

RESULTS

Regional Economic Sustainability and University Learning and Teaching Structures

Newcastle, 18-20 November, 2005

Statistical Measurement of Innovation

prof.dr. Lea Bregar

dr. Patricia Kotnik

E-mail: lea.bregar@ef.uni-lj.si

E-mail: patricia.kotnik@ef.uni-lj.si

Univerza v Ljubljani

**E K O N O M S K A
F A K U L T E T A**

Outline

- ✓ Introduction.
- ✓ How to measure innovation:
 - Conceptual Framework.
 - Scope of Measurement.
 - Basic Definitions, Classifications and Other Standards
 - System of Innovation Statistics.
 - Surveys.
- ✓ Data sources of innovation statistics.
 - Eurostat.
 - Cordis
 - OECD.
- ✓ Evaluation of innovation statistics.
 - General issues (impact of conceptual and methodological background)
 - Use and misuse of innovation statistics for empirical analysis.

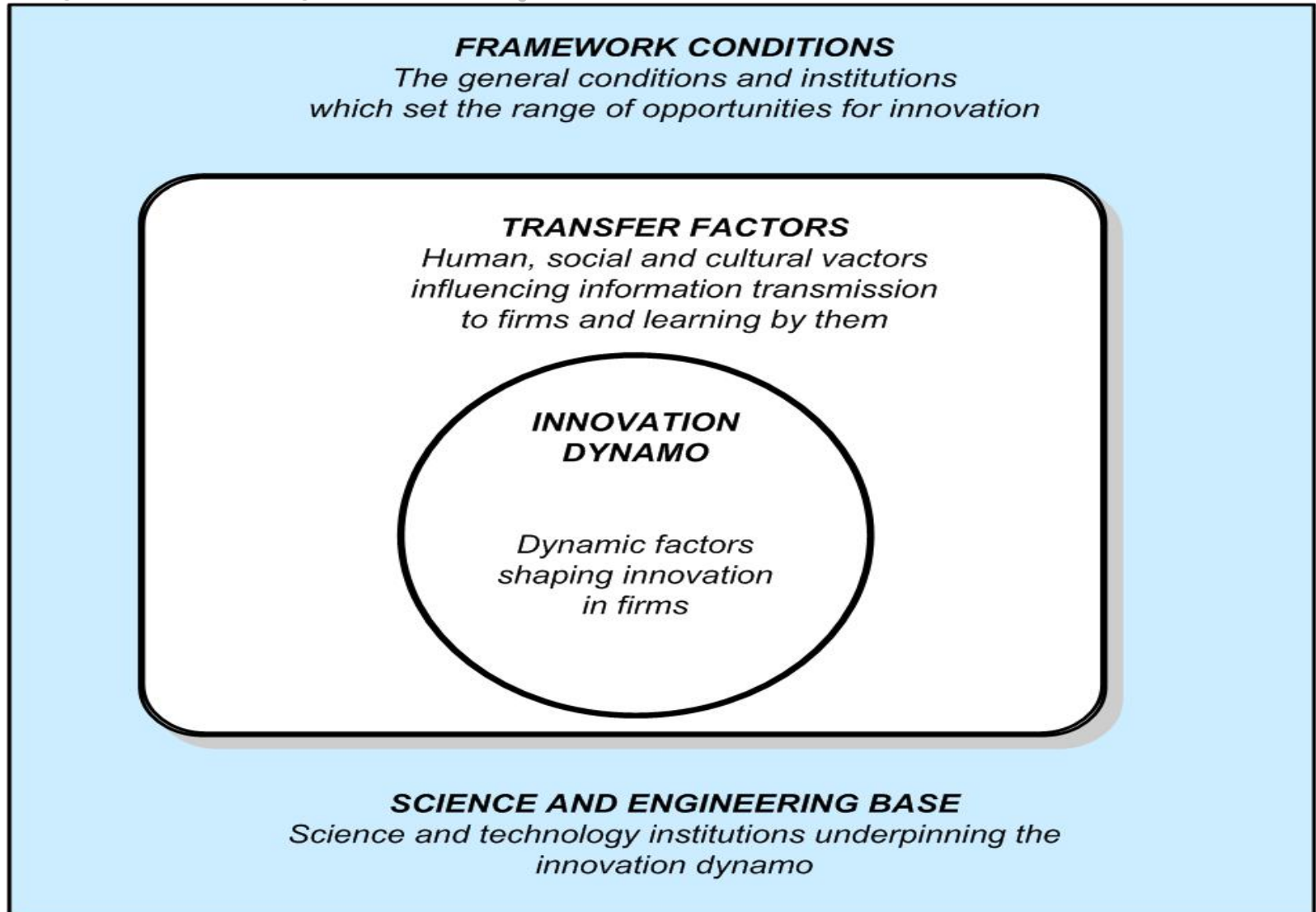
Introduction

- ✓ Purpose: review of content, scope, availability and quality of innovation statistics.
