



WORLD BANK GROUP

**Financial Instruments Supporting
Innovation Workshop**

1-2 March 2017

Belgrade, Serbia

Technology Transfer: Instruments and Market-based Incentives

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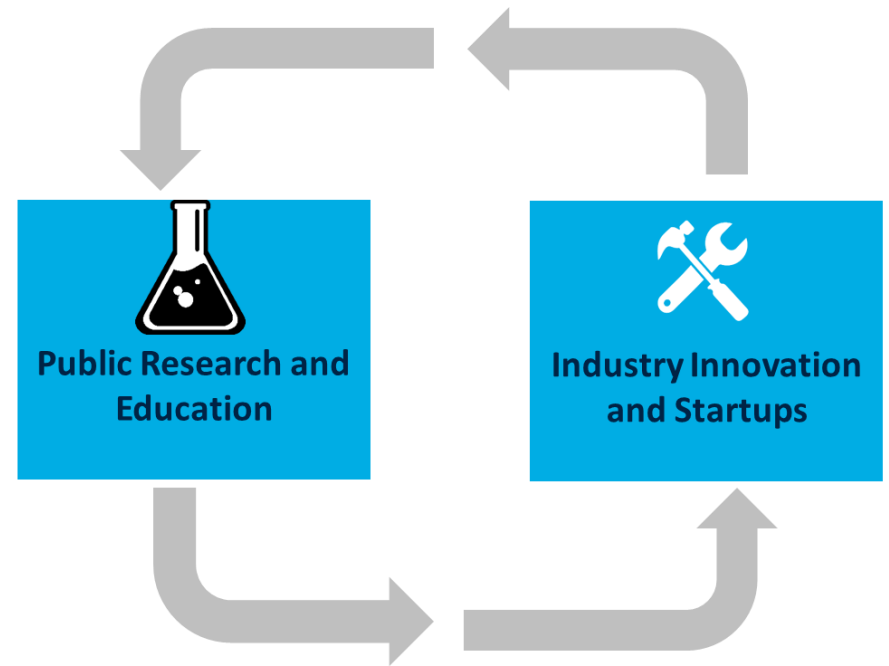
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Europe and Central Asia (ECA)

Trade & Competitiveness Global Practice

Presentation Outline

- I. Economics of Tech Transfer
- II. Contextual Challenges
- III. Framework
- IV. Instruments
- V. Main Takeaways



I. Economic Theory: Knowledge

Knowledge is the driving force key to the growth and employment creation inherent in the process of economic development

Where does knowledge come from?

- “Falls from heaven”, capital accumulation (Solow, 1957)
- Supply side - New Growth Theory, role of institutions in investing in knowledge creation and accumulation (Griliches, 1979; Romer, 1986; Lucas, 1988)
- Demand side – enterprises as conduit for spill overs of knowledge (Audretsch et al., 2012)

Does this spillover occur automatically?

- Penetrating the “Knowledge filter” (Aldridge & Audretsch, 2010)

I. Economics of Tech Transfer: Market Failures

Information Asymmetry

- Valuation of discovery
- Uncertainty about appropriation

Incentive misalignment

- Short-term/incremental improvements versus academic achievements
- Legal and regulatory framework and the incentives for collaboration

Access to specialized resources and support mechanisms

- *Information*: matching, valuation, market intelligence
- *Finances*: bridging the “valley of death”
- *Skills*: commercialization specialized skills

I. Economics of Tech Transfer: Systems Failure

- **Network failures:** lack of linkages between firms and institutions in the ecosystem, resulting in loss of opportunities for learning/ complementarities
- **Institutional failures:** Weak governance of the innovation ecosystem; universities and research institutions; intermediary institutions
- **Framework failures:** regulatory framework; investment climate; competition policy; background conditions (entrepreneurial culture)

II. Contextual Challenges of Tech Transfer in ECA

Generally, “*European Academic Paradox*”

- Strong science, weak commercialization

Legacy issues: readjusting research orientation

- RDIs traditionally designed to serve SOEs
- Linkages to SMEs were absent

SMEs’ limited capacity to identify tech., organizational, and managerial needs

- Demand for tech transfer (*its nature & channels*) strongly determined by level of economic development in the region
- Low levels of private R&D investment amplifies role of publicly-funded R&D

