



**InnoRenew CoE**

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# Methodological challenges of measuring innovation activities of micro companies

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# Background

- Internal InnoRenew project: „Revitalisation of traditional industry: An open innovation framework for Slovenia’s furniture sector“ (with National Institute of Public Health (NIJZ), Regional Development Agency of the Ljubljana Urban Region (RRALUR), and the University of Primorska)
- PhD project „Critical Success factors in Open Innovation: Does strategy matter?“ (Barbara Rovere)



# Problem

- Largy body of literature and data available on innovation activities of **small** (10-49), **medium** (50-249), and **large enterprises** (250+ employees)
- More than 90 % of companies in the wood value chain are **micro enterprises** (< 10 employees) and there is almost no research on them

**RQ: How biased are innovation indicators due to the omission of micro companies?**

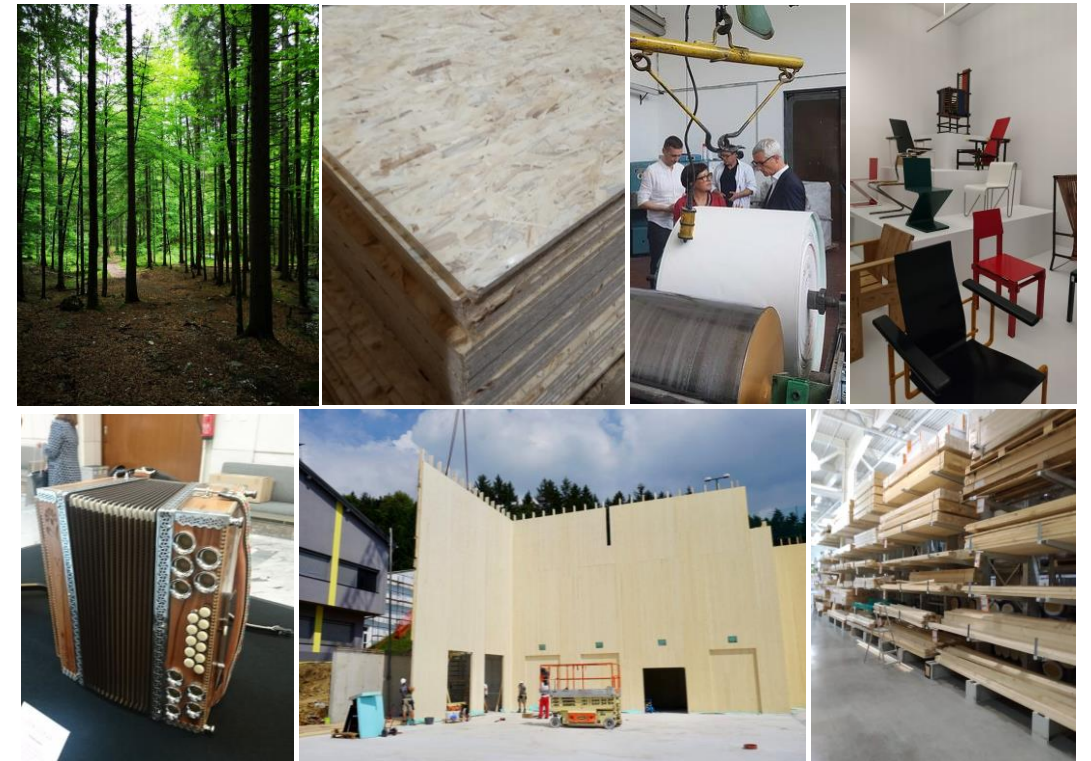


# Survey on market and innovation activities of Slovenian companies in the wood value chain

**Unit of analysis:** enterprise

**Population:** active enterprises (in January 2019) created before the 1st of January 2016 (agrarian communities, associations, and interest groups excluded) that are not bankrupt or in a liquidation process that are registered in Slovenia in one of the selected sectors (Forestry, Wood manufacturing, Paper manufacturing, Furniture, Other manufacturing, Construction, Wholesale)

