R&D Integration: How to Build a Diverse And Integrated Knowledge Community

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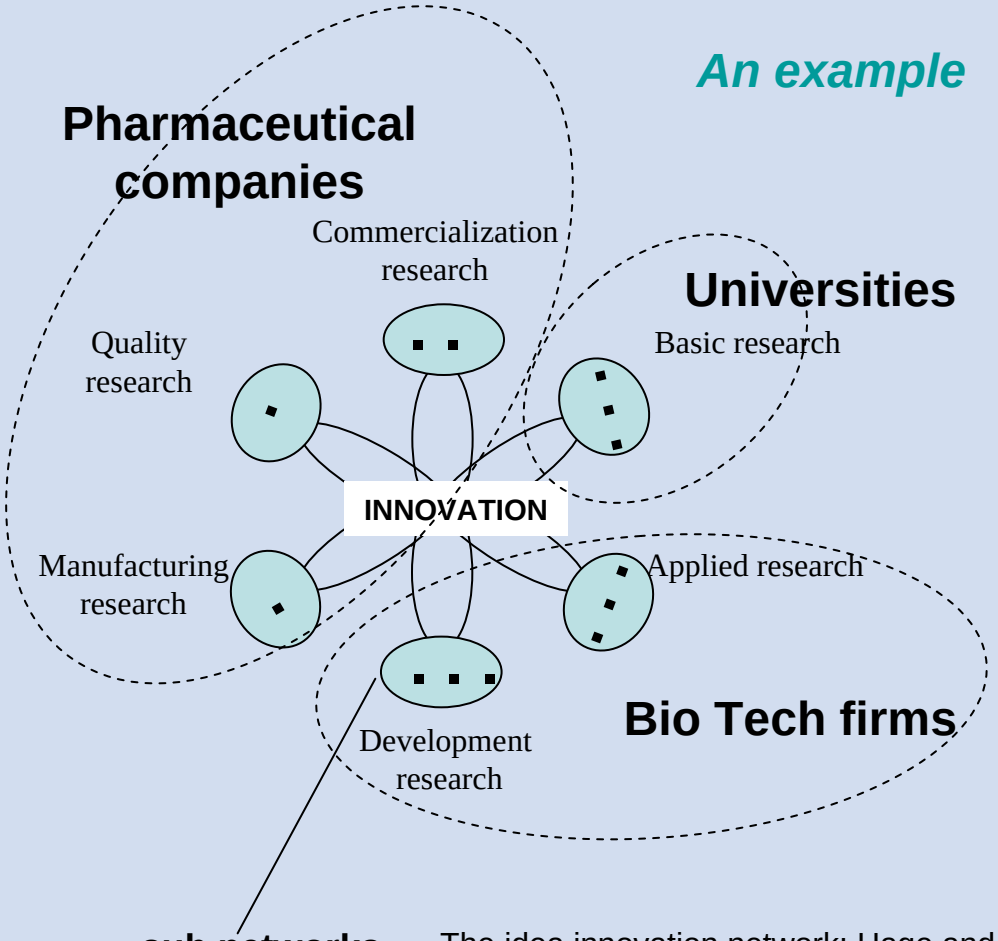
Objectives

- Outline need for greater integration of R&D activities
- Outline ways of creating integrated knowledge communities
  - Key leverage points in research environments suggest integrative mechanisms
  - Examples from a transformational organization – the Institut Pasteur
- Summary and References

The Changing Nature of Knowledge Production

- Sustained investment in R&D over time have led to
  - Occupational specialization
  - Structural differentiation
- Two primary issues
  - Increases cognitive distance
  - Reduces exchange of tacit knowledge

An example



The idea innovation network: Hage and Hollingsworth (2000), modifying Kline and Rosenberg (1986)

Evidence for Changing Nature of Knowledge Production

Study of telecommunications and pharmaceuticals in Western Europe (van Waarden and Oosterwijk)

- Increasing innovation led to greater structural differentiation
- Increasing need for researchers from different firms and organizations to cooperate
- Complementary R&D conducted elsewhere
- Increasing internationalization of research

Key Dilemmas of Changes in Knowledge Production

- Increasing Structural Differentiation
  - Research arenas become fragmented
  - Research firms/organization become fragmented

- Increasing Cognitive Distance
  - Researchers “interpret, understand and evaluate the world differently” (Nooteboom, 2007)
  - Curvilinear relationship between cognitive distance and innovation (Nooteboom, 1992, 1999)
  - Too much cognitive distance erases the mutual understanding needed for effective collaboration.