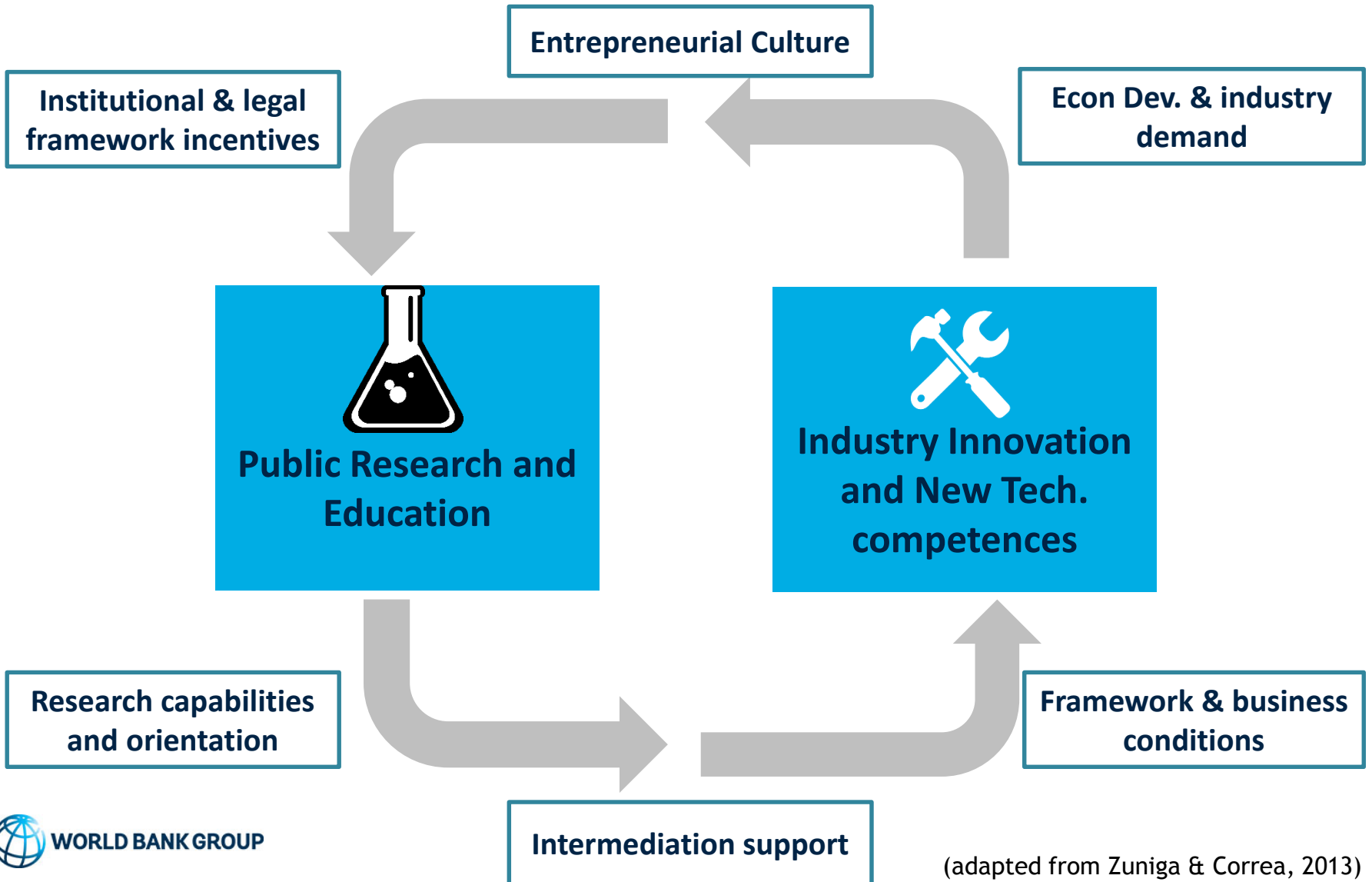
Commercialization specialized skills and technical capacity

