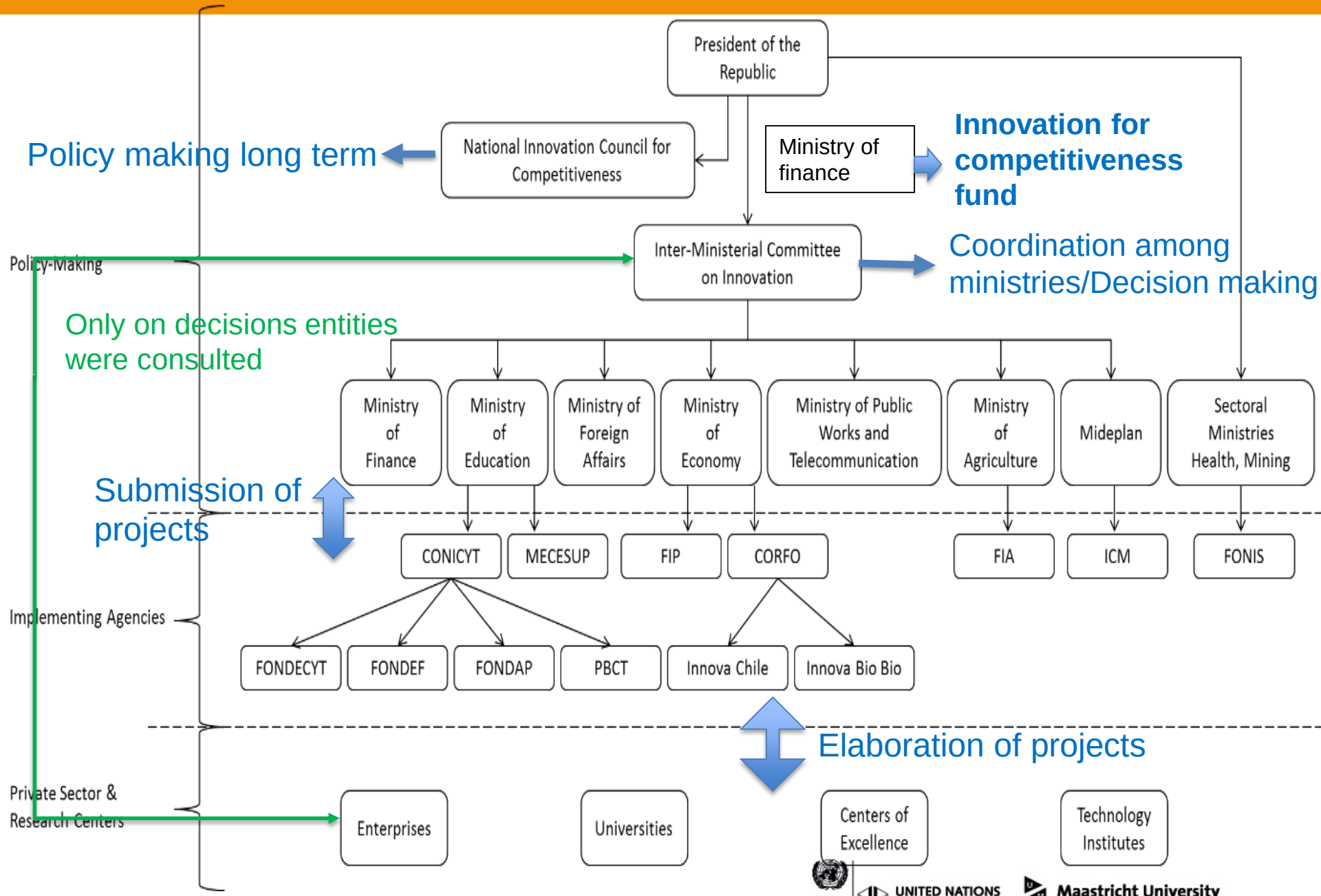

Source: OECD, 2014

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Case 1 : Chile (3)

- **Amount allocated for FIC:** USD 195.1 million (2014)(0.076% of GDP), increased from US$81.1million (2006)
- **Allocation of FIC: since 2008**
  - 75% **FIC National** executed by CMI in Santiago chaired by Min Econ
  - 25% **FIC Region** executed by Regional government (ADRP) manage; of which
    - 60 % goes to mining regions and;
    - 40% goes to non mining regions
    - 20% of regional FIC needs should be allocated to university or research centers in the regions
    - Need to negotiate with Ministry of Economy on disbursement

- **Access to fund:** Private sector and Implementing agency (public agency) prepare proposal and submit to Division of Innovation in Ministry of Economy. This is evaluated by CMI and other related ministries
- Ministry and Economy is in charge of monitoring financial flow