**Sampling frame:** [Bizi.si business registry](https://www.bizi.si/)





# Sampling (full population study)

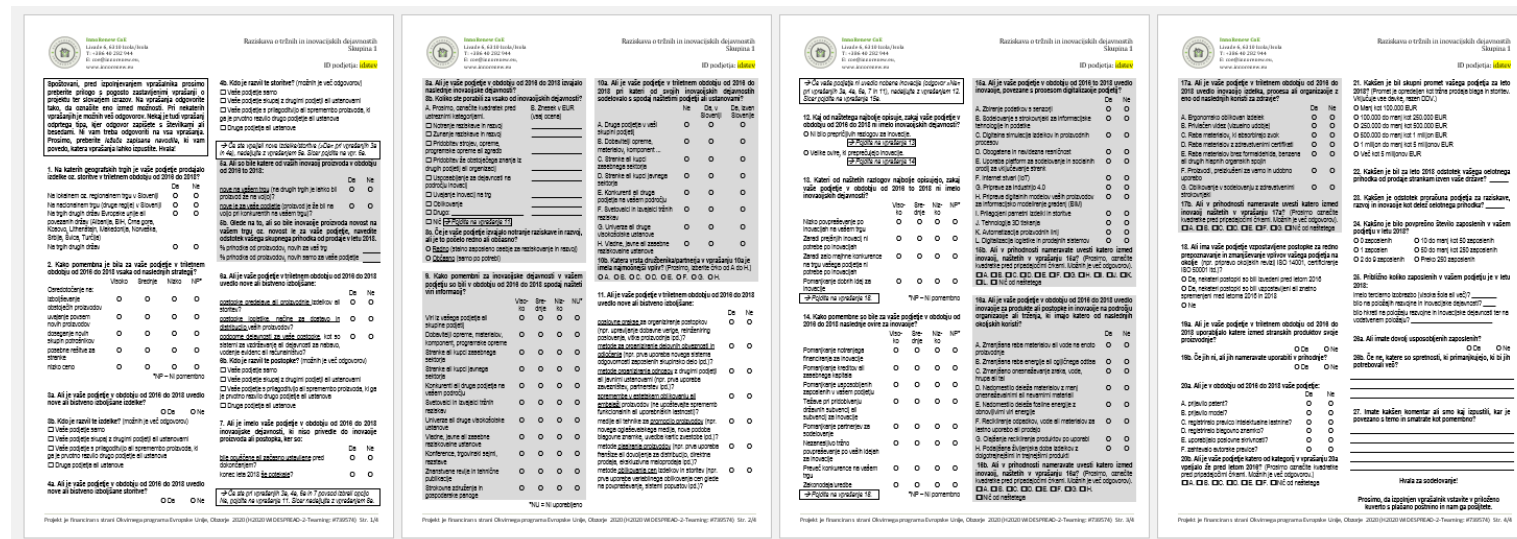
| NACE code  | Numer of units in Bizi.si registry |
|--|------------------------------------|
| Forestry and logging (A02 without A02.300)                                 | 740                                |
| <b>Manufacture of products of wood and cork (C16)</b>                      | <b>1747</b>                        |
| Manufacture of paper and paper products (C17)                              | 143                                |
| <b>Manufacture of furniture (C31 without C31.030)</b>                      | <b>995</b>                         |
| Other manufacturing (C32.120, C32.130, C32.200, C32.300, C32.400, C42.910) | 390                                |
| Construction of buildings (F41)  | 2651                               |
| Wholesale of wood, construction materials and sanitary equipment (G46.73)  | 448                                |
| <b>Total</b>   | <b>7123</b>                        |

| Size         | Number      | Percentage   |
|--------------|-------------|--------------|
| Micro        | 5427        | 89.9 %       |
| Small        | 521         | 8.6 %        |
| Medium       | 75          | 1.2 %        |
| Large        | 14          | 0.2 %        |
| <b>Total</b> | <b>6037</b> | <b>100 %</b> |
| Type         | Number      | Percentage   |
| Ltd.         | 3466        | 48.7 %       |
| Solo trader  | 2900        | 40.7 %       |
| Other        | 757         | 10.6 %       |
| <b>Total</b> | <b>7123</b> | <b>100 %</b> |