- ✓ Focus on macro level.
- ✓ International Recommendation: Oslo Manual (1996; 2005).

How to measure innovation: Conceptual Framework

- ✓ Why firms innovate?
- ✓ What firms inhibit from innovating?

Conceptual framework of statistical measurement of innovation



Source: OSLO Manual: The Measurement of Scientific and Technological Activities - Proposed Guidelines for Collecting and Interpreting Technological Innovation Data. European Commission, Eurostat, 1996, pg. 19.

How to measure innovation: Scope of measurement

Innovation is a complex, diversified activity with many interacting components .

International innovation surveys refer mainly on firms' innovation dynamo and surrounding transfer factors.

Focusing on:

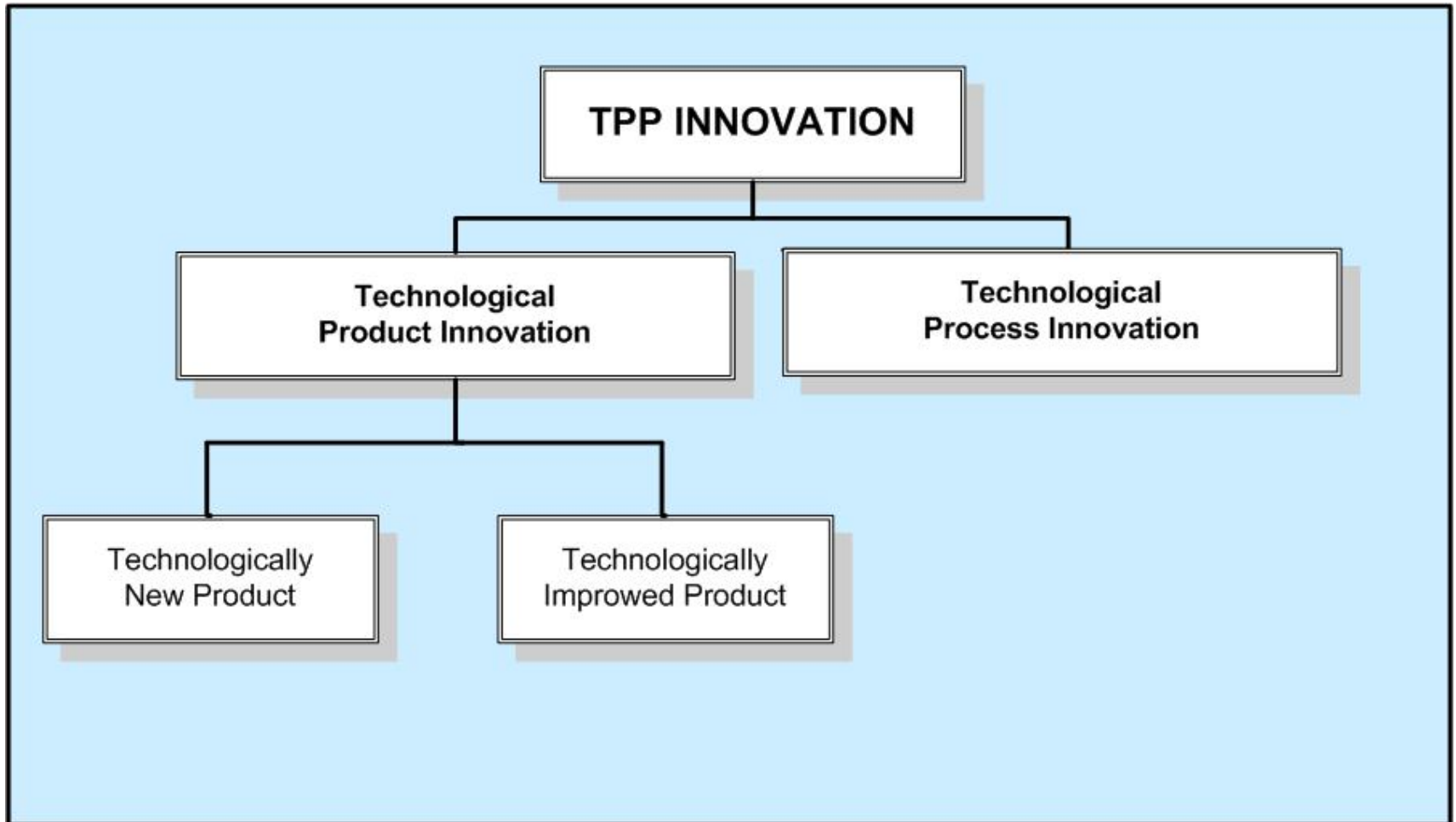
- What do we want to measure: Technological product&process innovation;
- How should it be measured: choice of survey approach (subject/object approach);
- Where should it be measured: sectoral coverage.