- Importance of tacit knowledge and learning by doing

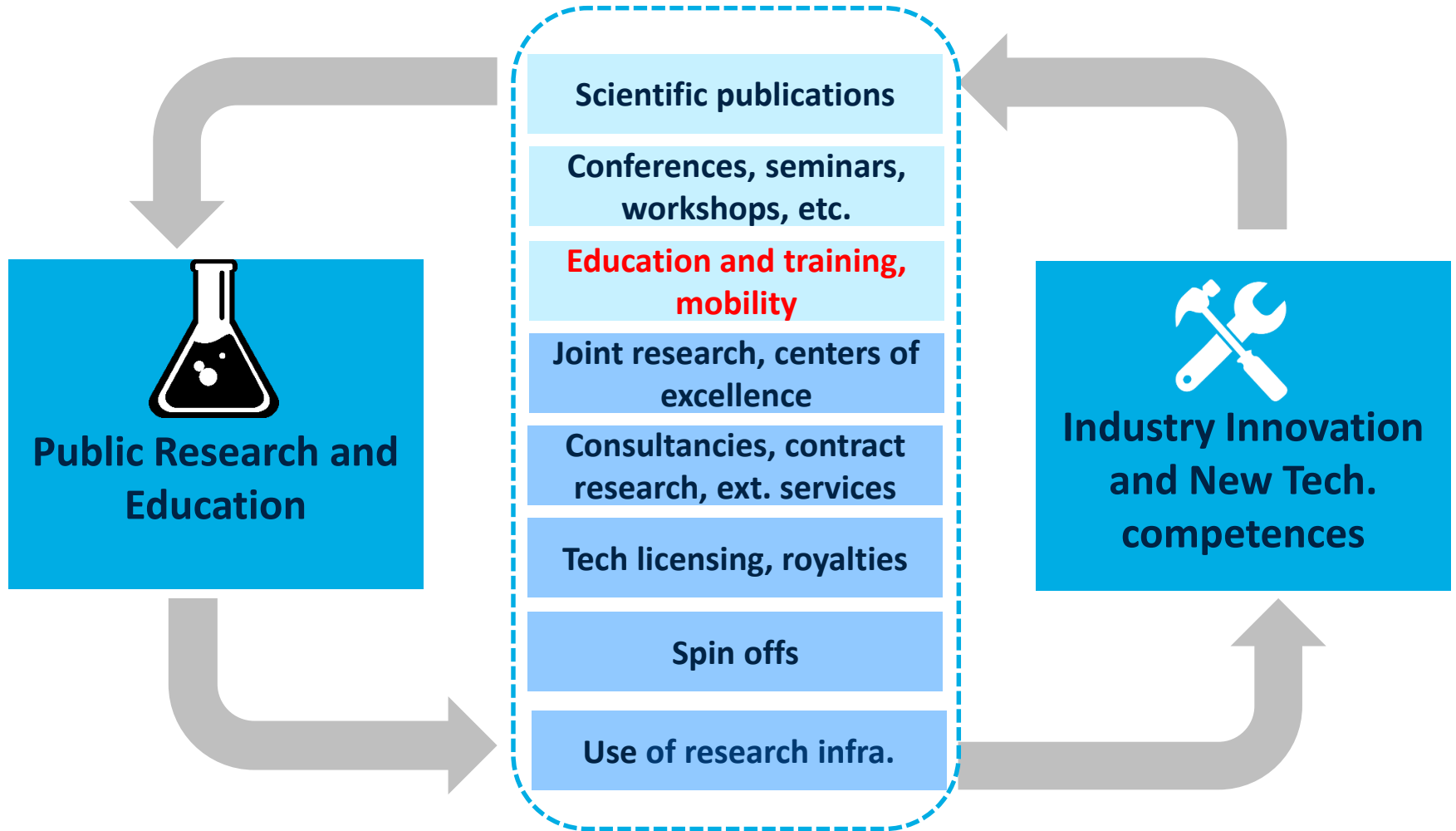
Entrepreneurial culture & institutional framework

- Incentive structure, risk taking, research governance, IPR regime, access to finance, degree of internationalization

III. Framework: Tech Transfer and Shaping Conditions



III. Framework: Formal and Informal Channels for Tech and Knowledge Transfer



III. Framework: University TTOs as a Platform for Tech Transfer

Primary objectives of the UTTO	Percentage of times appeared in mission statement (%)
Licensing for royalties	78.72
IP protection/management	75.18
Facilitate disclosure process	71.63
Sponsored research and assisting inventors	56.74
Public good (disseminate information/technology)	54.61
Industry relationships	42.55
Economic development (region, state)	26.95
Entrepreneurship and new venture creation	20.57
<i>N</i> = 128 TTOs.	