# Questionnaire

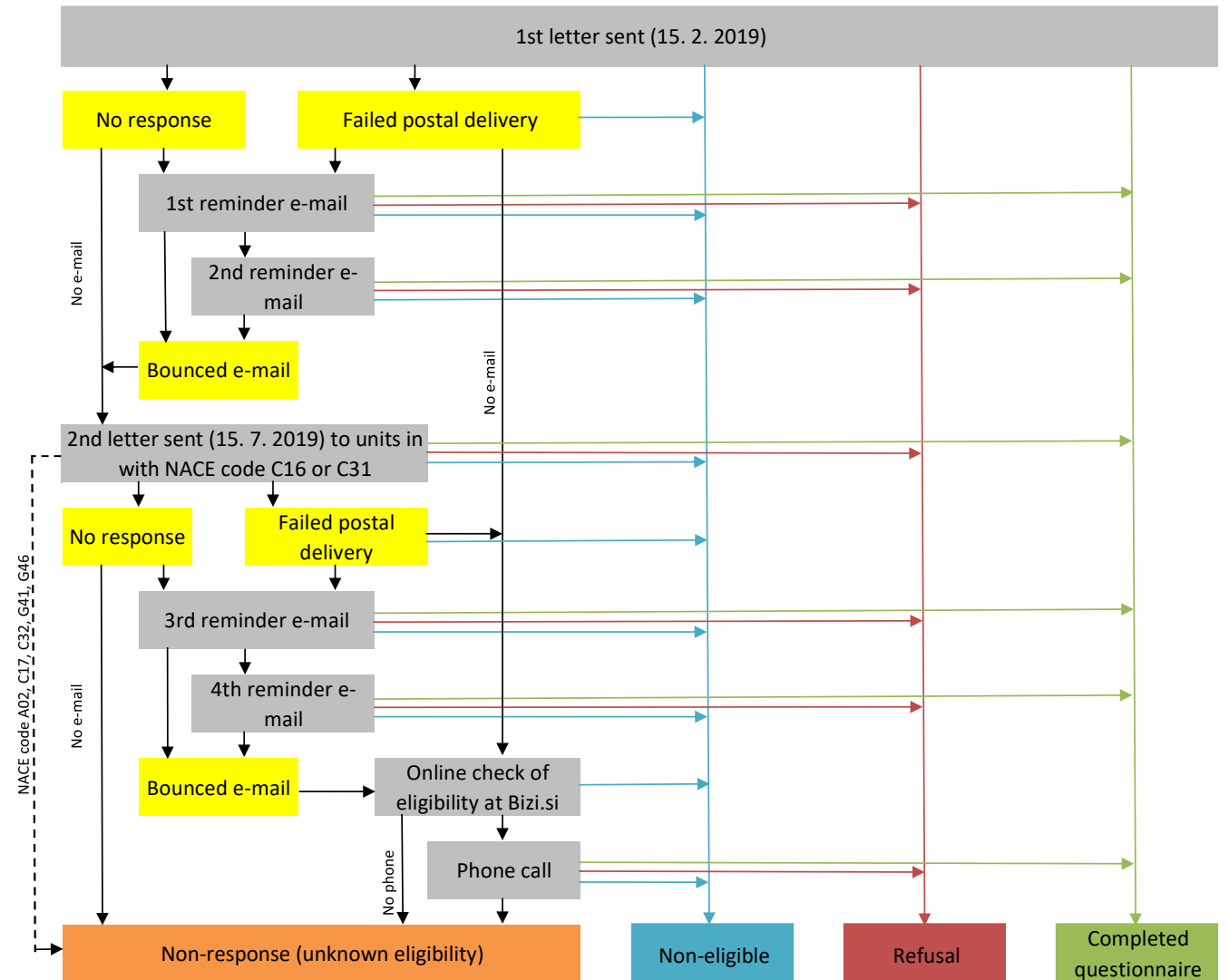
- Based on the Eurostat Community Innovation Survey (CIS)
- 4 pages long and with conditional branching:
  - About 10 minutes for non-innovators
  - About 20 minutes for innovators