How to measure innovation:

Scope of measurement

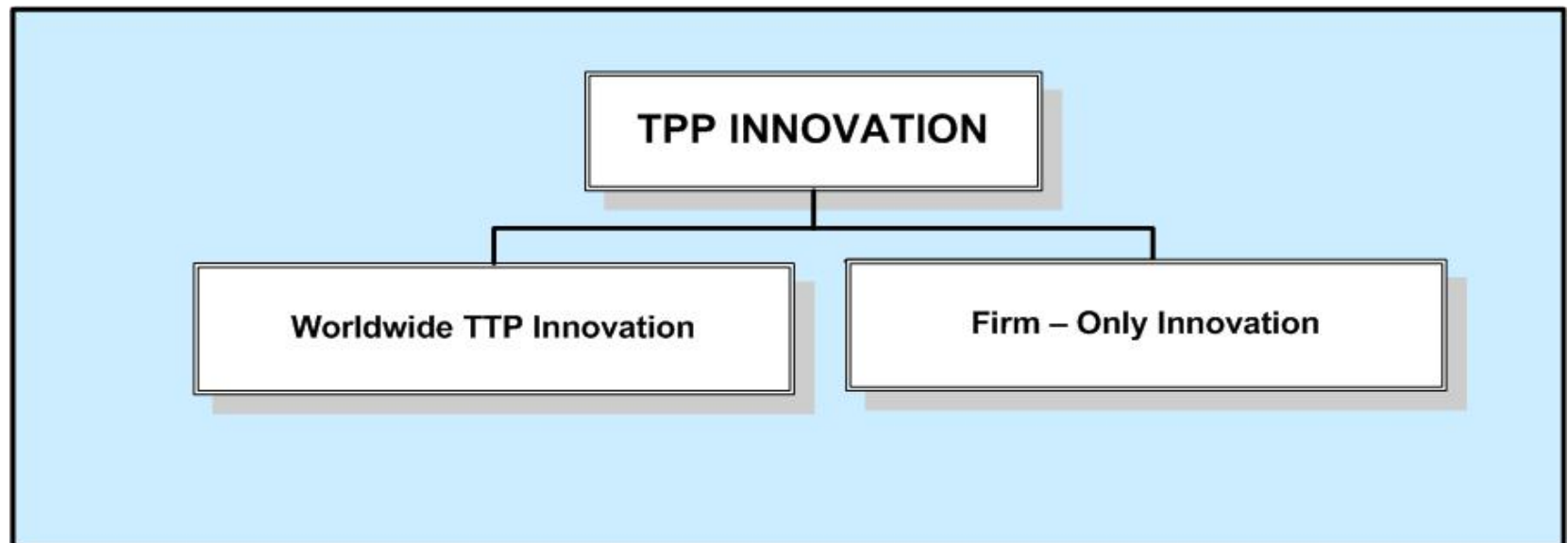
- ✓ Business enterprise sector as target population.
- ✓ Innovation at the level of firm.
- ✓ TPP innovations.
- ✓ Diffusion: new to the firm.
- ✓ Recent amendments: extension to marketing and organisational innovation.

How to measure innovation: Basic definitions - TPP innovations



How to measure innovation: Basic definitions - Diffusion of TPP innovation

- ✓ Minimum entry level is 'new to the firm.'
- ✓ All types of firms' activity may contribute to innovation.