(Markman et al., 2005)

III. Framework: University TTOs as a Platform for Tech Transfer

Licensing

- Bayh-Dole as one of several key influences behind the increase in university patenting and licensing (Mowery et al., 2001)
- Increased disparity in licensing incomes of US universities with those in other countries (WIPO, 2011)
- In terms of licensing, European TTOs performed comparably to their US counterparts but earned significantly less revenue from licensing activities (Conti & Gaule, 2011)

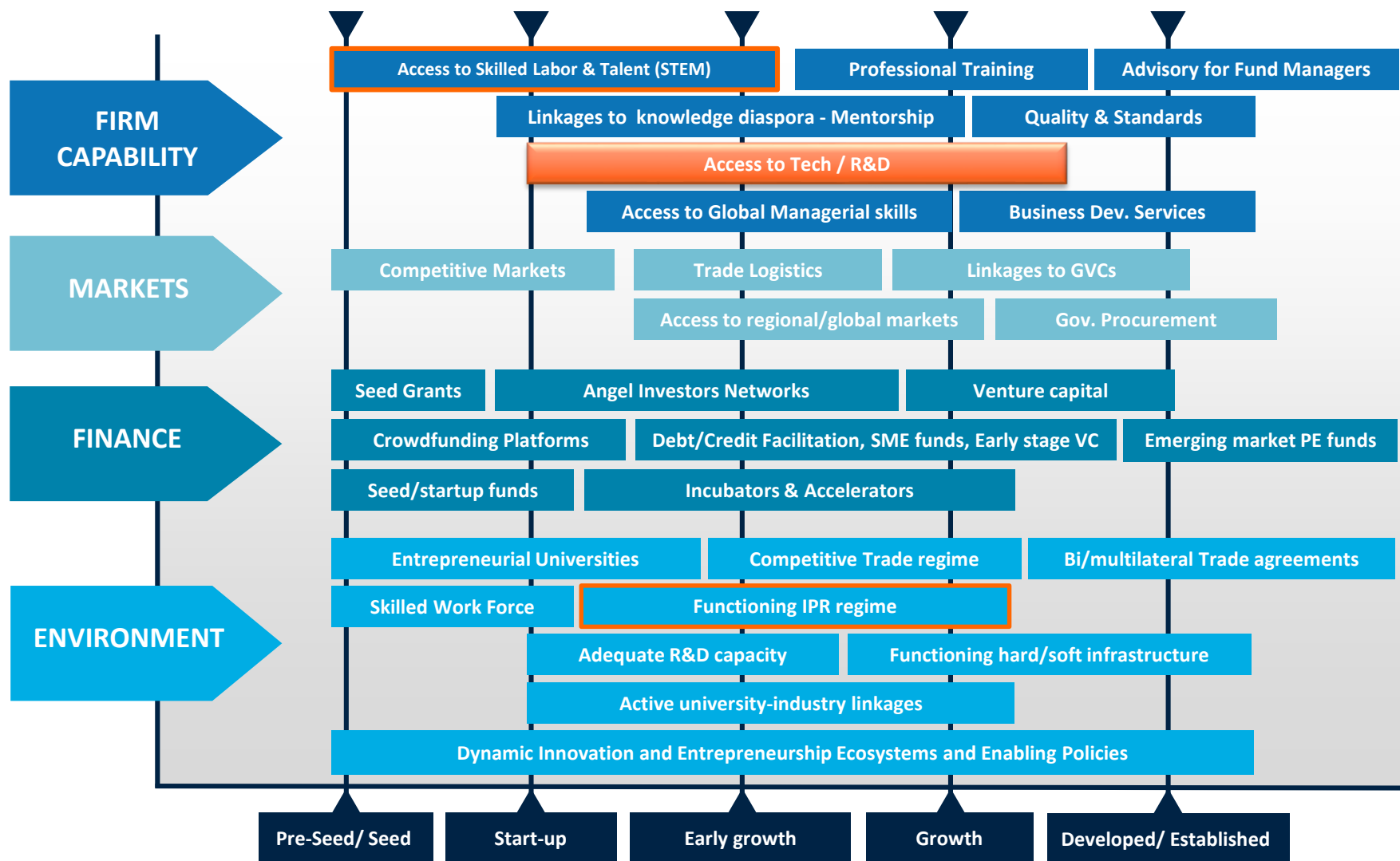
Academic Entrepreneurship (AE)