Options for Addressing the Changes in Knowledge Production

- More funding?
  - “Increase significantly the research budgets of agencies that support basic research” (Council on Competitiveness, 2004)
  - Overlooks changes in knowledge production.

- Greater integration of diverse research arenas?
  - Increased communication between basic and applied research?
  - Structural changes, like co-location and concurrent engineering?
  - But how do you successfully integrate into knowledge communities?

Key Leverage Points for Integration and Creating Knowledge Communities

Key aspects of the research environment identified in the development and application of a comprehensive survey at the Department of Energy (Jordan, 2005, 2006)

- Internal and external collaborations
- The strength of collaborations in exchanging technical ideas within and across disciplines (cross-fertilization, critical thinking)
- Research teams with varying degrees of complexity, both internal and external to the organization

Lessons from the Institut Pasteur (1887-1915)

- A transformational organization that ushered in the biomedical revolution
- Created multiple new specialties within biomedicine, yet fostered integration among them
- Made a series of major breakthroughs in biomedicine, many of which came from those recruited from less prestigious universities

But How?

Five Key Mechanisms for R&D Integration

- Broad vision (and organizational charter) that encompasses the entire knowledge community
- Visionary team leadership
- Diverse team membership, nationally and internationally
- Intellectual and emotional integration mechanisms
- Diverse sources of funding

Broad Vision

- Pasteur moved beyond a narrow focus on bacteriology to encompass a broader view of microbiology

- Pasteur's vision encompassed all aspects of the idea innovation network, from basic to commercialization
    - Strategy of teaching physicians how to conduct medical research
    - Develop and market biological products

Visionary team leadership – institutional entrepreneurs

- Created new scientific disciplines, research specialties, or technologies (Duclaux, Roux and Metchnikoff), pushing the boundaries of existing knowledge
- Built teams and networks with a wide range of researchers beyond national and organizational boundaries
- Reconstructed the larger institutional environment
  - Redefined what constituted the relevant research community
  - Created career paths, making the community a viable economic opportunity

Diverse Team Membership

Allowed for the creation of very diverse research teams along a number of dimensions

- Nationally and internationally
- Different disciplines, occupational specialties
- Different research focus
- Different educational status
- More diverse personal networks

Intellectual and *Emotional* Integration Mechanisms

- Cross-functional teams
- Dual leadership of research projects – complementary skills sets
- Common training in microbiological techniques – research platform to foster exchange of tacit knowledge
- Creation of the *Annales de l'Institut Pasteur* – broke free of institutional constraints of French science
- Personnel exchanges within the network of institutes – counterweight to the development of disparate organizational cultures
- Socio-emotional leaders and the fostering of an inclusive culture, the Pasteurian family

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Diverse Sources of Funding

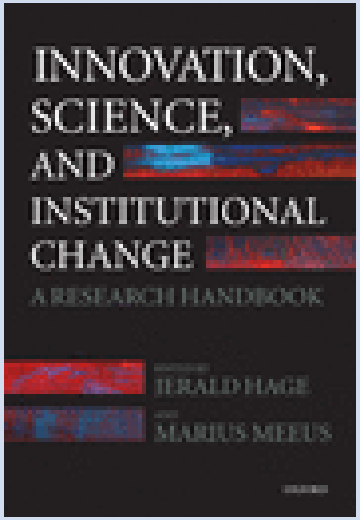
- Institute had funds from
  - Public subscriptions
  - Patent royalties – mostly agricultural products
  - Sale of Pasteur products – mass-produced serums and vaccines (monopoly producer of diphtheria serum)
  - Small operating grants
  - Bequest and wills

- Multiple sources
  - Mitigates the influence of a single source to narrow research vision
  - Allows greater freedom

In Summary

How do you foster knowledge communities?

- Changing nature of knowledge production necessitates specific approach
- Key leverage points have been identified and can be measured
- Institut Pasteur (and other case studies) highlights specific mechanisms



(Hage and Meeus, Oxford University Press)

http://www.bsos.umd.edu/socy/centerforinnovation/

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