Diffusion of TPP innovation

Type and degree of novelty and the definition of innovation

			INNOVATION			Not innovation
			Maximum	Intermediate	Minimum	
			New to the world	(a)	New to the firm	
TPP	Technologically new	Product				
		Production process				
		Delivery process				
INNOVATION	Significantly technologically improved	Product				
		Production process				
		Delivery process				
Other innovation	New or improved	Purely organisation				
Not innovation	No significant change, change without novelty, or other creative improvements	Product				
		Production process				
		Delivery process				
		Purely organisation				

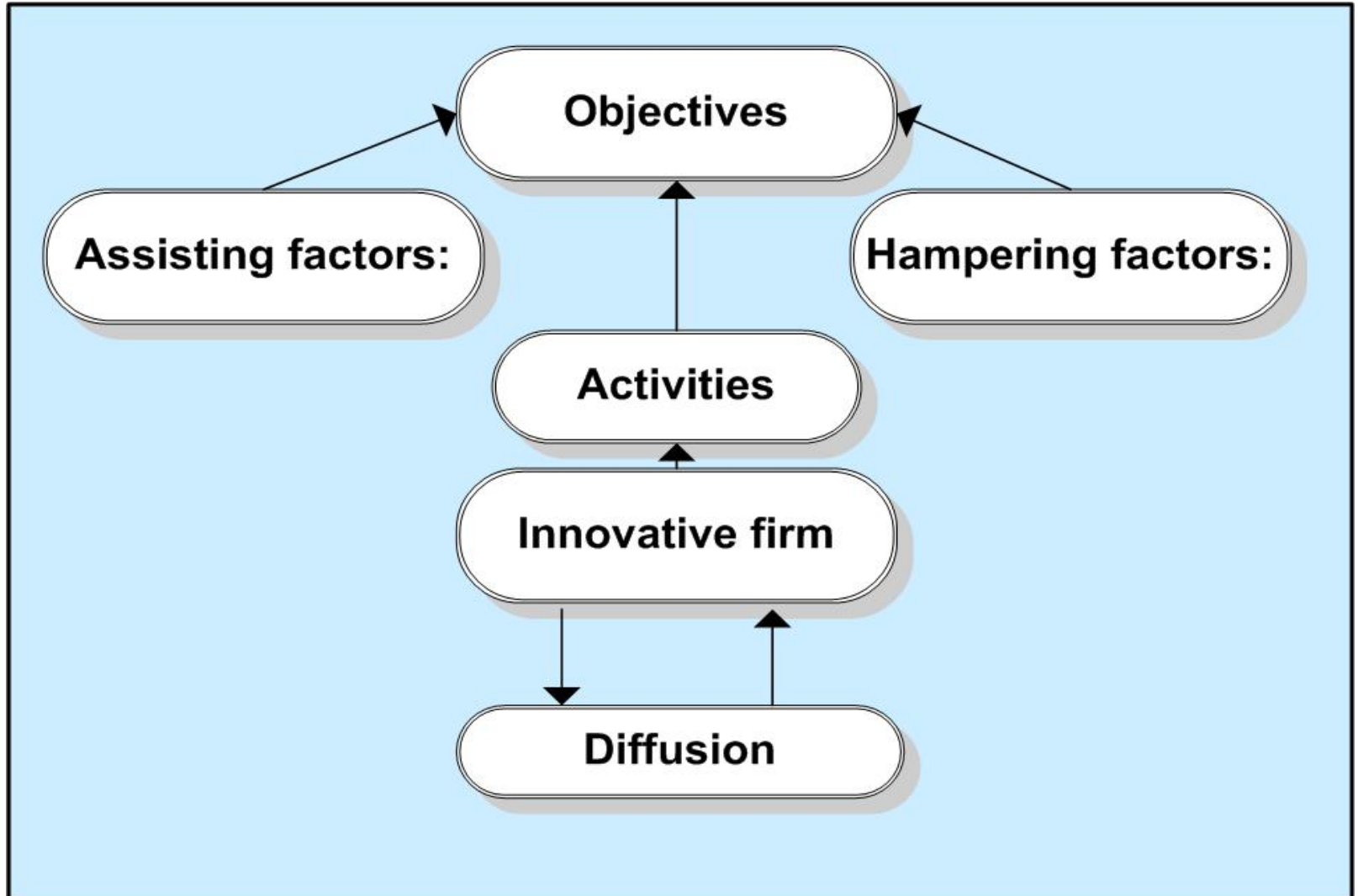
TPP innovation Other innovation Not innovation

How to measure innovation:

Basic definitions - TPP innovation activities

- ✓ Acquisition and generation of relevant knowledge: new to firm.
- ✓ Other preparation for production.
- ✓ Marketing for new or improved products.