- Startups emanating from US universities reported by AUTM averaged 426 per year from 1998 to 2004
- Many Spin-off activities that occur “through the back door” (Shane, 2004).
- “Social Capital” - Network Assets as a catalyst for AE (Aldridge & Audretsch, 2010)
- Need to adapt promotion and tenure and remuneration systems for academics

TTOs versus “Hubs for Entrepreneurship” support

- TT officers may or (*more likely*) may not have the networks needed to connect academic entrepreneurs to the 'right' resources and contacts
- Conflict of interest: short-term revenue goals versus long-term goals of AE
- TTOs may be impeding compared to a decentralized network approach (Hayter, 2016)

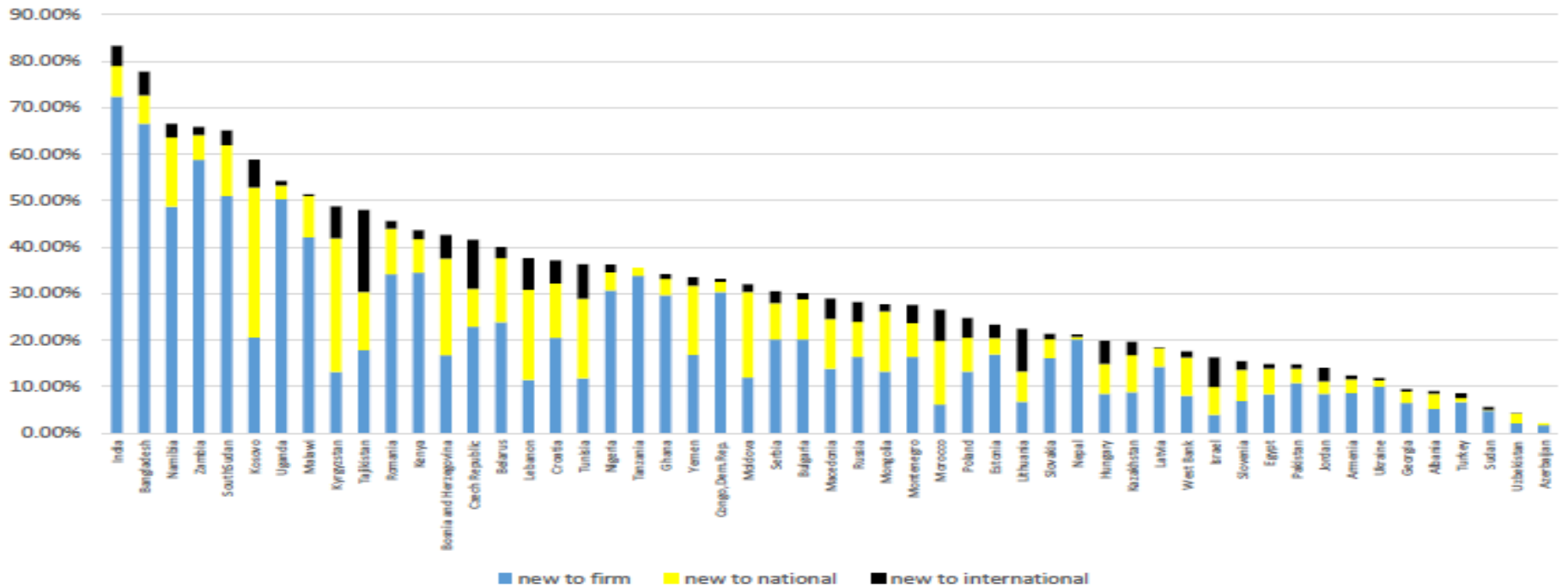
III. Centrality of the Firm: Tech Transfer as Leverage for Upgrading Firm Capability