Case 1 : Chile (4) Challenges identified

- **M&E** has no clear feedback loop for policy learning
- **Coordination** entity CMI & CNID are not strong enough coordinate/guide ministries with different interests on use of FIC.
  - Negotiate without resources
  - Decentralization and **capacity gap** in the regions
  - Unclear division of responsibility at regional level (e.g. Regional Government & ARDP monitoring and evaluation difficult)
- Tension between Ministry of Finance and Ministry of Economy in use of FIC
- **Continuity : due to the legal nature of establishment, activates of CNI and CNID is influenced by political cycle.**

Quick Diagnostics: Chile

Static Criteria		Dynamic criteria	
1) Clear purpose of statement	X	1) Monitoring and Evaluation for policy learning	?
2) Rule based design	X	2) Institutional /managerial capacity	?
3) Multiple stakeholder governance	X	3) NR integrated in STI institutions: Policy Mix	X
4) Transparency on money flow	X		

Case 2: Colombia (1)

Background

-In 2010 Colombia issued National Development Plan 2010-2014. This document states potential of exploiting NRs to enhance productivity

-Influenced by Chile, adapts the similar institutions. This marks great change from the past (1994 law) where

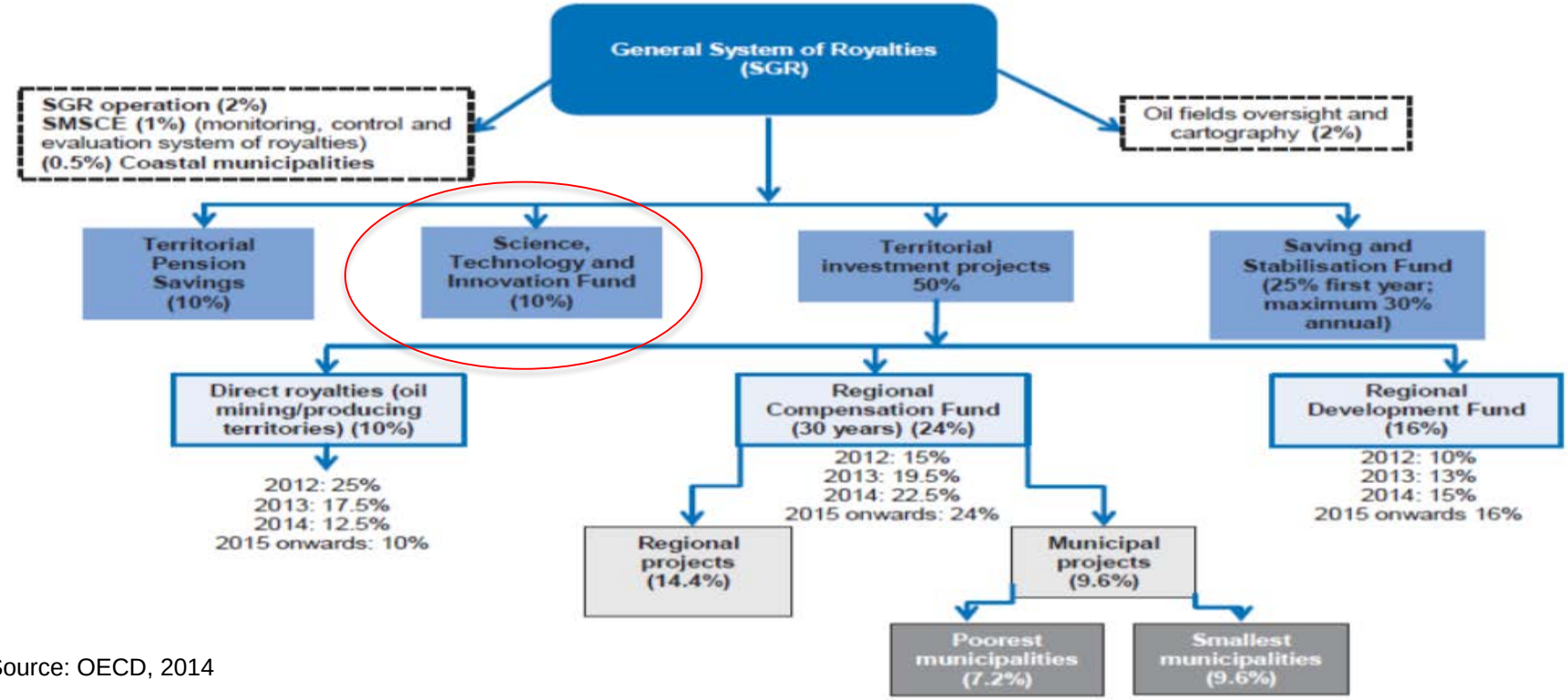
- 80% of the Mining Royalties revenue were allocated to mineral producing regions(where 17% of population lives) and
- 20% were National Royalty Fund to finance mining infrastructure.