System of innovation statistics



Classifications

- ✓ By main economic activity (ISIC Rev.3; NACE Rev.1).
- ✓ By size.
- ✓ By institution.
- ✓ Others (form of activity; type of goods produced; R&D intensity; export intensity; membership of group).

Standards and Guidelines

- ✓ Oslo Manual.
- ✓ Frascati Manual.
- ✓ TBP manual.
- ✓ Patent Manual.
- ✓ Canberra Manual.

Surveys: Community Innovation Surveys

- ✓ Carried out: 1992, 1996, 2001, 2005.
- ✓ Coverage: enterprises with more than 10 employees included.
- ✓ Statistical unit: enterprise.
- ✓ Geographical coverage.
- ✓ Stratified sampling by size and activity.
- ✓ Data collection: postal surveys.
- ✓ Response rate: DE - 21%; NO - 94%.

Data sources of innovation statistics: Eurostat

Database Newcronos

Eurostat: Database on Science and Technology

-  **Science and technology**
-  **Research and development** 
-  **Survey on innovation in EU enterprises** 
-  **High tech industry and knowledge based services** 
-  **European and US patenting systems**
-  **Human Resources in Science & Technology** 
-  **Information society statistics**



Survey on innovation in EU enterprises

  Results of the second community innovation survey (CIS2) 

  Results of the third community innovation survey (CIS3) 

   General information about the enterprises 




   Basic economic information on the enterprises 

   Product and process innovation 

   Innovation activity and expenditure in 2000 

   Intramural R&D 

   Effects of innovation during 1998-2000 

   Innovation co-operation during 1998-2000 in absolute value



Innovation co-operation during 1998-2000 in absolute value 



Innovation co-operation during 1998-2000 in percentage 



Public funding of innovation 



Source of information for innovation during 1998-2000 



Hampered innovation activities 



Patents and other protection methods 



Other important strategic and organizational changes 



The European Innovation scoreboard indicators 



Results of the first community innovation light survey - CIS light

Data sources of innovation statistics: CORDIS

<http://www.cordis.lu/innovation-smes/scoreboard/home.html>

Data sources of innovation statistics: OECD

Statistics: Science, Technology and
Patents



Evaluation of innovation statistics: conceptual issues

- ✓ Limits: business sector only.
- ✓ Precision of definition and borderline cases.



Evaluation of innovation statistics: methodological issues

- ✓ Coverage
- ✓ Statistical units.
- ✓ Data collection method.

