

# Rethinking Science as a Vocation:

## 100 Years of Bureaucratization of Academic Science

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# 1. Introduction

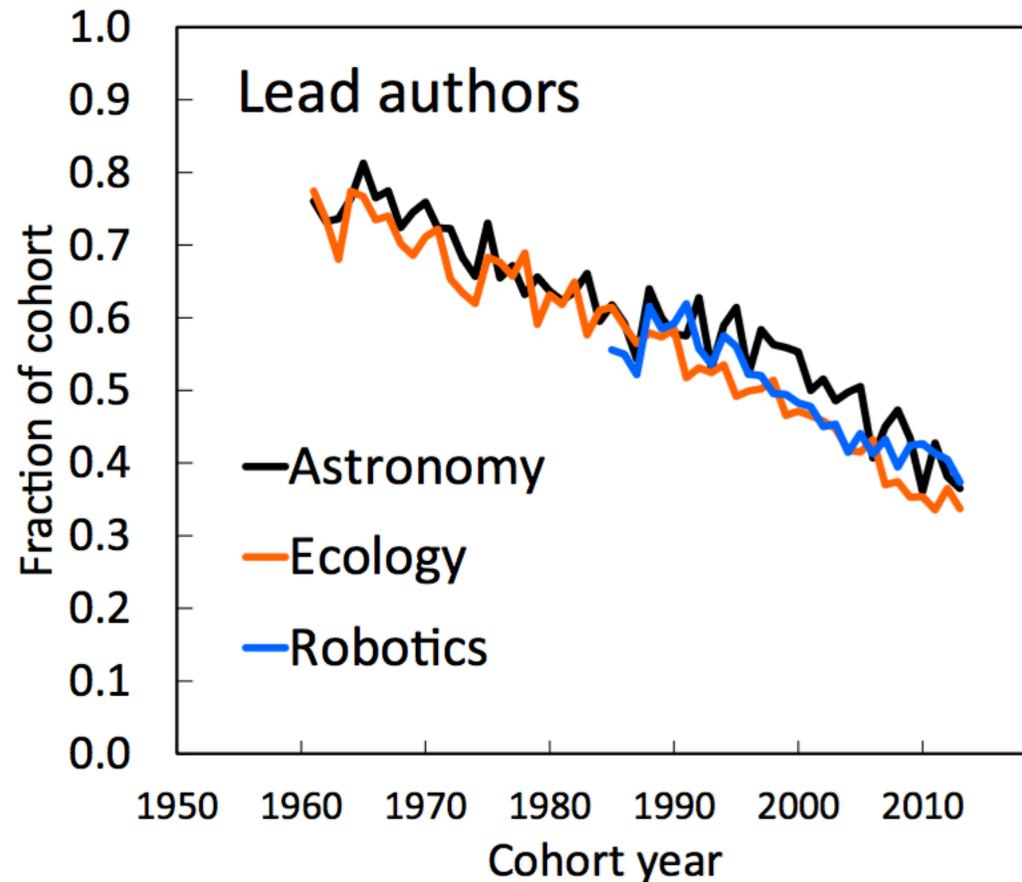
- Science has long been characterized as a craft practice, and even as a vocation (Hagstrom 1964; Weber 1946).
- However, science is increasingly becoming a team activity and the teams may be increasingly bureaucratized (Milojević 2014; Walsh & Lee, 2015; Weber 1978)
- In this paper we show:
  - This long debated transition has in fact occurred.
  - How this structural change can affect the work, careers and products of science
  - Synthesis of the findings with Weber's discussion of science as a vocation
    - Whether, and in what ways, such a vocation can survive in this new bureaucratized structure

## 2. Work and Careers in Bureaucratized Science

- Increasing bureaucratization of science
  - Traditionally, scientific training and careers followed a craft model, generating fully integrated, independent scientists (Hackett 1990; Walsh 1989).
  - However, even in the 1960s, Hagstrom (1964) notes the rise of the dependent, but skilled, role of “professional technicians” (--we call them supporting scientists).
    - Those with important specialist skills, but who may not be fully capable of executing a complete research project, only supporting others’ projects.
  - Size is associated with greater bureaucratization (Walsh and Lee 2015): division of labor, standardization, hierarchy, decentralization
    - pushes trainees into premature specialization, becoming supporting participants in teams (Hackett 1990; Walsh & Lee 2015)

## 2. Work and Careers in Bureaucratized Science

- Rise of the Supporting Scientist: among recent cohorts, over half



Source: Milojević, et al. 2018.