III. Centrality of the Firm: Nature of Innovation in Developing Economies

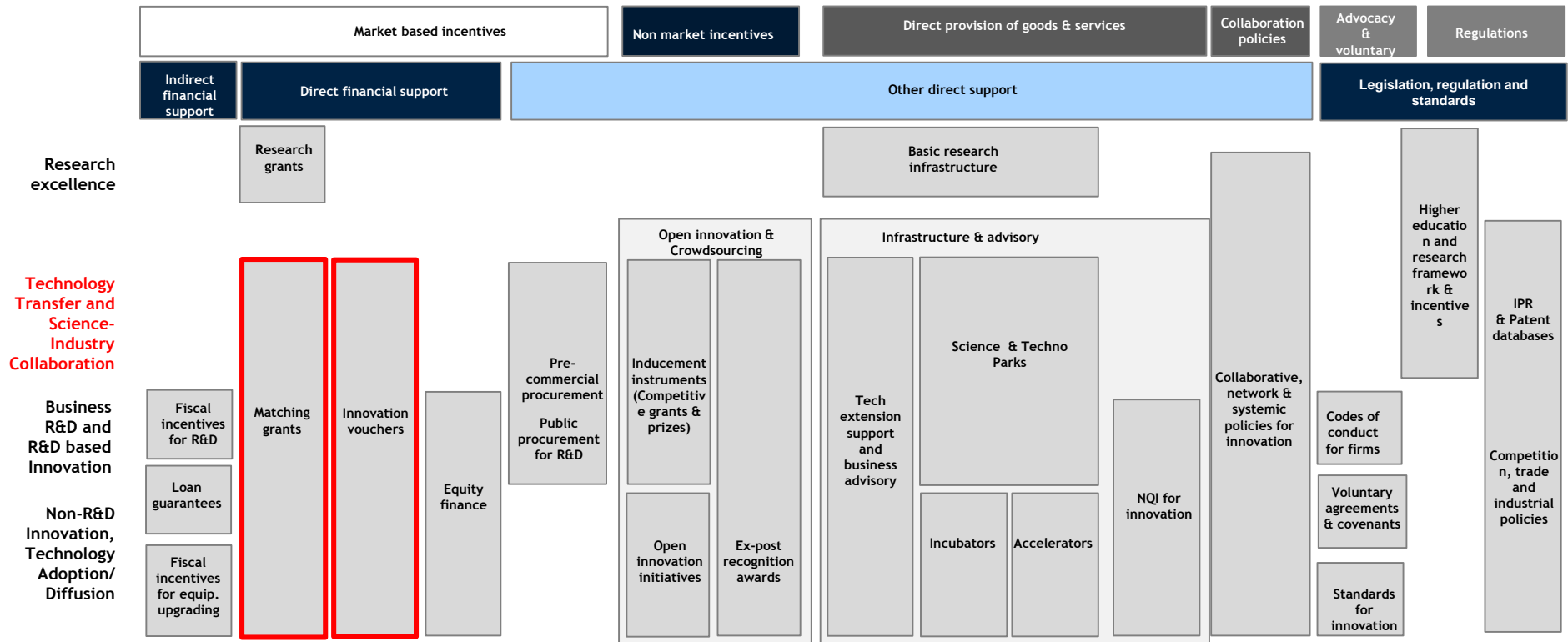
But most innovation in developing countries is imitation rather than radical....

Technological innovation -product or process (% of all firms)



Source: Cirera et al, 2015

IV. Instruments: A Typology of Innovation Policy Instruments



Source: Forthcoming, Cirera, X., Frias, J. (2017). Innovation Policy Instrument Guide. World Bank

IV. Instruments: Vouchers

Definition

Vouchers are small grants allocated to non-innovative SMEs to purchase services from external knowledge providers. The main objective is to induce non-innovator SMEs to start collaborating with knowledge organizations and providers. Vouchers are often entitlement-based rather than competition-based

Market and system failure addressed

The policy justification for the application of grants & matching grants:

- Capability failure
- Information asymmetry
- Coordination/network failure

Target group

- SMEs.
- Knowledge providers: including private sector knowledge providers

Strengths

- Simplicity in design, implementation, & evaluation. Minimal bureaucracy, low cost
- Flexibility for recipient to decide how to use
- Demand orientation, projects are defined according to the actual need of the SME.