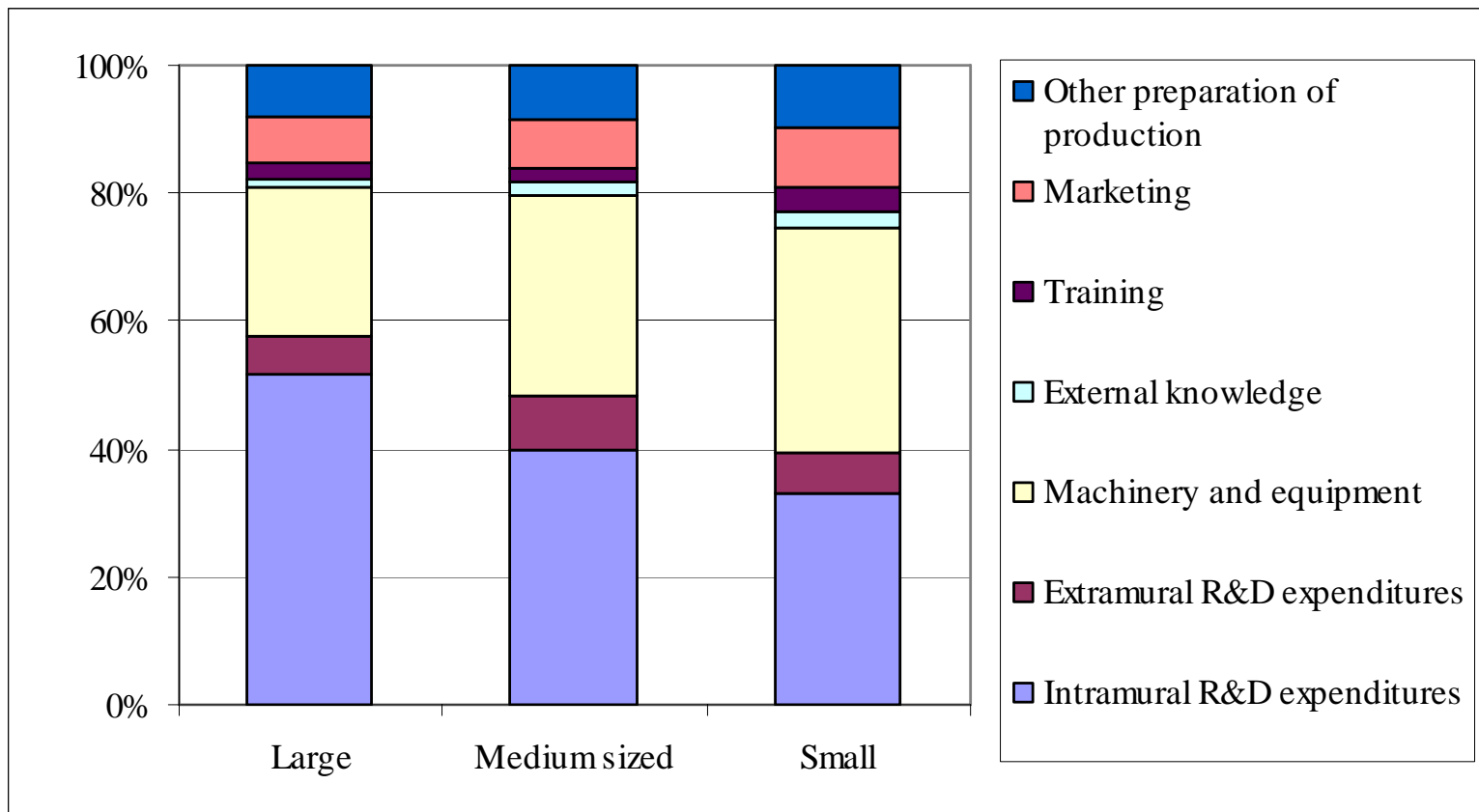
Use of innovation statistics for empirical analysis

- ✓ R&D expenditures.
- ✓ Number of patents.
- ✓ Innovation expenditures.
- ✓ Innovative sales.