-New law: SGR: General Royalty system: among other things making the NR resources to non-mining regions.

- Allocation of NR funds for STI were calculated based on basic needs calculation

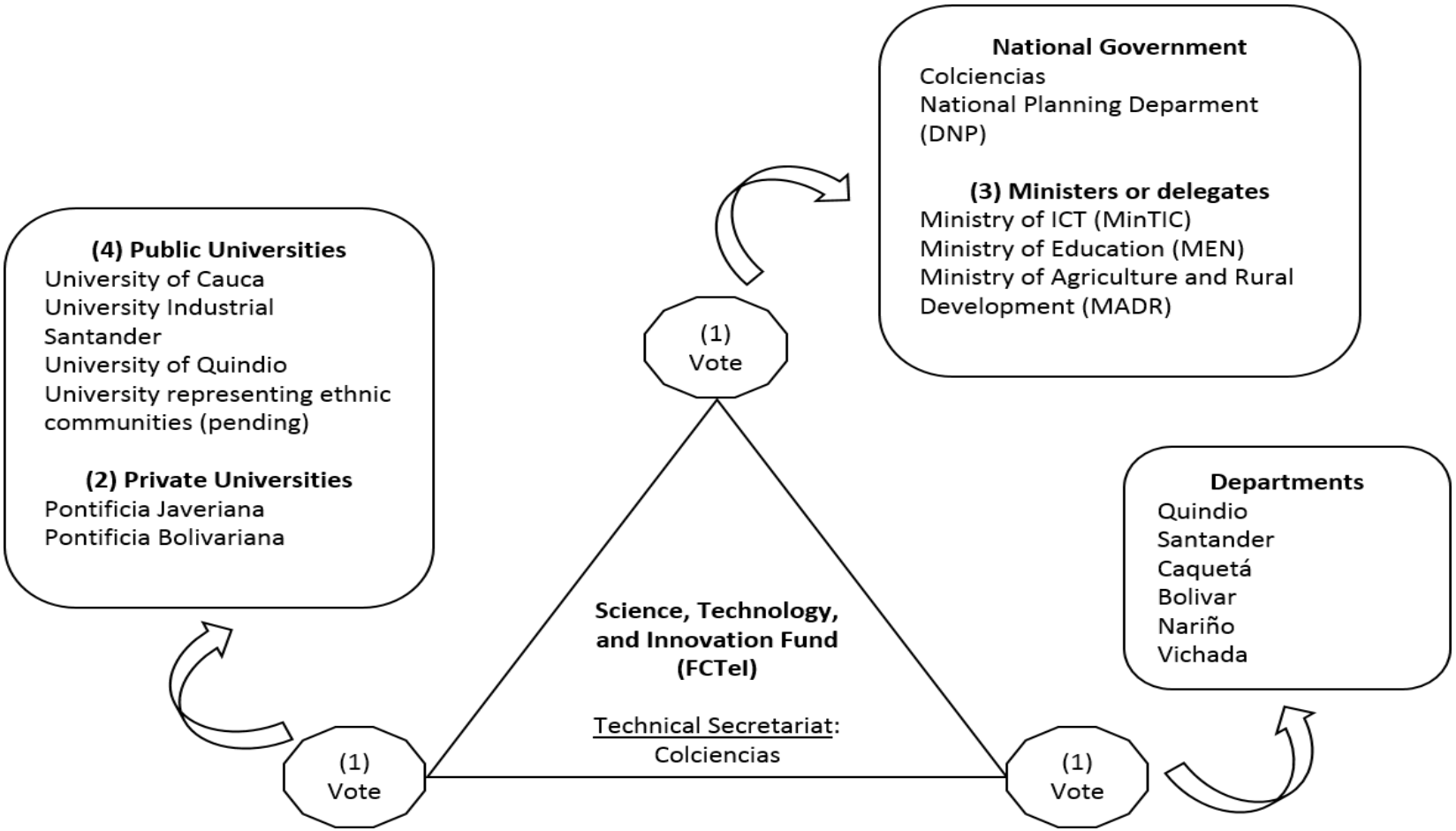
Case 2: Colombia (2)

- **General System of Participation (SGP) (Law No. 05/Law No. 1530) allocated mining royalties based on formula on basic needs:**
  - **Creation of STI fund: FCTeI (10%)**
  - **Creation of NRF** called Saving and stabilization Fund (25% first year, max 30%)
  - Territorial investment projects (50%)
  - Territorial pension savings (10%)



Source: OECD, 2014

Case 2: Colombia (3) How funds were used?



