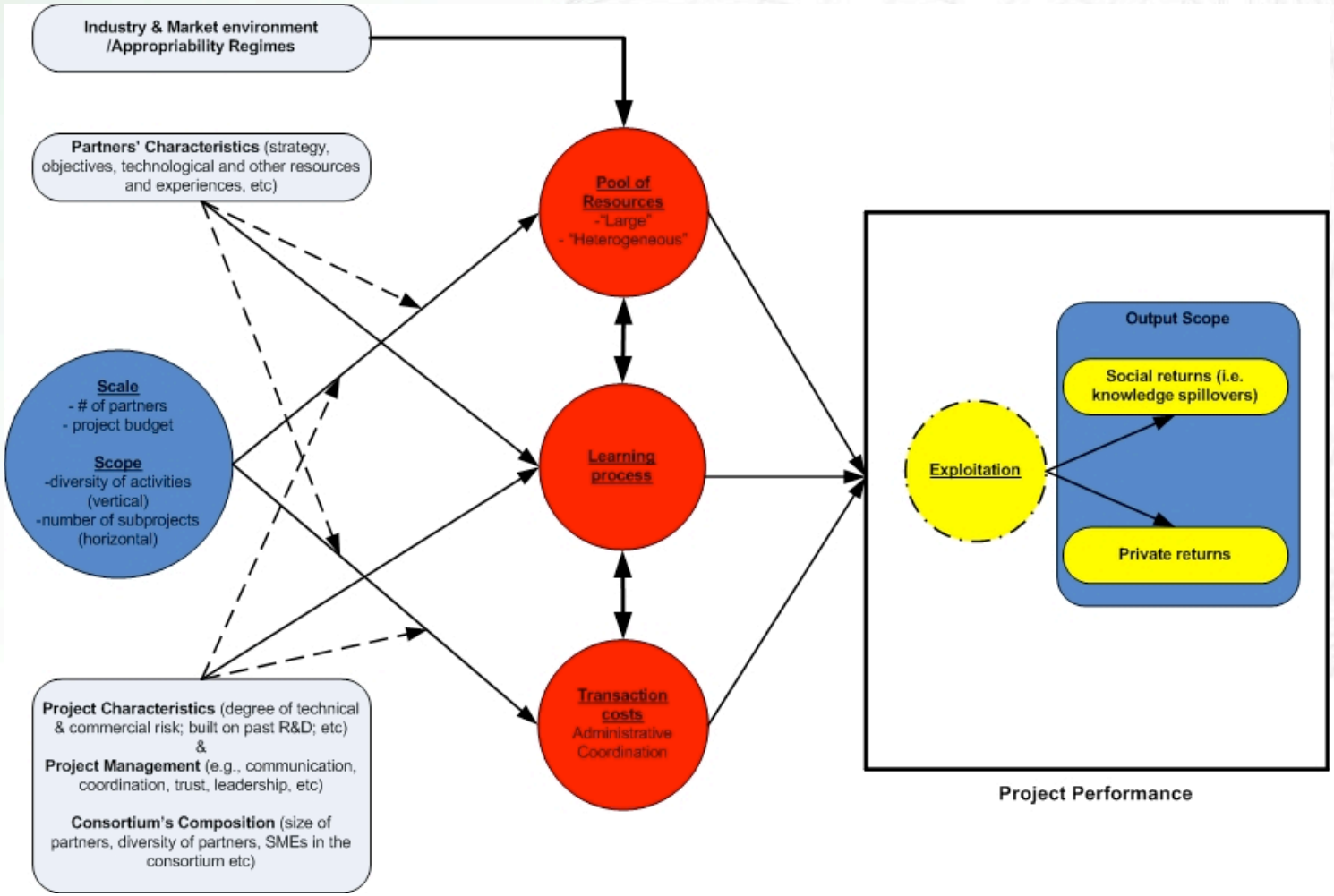
Economies of Scale and Scope in R&D projects: Preliminary Results

High Level Advisory Group Meeting
April 2010, Vienna

Introduction and Framework of Analysis

- **The basic question we are dealing with**: economies of scale (and scope) in R&D projects
  - **Rationale**: R&D projects may experience *increasing returns* to **Scale** because of specialization, complementarities of resources and skills, and more efficient utilization of resources
    - A counter argument: *decreasing returns* to scale because of higher transaction and administrative costs associated the implementation of a large project
  - Similarly for **Scope**: *increasing returns* to scope may arise in the pursuit of multiple "sub-projects" within the same research effort because of e.g., cost savings, cross-fertilization of ideas and intermediate results, etc
    - A counter argument: (as above) diseconomies of scope because of transaction costs to managing a complex project

Conceptual Framework



- Scale and scope, as reflected (primarily) by **consortium size and project budget**, would exhibit an inverted-U shaped effect on project performance *via* its effect on the different "mediator" variables.
  - That is, scale and scope would have a **positive** influence on performance *through* a positive effect on the *pool of resources* and *learning*
  - and a **negative** effect by increasing the *transaction costs*, i.e., the administrative and coordination costs of running the project.
  - Other specific hypotheses will be discussed subsequently, when interpreting the results

Data and Measures

- The data collection process and the sample have been described in detail in another document; won't be repeated here.
- Key descriptive statistics for the final sample used for analyses
  - 1172 observations (750 ROs + 422 enterprises)
  - 676 unique projects (328 projects with responses >= 2)
  - Lots of missing values: we had to be selective on the variables to represent the key constructs of interest

- All "composite" variables used in the analyses (see below) were constructed following Confirmatory Factors Analysis

Overview of Variables

- **Scale**:
  - log (number of partners)
  - Log (project budget)
  - *Notice that using the logarithm of scale allows the effect on performance of increased scale to be greater when moving from small-sized to medium-sized projects than when moving from large to very large projects.*
- **Scope**:
  - Project_included_sub_projects: No/Yes (0/1) → (302 observations only)
  - Number of sub_projects → too many missing values
  - Because of the missing values, we use instead a proxy: A Likert item on "type of project", extending from "R&D only" to "R&D up to market-oriented activities"
- **Project Performance**
  - 8 dimensions of performance
    - "achievement of project objectives"
    - Knowledge-related "outputs" (e.g., publications)
    - Technology-related "outputs" (e.g., models and simulations)
    - Network-related "outputs"
    - Research-capacity related impacts
    - Commercialization-related impacts
    - Product and process innovation (as a result of the project) (two dichotomous variables)
  - These are measures of performance at the level of the *individual* participant
  - The last three (commercialization, product, and process innovation concern **enterprises only**)

- **Mediators**:
  - Complementarity of resources
  - Absorptive Capacity
  - Transaction Costs → 2 dimensions derived from CFA → (clear objectives, coordination)
    - *These 2 dimensions were reverse coded for the analysis so that higher values represent "unclear objectives" and "difficulties in coordination".*
- **7 classes of independent variables**
  - Project management
  - Project "nature"
  - Project "controls"
  - Partner "controls"
  - Resources devoted to the project
  - Firm "innovation history"
  - Environment
- In the attached document you may see a detailed description of the variables used in the analyses