Topics: *Geographic markets; Strategy, Product (goods and services), process, organisational and market innovations; Innovation activities; Information sources; Co-operation with other organisations; Barriers to innovation; Innovation in business process digitalisation; Innovations with environmental benefits; Innovations with health benefits; Environmental impacts; Intellectual property rights; etc.*

# Data collection

- February – September 2019 (WIP)
- **Postal survey** with two options:
  - Return paper questionnaire in enclosed envelope
  - Type link and respond online
- **E-mail reminders** (e-mail available for 32% of the sample)
- Manual search to exclude non-eligible companies
- **Phone calls** (although phone number is available for 70% of the sample we only tried to call those without a valid postal or e-mail address)





# Response rates

| NACE code              | Sample      | Unknown eligibility | Not eligible | Refusal   | Completed  | RR2         | RR4 (e=0.8) |
|------------------------|-------------|---------------------|--------------|-----------|------------|-------------|-------------|
| Forestry (A02)         | 740         | 701                 | 9            | 8         | 22         | 3.0%        | 3.7%        |
| <b>Wood (C16)</b>      | <b>1747</b> | <b>1537</b>         | <b>46</b>    | <b>51</b> | <b>113</b> | <b>6.6%</b> | <b>8.1%</b> |
| Paper (C17)            | 143         | 137                 | 1            | 6         | 8          | 5.3%        | 6.5%        |
| <b>Furniture (C31)</b> | <b>995</b>  | <b>871</b>          | <b>24</b>    | <b>43</b> | <b>57</b>  | <b>5.9%</b> | <b>7.2%</b> |
| Other m. (C32)         | 390         | 361                 | 9            | 12        | 8          | 2.1%        | 2.6%        |
| Construction (F41)     | 2651        | 2347                | 174          | 76        | 54         | 2.2%        | 2.7%        |
| Wholesale (G46)        | 448         | 388                 | 26           | 22        | 12         | 2.8%        | 3.5%        |
| Total                  | 7123        | 6342                | 289          | 218       | 274        | 4.0%        | 4.9%        |

Note: Disposition codes assigned and response rates calculated according to [AAPOR Standard Definitions](#)



# Preliminary bias analysis

- The objective of bias analysis is to estimate the potential **error in estimates due to systematic mistakes** (e.g., omission of micro companies) **that lead to consistently high or low results compared to true values**
- We selected 20 indicators (12 innovation and 8 cooperation) to estimate the standardized bias
- The statistic of interest is the percent of respondents answering „Yes“ ( $p$ )
- Assuming the  $p$  calculated on data that includes micro companies (**i.e., with**) are our reference („true“) values ( $p_{\text{with}}$ )
- If we would not have collected data for micro companies and tried to estimate the true value **without** them ( $p_{\text{without}}$ ), the estimate would be biased:

$$\text{Bias} = p_{\text{with}} - p_{\text{without}}$$

- The bias measure is standardized by dividing it with the standard error:

$$\text{Standardized bias} = \text{Bias} / \text{SE}_{\text{without}}$$

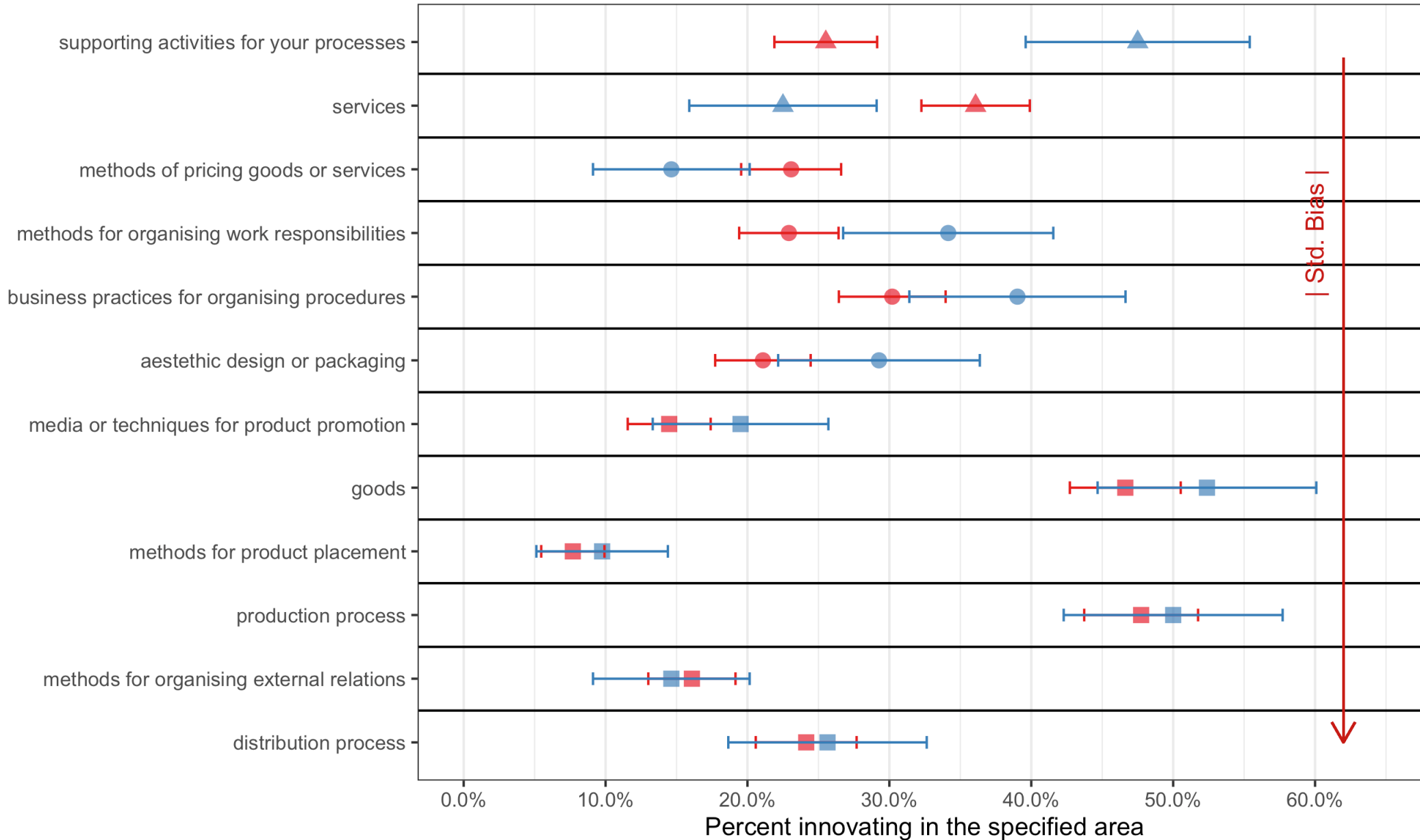
|   | Innovation indicators                              | p <sub>with</sub> | p <sub>without</sub> | n <sub>with</sub> | n <sub>without</sub> | SBias |
|---|--|-------------------|----------------------|-------------------|----------------------|-------|
| During the three years 2016 to 2018, did your enterprise introduce new or significantly improved... | 3a. goods  | 47%               | 52%                  | 163               | 42                   | -0.75 |
|   | 4a. services                                       | 36%               | 23%                  | 158               | 40                   | 2.07  |
|   | 6a_1. production process                           | 48%               | 50%                  | 155               | 42                   | -0.29 |
|   | 6a_2. distribution process                         | 24%               | 26%                  | 145               | 39                   | -0.22 |
|   | 6a_3. supporting activities for your processes     | 26%               | 48%                  | 145               | 40                   | -2.80 |
|   | 11_1. business practices for organising procedures | 30%               | 39%                  | 149               | 41                   | -1.17 |
|   | 11_2. methods for organising work responsibilities | 23%               | 34%                  | 144               | 41                   | -1.53 |
|   | 11_3. methods for organising external relations    | 16%               | 15%                  | 143               | 41                   | 0.26  |
|   | 11_4. aesthetic design or packaging                | 21%               | 29%                  | 147               | 41                   | -1.16 |
|   | 11_5. media or techniques for product promotion    | 14%               | 20%                  | 145               | 41                   | -0.82 |
|   | 11_6. methods for product placement                | 8%                | 10%                  | 143               | 41                   | -0.45 |
|   | 11_7. methods of pricing goods or services         | 23%               | 15%                  | 143               | 41                   | 1.54  |