Source: based on Colciencia

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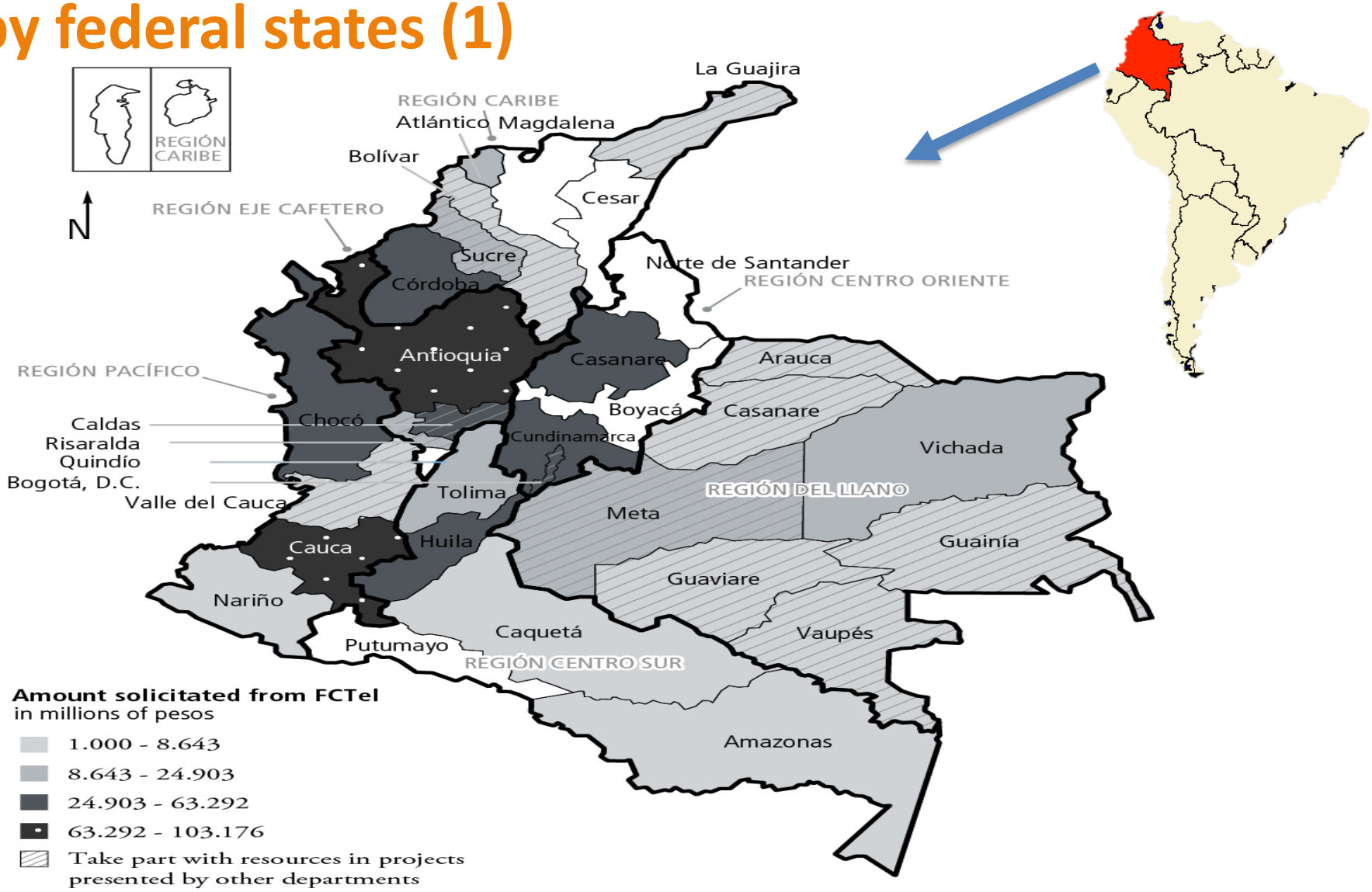
Case 2: Colombia (4)

- **DNP** will selectively evaluate project approved by OCAD (M&E)
- **Monitoring and evaluation system embedded in the system (as identified in the budget system)**
- **Regional institutions were established CDECTI (Departmental Council for Sci, Tec & Inno) &PEDCTI (Departmental Strategic Plan for Sci, Tech& Inno) to draft regional strategies to choose appropriate projects**
  - Strengthened by law no. 1286 (2009), establish the priority to invest STI in department (subnational level): Regional role was strengthened

Colombia: differences in use of allocated funds by federal states (1)



Source: based on Colciencia

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Colombia: Use of allocated funds (2)