Potential drawbacks & risks

- Risk of one-off transaction, lack of long-term behavioral change
- Difficulty to reach aimed target group, high risk of non-additionality
- Risks of lock-in with local knowledge providers
- Fraudulent use of the scheme, complicity of SMEs and service providers

Evidence of impact

- *Overall*: no input additionality since it doesn't require matching contribution. Most relevant to small firms in service industry
- *Output additionality*: some project additionality and some positive impact on sales and value added in the short-run
- *Behavioral additionality*: some follow up projects, evidence of change of attitude towards collaboration
- *Spillover effects*: improved firm public profile after collaboration with universities. For knowledge providers, introduction to new research areas, commercial opportunities, and new teaching opportunities

Key “must have” for replicability

- Required competence from SMEs: identifying the challenge, providing detailed description of service required
- Competence from knowledge providers: capability & willingness to work with SMEs
- Enabling conditions: matching and brokerage, verification system to avoid fraudulent use

Do's

- Take stock of supply/demand for knowledge services
- Design simple application and selection procedures
- Define range of services covered
- Design (small) voucher amount
- Adopt proactive advertising
- Setup brokerage services
- Data collection for evaluations

Don'ts

- Overcomplicate application procedures
- Leave list of services providers open
- Underestimate role of knowledge providers in bearing application paperwork
- Overstretch role of the scheme
- Expect development of large innovation projects

Source: Forthcoming, Cirera, X., Frias, J. (2017). Innovation Policy Instrument Guide. World Bank

IV. Instruments: Grants and Matching Grants

Definition

Grants represent direct allocation of funding from public agencies to innovation actors to finance all or part of an innovation project. Modalities of grants are primarily defined by dimensions such as the selection mechanism, size, duration, eligible activities, payment procedures and delivery mechanisms.

Market and system failure addressed

The policy justification for the application of grants & matching grants:

- Externalities and spillovers
- Information asymmetry
- Coordination failure
- Capability failure

Target group

- Individual firms, and among them, SMEs.
- Collaboration between firms or between firms and other organizations

Strengths

- Selectivity of goals, and directionality of policy.
- Ease of implementation, relative to other instruments.
- Flexibility and Control in the definition of conditions for support.
- Signaling power for accreditation of firms capabilities.

Potential drawbacks & risks

- Managerially and bureaucratic costs compared to indirect mechanisms
- Require monetary stability
- Susceptible to government failure
- Inability to address broader policy issues.
- Can crowd out private funding

Evidence of impact

- *Overall*: positive impact of grants schemes on business innovation; especially regarding input and behavioral additionality. Literature rejects full crowding-out effects, while confirming crowding-in effects, especially in emerging countries
- *Output additionality*: additionality of grants schemes is relatively limited compared with that on input additionality, but includes: Growth –employment: 4.6-6.4% %; sales: 11.5-39.6%; 31.4% increase in TFP; 6-10% increase in labor productivity.
- *Behavioral additionality*: increased their probability of innovating by 19.3%. higher probability to initiate new collaborations by about 27%;

Key “must have” for replicability

- Capability needs to design and implement policy instruments
- Industry and collaborators competence: infrastructure & managerial competencies
- Design and implementation factors: M&E and learning
- Enabling conditions: brokerage, absorptive capacity, such as openness and learning behavior, verification system to avoid fraudulent use

Do's

- Consider alternatives
- Evaluate the extent of market failure and potential additionality of beneficiaries
- Ensure political commitment predictability and policy continuity
- Design agile and simple application processes

Don'ts

- Don't simply assume that grant is the right response
- Don't select the participants on the merit of proposals, as they are likely to find private funding sources independently
- Don't treat all firms within the same broad target group

Source: Forthcoming, Cirera, X., Frias, J. (2017). Innovation Policy Instrument Guide. World Bank

V. Main Takeaways

- A **strong *Research System*** is a precondition for TT policies
 - Centrality of the scientific research Reform agenda
- Tech transfer is **more than establishing TTOs**
 - Informal knowledge transfer is as important, and not captured in metrics
- **Adopt an ecosystem approach**
 - *Transactionally*: Intelligent public interventions should address bottlenecks on the supply and the demand sides
 - *Institutionally*: sustainable, long-term funding, targeting strategic specialization areas
- **Don't underestimate the culture**
 - Time to build institutions' capacity and learning by doing

Thank you

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