p – percentage of „Yes“ (with/without micro companies); n – number of respondents; Sbias – Standardized bias

|  | Cooperation indicators  | p <sub>with</sub> | p <sub>without</sub> | n <sub>with</sub> | n <sub>without</sub> | SBias |
|--|---|-------------------|----------------------|-------------------|----------------------|-------|
| 10a. During the three years 2016 to 2018, did your enterprise co-operate on any of your innovation activities with other enterprises or organisations? | A. Other enterprises within your enterprise group             | 45%               | 57%                  | 74                | 23                   | -1.16 |
|  | B. Suppliers of equipment, materials, components, or software | 82%               | 86%                  | 76                | 28                   | -0.63 |
|  | C. Clients or customers from the private sector               | 47%               | 62%                  | 77                | 26                   | -1.56 |
|  | D. Clients or customers from the public sector                | 15%               | 5%                   | 71                | 22                   | 2.47  |
|  | E. Competitors or other enterprises in your sector            | 19%               | 26%                  | 72                | 23                   | -0.73 |
|  | F. Consultants or commercial labs                             | 15%               | 26%                  | 71                | 23                   | -1.16 |
|  | G. Universities or other higher education institutes          | 18%               | 33%                  | 72                | 24                   | -1.59 |
|  | H. Government, public or private research institutes          | 11%               | 26%                  | 71                | 23                   | -1.63 |