Department	% being used(2015-2016)		% being used(2012, 2013-14)
AMAZONAS	91.9		59.8
ANTIOQUIA	93.4		6.3
ARAUCA	86.4		2.4
ATLÁNTICO	72.0		0.0
BOGOTÁ	91.1		19.9
BOLIVAR	32.3		52.5
BOYACÁ	42.0		6.0
CALDAS	77.5		0.0
CAQUETÁ	95.9		64.9
CASANARE	71.4		4.1
CAUCA	82.6		6.5
CESAR	69.2		65.1
CHOCÓ	81.9		0.0
CÓRDOBA	80.1		34.0
CUNDINAMARCA	85.8		21.9
GUAINÍA	86.7		54.6
GUAJIRA	73.5		5.0
GUAVIARE	59.0		7.0
HUILA	57.1		41.3
MAGDALENA	77.8		6.1
META	61.1		0.0
NARIÑO	52.5		23.8
NORTE DE SANTANDER	59.7		0.0
PUTUMAYO	39.4		4.2
QUINDÍO	74.9		0.0
RISARALDA	104.5		0.0
SAN ANDRÉS	0.0		39.3
SANTANDER	86.3		37.4
SUCRE	52.3		14.2
TOLIMA	86.9		30.5
VALLE DEL CAUCA	55.3		1.9
VAUPÉS	30.8		14.9
VICHADA	87.6		56.6
TOTAL	69.8		22.3

Source: based on Colciencia

Case 2 Colombia: Problems identified

- **Capacity gaps exist** among department (as can be seen in the variability in spending allocated amount of funds)
  - Bottom up decision making process
  - Federal government
  - Distribution of human resources
- **Coordination** at national level is difficult due to :
  - Limited power of Colciencia over the funds
  - Multiple governance structure: sometime decision making takes too long
  - Federal governments have too much power over NR fund

- **Monitoring and evaluation** system was installed but feedback loop was not clear

Quick Diagnostics: Colombia

Static Criteria		Dynamic criteria	
1) Clear purpose of statement	X	1) Monitoring and Evaluation for policy learning	?
2) Rule based design	X	2) Institutional /managerial capacity	?
3) Multiple stakeholder governance	X	3) NR integrated in STI institutions: Policy Mix	X
4) Transparency on money flow	X		

Case 3: Peru (1)

Background

In Peru, from the 2000s, enhancing productivity became critical goal
This is due to:

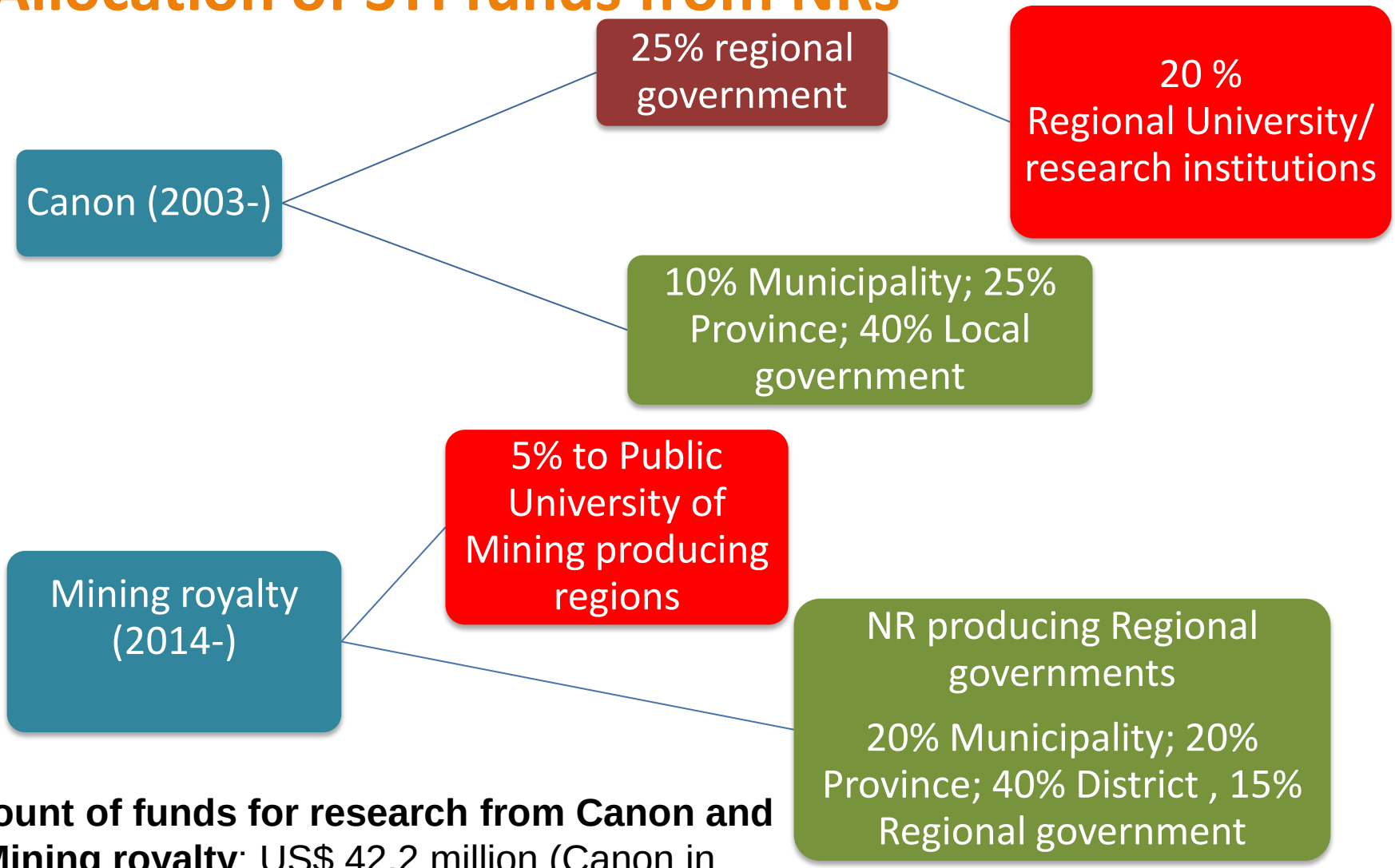
- Since of urgency: high economic growth in Peru between 2004-2013 did not increase productivity, diversity nor reduce income disparity or the rate of informal economy.
- Overall trends of more policy intervention approach in the LA
- Chile's influence