R&D expenditures

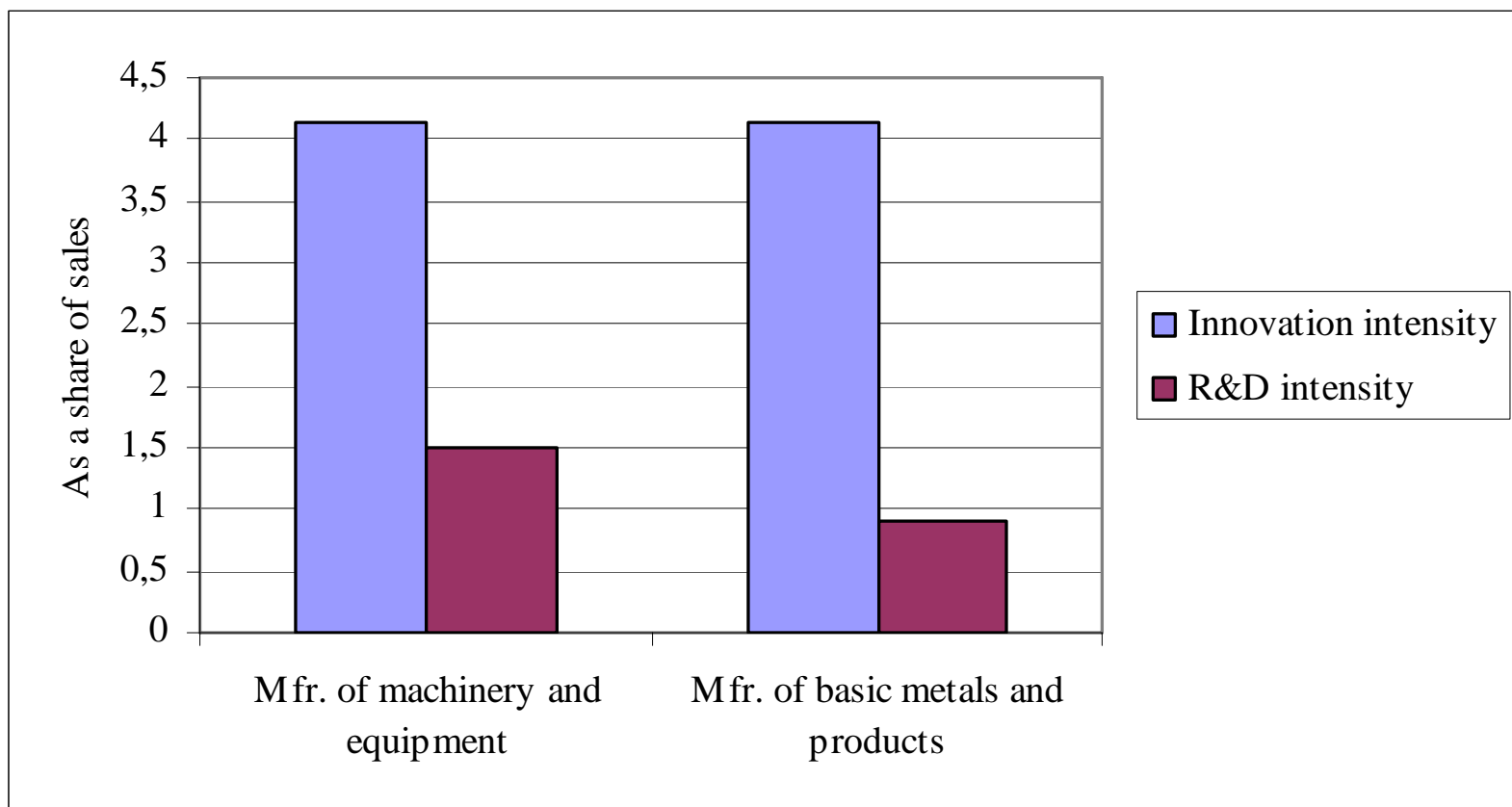
- ✓ Input-based measure.
- ✓ By using this indicator, we underestimate:
 - Innovation activities of SME's.
 - Innovation activities of traditional industries.
 - Effects of process innovations.

Innovation expenditures by size of firm, Slovenia, 2002



Source: Rapid Reports – research, development, science & technology. Ljubljana: Statistical Office of the Republic of Slovenia, 1996, pp. 14.

R&D and innovation intensity for selected industries, Slovenia, 2002



Source: Rapid Reports – research, development, science & technology. Ljubljana: Statistical Office of the Republic of Slovenia, 1996, pp. 12.

Number of patents

✓ Output-based measure

✓ However:

- Propensity to patent differs between industries.
- Propensity to patent differs between firms' size.
- Economic value of patents.