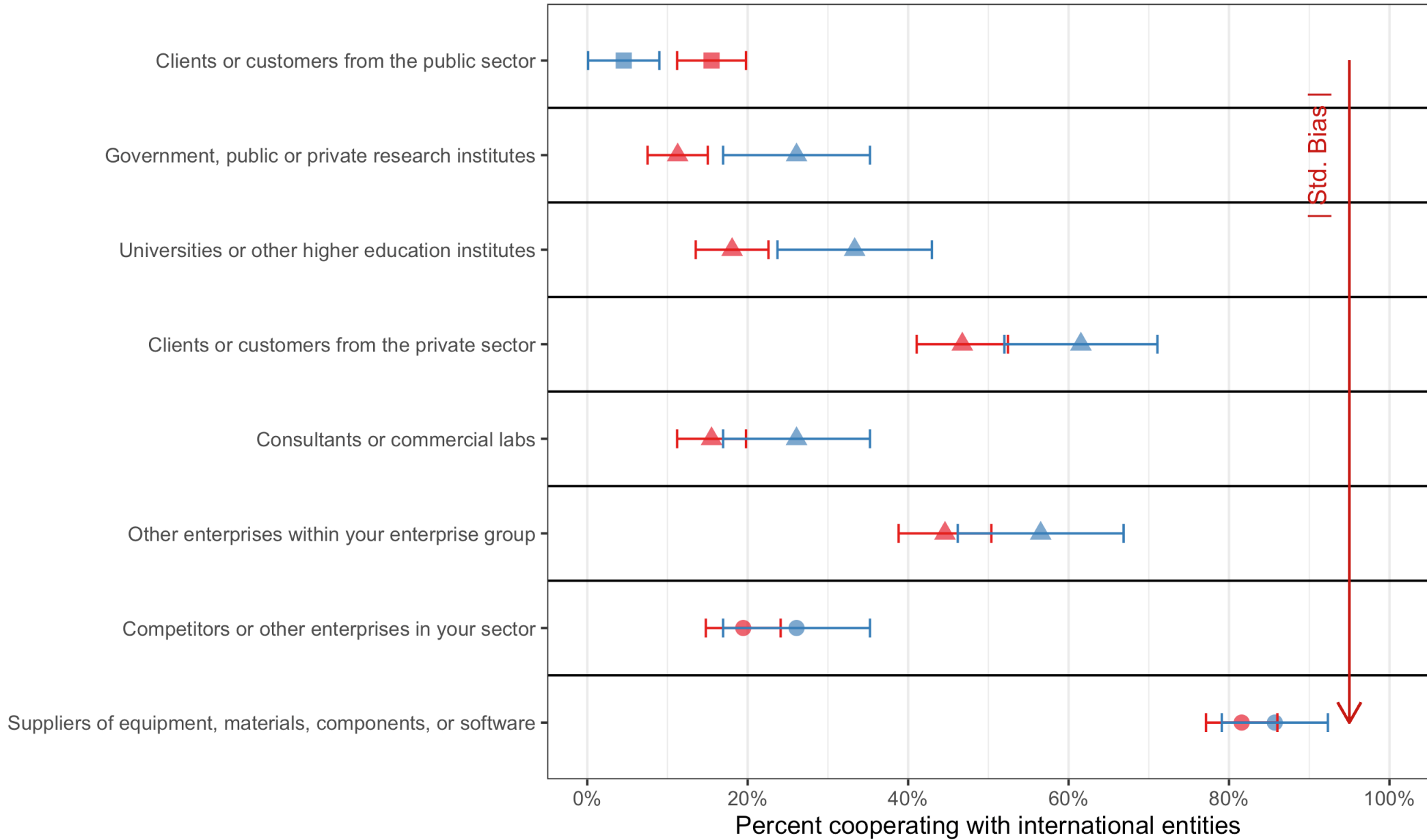
p – percentage of „Yes“ (with/without micro companies); n – number of respondents; Sbias – Standardized bias

# Standardised Bias: Innovation



Bias ● > 1 ▲ > 2 ■ < 1 Micro Co's ● with ● without

# Standardised Bias: Cooperation



Bias ● < 1 ▲ > 1 ■ > 2 Micro Co's ● with ● without



# Conclusions and discussion

- Absolute standardized bias estimation:
  - Over 1 for 11 out of 20 indicators (5 innovation and 6 cooperation)
  - Over 2 for 3 out of 20 indicators (2 innovation and 1 cooperation)
- **Micro companies should be included in research studies about innovation**
- However, **surveying micro companies is methodologically challenging and expensive;** discussion is needed on **how to improve response rates.** Possible solutions:
  - Invest more resources in data cleaning before data collection (a high number of non-eligible units)
  - Stricter exclusion criteria (exclude institutes, cooperatives, and supplementary farm activities)
  - Make questionnaire shorter (less is more)
  - Incentives?



# Future work

- Computation of Bias due to exclusion of micro companies for other variables and other sectors
- Sensitivity analysis (difference between companies with 0, 1 and 2-9 employees)
- Estimation of nonresponse bias (based on auxiliary information in Bizi.si database)
- Comparison with Community Innovation Survey data for 2016-2018 (will become available in Autumn 2020)
- Additional research questions: How biased would the results be if we excluded ...
  - Companies without e-mail?
  - Additional company types according to legal form?



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**Thank you for your time.**