Hence, from the 2000s, many attempts were made to invest in STI; however, these are rather dispersed attempt and were not very much materialized until consolidation of STI institutions with the Supreme Degree in 2016.

Case 3: Peru (2)

- NR Tax with financing link to STI: **Canon & Mining Royalty**
  - **Canon** is the share of total income from the exploitation of natural resources that goes to regional and local government.
  - **Mining royalties** are the economic remunerations paid to the state to exploitation of metallic and non metallic mineral resources.
    - **Canon law** is established by the law no.28077 in 2003.
      - **20%** of regional government fund to the public universities in their regions.
    - **Mining royalty** is established by law 29788 in 2011.
      - **5% of mining royalty goes to public universities** in mineral producing regions.
  - Research institutions can only use this fund for **research purposes**

Allocation of STI funds from NRs



Amount of funds for research from Canon and Mining royalty: US$ 42.2 million (Canon in 2014); US$ 8.1 million (Mining Royalty in 2014). The total of two are 0.025% of GDP.

Case 3: Peru (3): Problems identified 2

- **Lack of capacity in the public university** to use funds allocated
  - Regional/mining producing regions may not have research capacity
  - Lack of flexibility of fund use : much of the funding are used for physical infrastructure (research related) but not on research nor on training of new researchers.

- **Coordination problem**
  - conflictive relationship between University and Ministry of economies on use of funds from NR tax
  - Lack of coordination (until recently) with STI and NR funds

- **M&E** is done by NGO and not by the public sector
  - Lack feedback loop for policy learning

Quick Diagnostics: Peru

Static Criteria		Dynamic criteria	
1) Clear purpose of statement	X	1) Monitoring and Evaluation for policy learning	?
2) Rule based design	X	2) Institutional /managerial capacity	?
3) Multiple stakeholder governance	?	3) NR integrated in STI institutions: Policy Mix	?
4) Transparency on money flow	X		

Case 4: Bolivia (1)

Background

Several tax regime for NRs exploitation exist in Bolivia. These are:

- Mining royalty (Law 535, 2014),
- Hydrocarbons Royalty (Law 3058 2005),
- Special tax on hydrocarbons and its derivate (Law No. 1606, 1994), and
- Direct tax on Hydrocarbons (IDH) (Law No. 3058, 2005).

IDH is the only one that has links to financing Universities.