Example: Estimating innovation potential of Slovenian regions

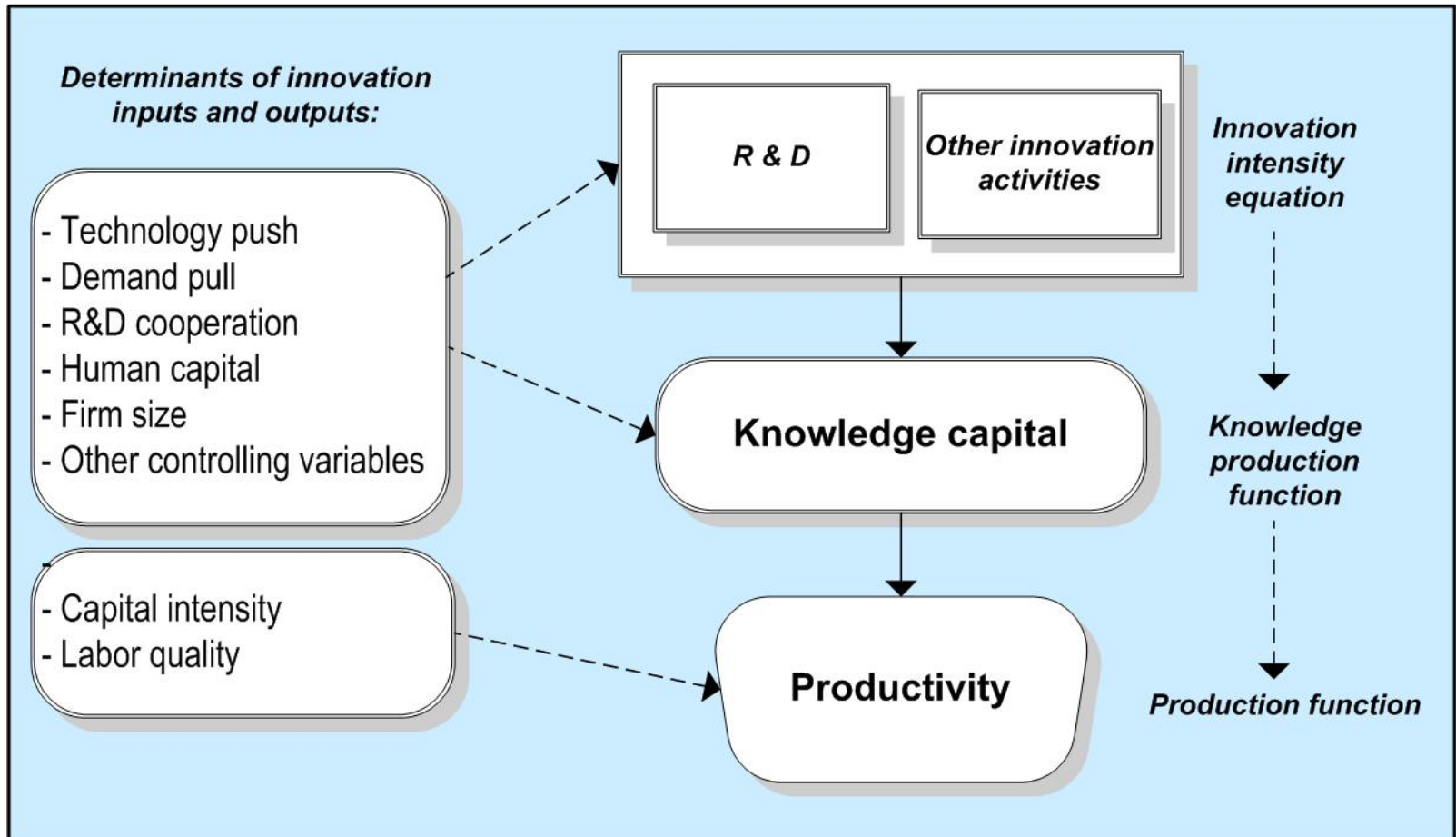
- ✓ Using patents and R&D to measure Technology index.
- ✓ Problems of the data: value of variables small or even equals zero
- ✓ Problems of comparisons between regions.

Use of CIS data

- ✓ Solving some of the problems of R&D and patent data.
- ✓ Extended possibilities for analysis.

Example:

Econometric model of determinants and effects of innovation activities



Source: Kotnik, P.: *Inovacijska dejavnost podjetij: Njene determinante, vpliv na produktivnost in pomen za mednarodno konkurenčnost*. A doctoral dissertation, University of Ljubljana, Faculty of Economics, 2004.

Innovation expenditures and innovative sales

- ✓ The data less reliable.
- ✓ Non-response rate higher.
- ✓ Limited comparability between years.
- ✓ Interpretation of "technological innovation" between countries may differ.

**Relevance of topics for RESULTS'
on-line seminar:
discussion**



References

1. *OSLO Manual: The Measurement of Scientific and Technological Activities - Proposed Guidelines for Collecting and Interpreting Technological Innovation Data. European Commission, Eurostat, 1996.*
2. *OSLO Manual: The Measurement of Scientific and Technological Activities - Guidelines for Collecting and Interpreting Innovation Data. 3rd Edition. European Commission, OECD, 2005.*
3. *FRASCATI Manual: The Measurement of Scientific and Technological Activities - Proposed Standard Practice for Surveys on Research and Experimental Development. OECD, 2002.*
4. *Kotnik, P.: Inovacijska dejavnost podjetij: Njene determinante, vpliv na produktivnost in pomen za mednarodno konkurenčnost. A doctoral dissertation, University of Ljubljana, Faculty of Economics, 2004.*
5. *Rapid Reports - research, development, science & technology. Ljubljana: Statistical Office of the Republic of Slovenia, 1996, pp. 14.*
6. *Rapid Reports - research, development, science & technology. Ljubljana: Statistical Office of the Republic of Slovenia, 1996, pp. 12.*