Use of NRs changed significantly since 2006 when all NRs are nationalized

Statement linking the use of NR for national development is present in

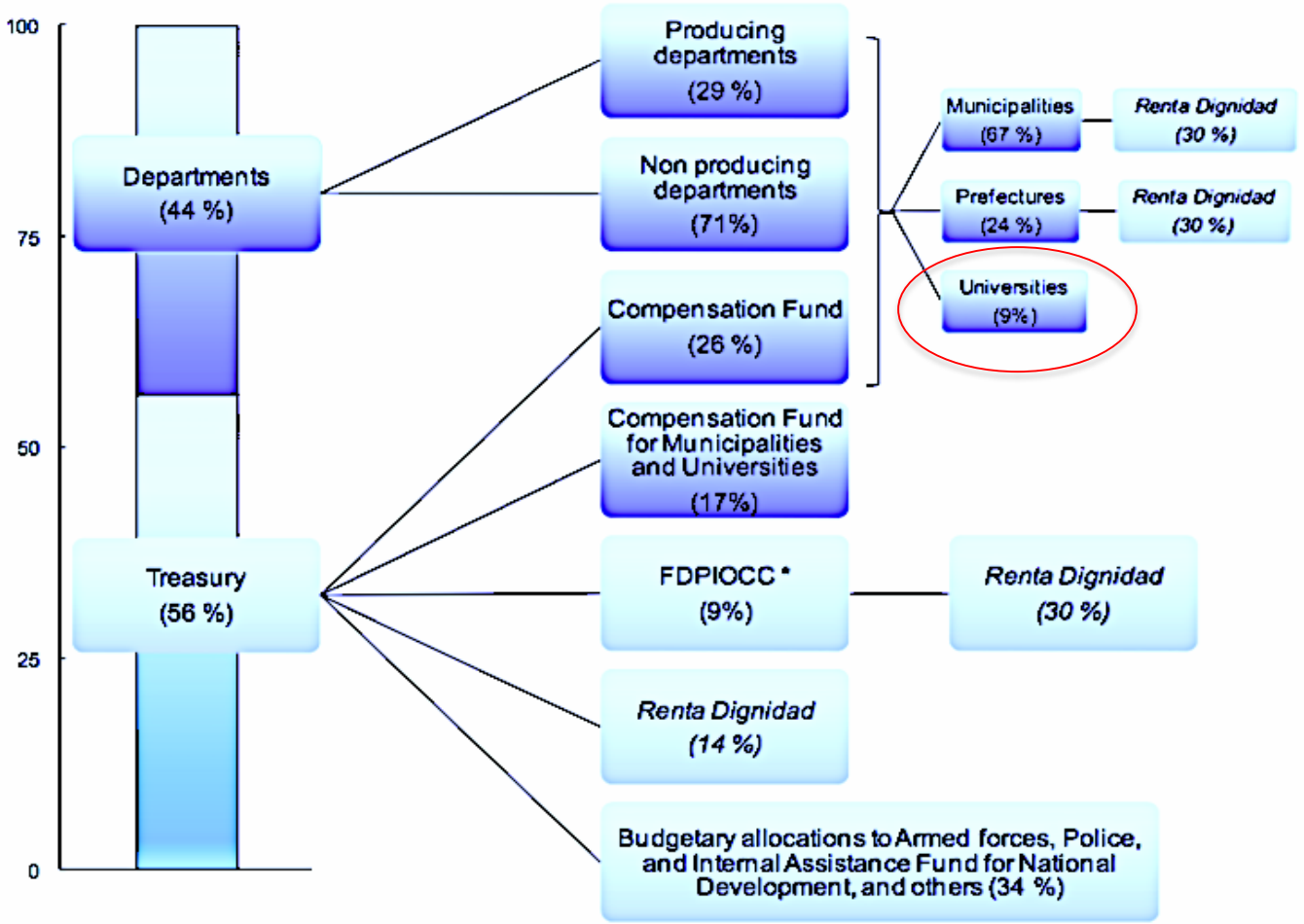
- National Development Plan
- New Constitutions in 2009.
- Agenda Patriotica de Bicentinario 2025 (2013)

The STI is important but emphasis were perhaps placed on poverty reduction in the regions.

Case 4: Bolivia (2)

- **Supreme Decree no. 29322 (2007) allocate 8.68% of hydrocarbon tax (IDH)** allocated to public universities in the regions.
- If there were more than one university in the region, allocation were to be decided by the Ministry of Economy and Finance, Ministry of Education and CEUB (association of universities) and benefiting universities.
- Total IDH allocated to Public University is US$ 192 million (2013). This is 0.58% of GDP. The NR fund increased almost 3 times since 2007.
- In 2013, much of funds are not spent and if it were spent, spent on public infrastructure due to the lack of capacities at the level of university and Ministry of Economy and finance

IDH: revenue sharing and Earmarking arrangements (2009)



Notes: * FDPIOCC: *Fondo de Desarrollo para los Pueblos Indigenas, Originarios y Comunidades Campesinas.*
Based on CEDLA (2009)

Expenditure of IDH by public university (2013)

In Millions of bolivianos

University	Transfer TGN*	Infrastructure & Academic Equipment	Processes of Evaluation & Accreditation	Programs for the Improvement of Quality & Academic Performance	Research on STI in the Framework of Development Programs	Programs of Social Interaction for the Poor	Total Amout spent	Spending of resources in %
UMSFX	83,53	26,15	0,02	5,71	0,00	8,33	40,22	48,15%
UMSA	130,53	2,50	0,00	38,96	0,76	0,41	42,63	32,66%
UPEA	54,89	26,85	0,00	0,03	0,06	0,00	26,94	49,07%
UMSS	136,03	12,07	1,01	4,96	1,77	0,52	20,32	14,94%
UTO	83,53	55,02	0,03	11,03	0,30	0,10	66,48	79,59%
UATF	30,90	14,93	1,77	5,28	0,02	0,44	22,43	72,59%
UNSXX	52,62	29,41	0,00	0,00	0,00	0,00	29,41	55,90%
UAJMS	110,59	98,31	1,26	19,34	0,05	0,00	118,96	107,57%
UAGRM	189,84	186,43	0,69	37,52	0,90	0,19	225,73	118,90%
UTB	83,53	58,69	0,21	0,00	2,37	0,00	61,26	73,35%
UAP	83,53	6,39	33,02	27,45	0,10	0,01	66,97	80,18%
TOTAL	1.039,52	516,75	38,01	150,29	6,31	10,01	721,36	69,39%

*Source: Ministerio de Economía y Finanzas Públicas (n.d.). Note: *TGN, National General Treasury*

Note: UMSFX: Universidad San Francisco Xavier, UMSA: Universidad Mayor de San Andrés, UPEA: Universidad Pública de El Alto, UMSS: Universidad Mayor de San Simón; UTO: Universidad Técnica de Oruro;

UATF: Universidad Autónoma Tomas Frías; UNSXX: Universidad Nacional Siglo XX; UAJMS: Universidad Autónoma Juan Misael Saracho; UAGRM: Universidad Autónoma Gabriel René Moreno; UTB: Universidad Tecnológica Boliviana; UAP: Universidad Amazónica de Pando.

Case 4: Bolivia (3)

Problem identified:

- Capacity gaps among regional public university to use the funds for STI purposes;
- STI institutions are weak and link with NRs resources is weak. There were no active participation on STI related agency: Vince ministry of Science and Technology (VyCT)
- Also VyCT cannot coordinate Universities due to lack of means to govern.
- Lack integrated design on STI and NRs
- Lack of/weak monitoring and evaluation mechanisms: University is independent, only check is by the auditing
- Coordination power of VCyT weak due to lack of resources and political power

Quick Diagnostics: Bolivia

Static Criteria		Dynamic criteria	
1) Clear purpose of statement	X	1) Monitoring and Evaluation for policy learning	?
2) Rule based design	X	2) Institutional /managerial capacity	?
3) Multiple stakeholder governance	?	3) NR integrated in STI institutions: Policy Mix	?
4) Transparency on money flow	X		

Country cases: main diagnosis on Criteria 1

All countries are influenced by knowledge economy concept with shfit towards stronger role of policy in the 2000s

- All countries comply with **Static Design Principle** but differs slightly in the degrees of implementation
  - **Policy statements**: clearly stated all countries examined but implemented differently → Dynamic criteria
  - **Law is used to define use/allocation of NR(all)** but some countries use **presidential decree for STI** (Chile, Peru, Bolivia) to establish STI institutions in managing STI
  - **Multiple stakeholder governance**: **complex** (Chile and Colombia), **simple** (Peru and Bolivia)in both cases, institutional capacity is still lacking
  - **System of transparency**: all publish information on money flows

Country cases: main diagnosis on Criteria 2

- **Dynamic design principle shows common problems**
  - **M&E**: Differences in implementation but all countries lacks clear feedback loop to improve policy via learning
  - **Capacity**: Capacity gap exist in the regions—decentralization efforts need to accompany with capacity building
- **Degree of integration of NR funds to STI policy**: integrated (Chile &Colombia) not integrated (Peru &Bolivia)

Policy implications 1

Areas of considerations when designing institutions

- **Right balance between rigidity and flexibility of regulations for investing in STI**
  - Having phasing out/in for implementing regulations with capacity building may lead to better implementation outcome in long run;
- **Defining appropriate strength of role of coordinating agency** so that it can negotiate with other ministries as well as private sector
- Appropriate way to let **private sector participate in decision making** while preventing regulatory capture
- **Maintaining continuity of the policy**: legal (hard) vs private sector involvement (soft)
- **Establish M&E with feed back loop** to generate policy learning important in adjusting above in dynamic manner

Policy implications 2

- Complying with Static design criteria may not be sufficient conditions for the implementation.
- Dynamic criteria focus on effective implementation process and continuation of system installed.
- Capacity building of public institutions (policy makers and administrators) necessary, especially in regions. This is ’investing in investing’.

Natural resource and productive development: Wrapping up

- Natural Resources plays role in development process and Institution and technology plays an important role
- LA countries studied, in the 2000s, started STI institution building with policy implementation in attempt to link NR funds to STI
- Key is to identifying the appropriate intuitions that can Integrate STI to NR resource use and enable to coordinate with continuous basis.
- Capacity development is necessary not only the recipient of the Funds but managers of the funds (Policy makers in the regions)
- How to incorporate Private sector (not only in decision making but plannig stage) is another issues to be considered

Limitation of this case for applying to other regions

All the LA cases happened with following background

- Sound political economy context; somehow all the actors' different interests were aligned to change the way
- Sound financial background of increasing inflow of money
- Regional example: demonstration effect
- Financial facility to promote STI activities: e.g. IADB

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