## 2. Work and Careers in Bureaucratized Science

- In addition, competition for funding and productivity demands leads to specialization and training in support roles (Hackett 1990)
  - Therefore, both size and competition drive and reinforce bureaucratic structure (division of labor), producing specialist supporting scientists (with possible adverse consequences)
  - System generates both supply of AND demand for supporting scientists

# **3. Impacts of Bureaucratic Structuring**

## **: Bureaucratization and Motivation**

- **The traditional model of scientist driven by internal motivation (calling) and the Mertonian model based on recognition depend on a tight link with the credit assigned to a scientific finding**
- **The growth of teams of supporting scientists uncouples the links between authorship and the reward structure of science (Biagioli 2003, Jabbehdari & Walsh 2017)**
- **Can lead to goal displacement, “hired-hand research” (Roth 1966; Merton 1973; Hackett 1994)**

# **3. Impacts of Bureaucratic Structuring**

## **: Bureaucratization and Academic Performance**

- The contemporary academic system rewards speed and productivity and hence there are benefits from bureaucratic structuring – especially division of labor (Shibayama et al. 2015; Walsh et al. 2018).
- If we consider other indicators of performance...
  - Novelty, serendipity, basic research findings
  - Effects of division of labor and hierarchy are more mixed

# **3.Impacts of Bureaucratic Structuring**

## **: Bureaucratization and Pathologies in Science**

- **Furthermore, bureaucratic structures may have an unexpected downside (Walsh et al. 2019, Warren 2003),**
  - **Sacrificing caution and accuracy to the demands of productivity**
- **Division of labor and specialization, designed to increase productivity, also increases pathologies in science (errors, malfeasance).**
  - **Structural secrecy, Goal displacement, Delegation of responsibility (Goodman et al. 2011, Greve et al 2010, Vaughan 1999)**
- **The organizational view of scientific pathologies suggests the need for a structural research integrity beyond individual-level interventions**
  - **Cross-training, job rotation, cross-checking, redundancy in experimental procedures.**

# 4. Rethinking Science as a Vocation in the Era of Bureaucratized Academic Science

- Whether, and in what ways, Weber's (1946) view on science as a vocation can survive in this new bureaucratized structure of scientific work
- Even 100 years ago, Weber notes a bureaucratization of science.
- Weber argues that such bureaucratized structures may increase productivity, but may not be compatible with science as a calling

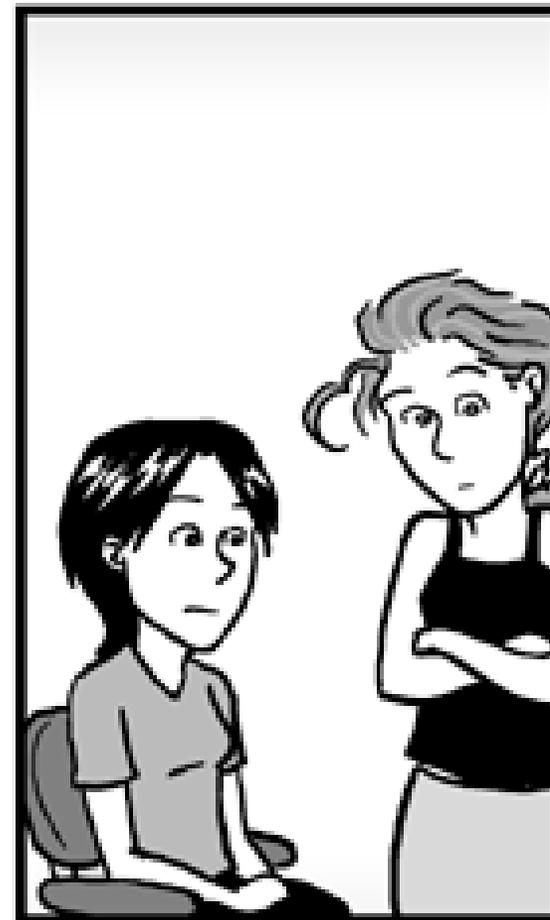
# 4. Rethinking Science as a Vocation

## : Meaning of 'Vocation'

- Weber's internal orientation aspects vs. Merton's socially focused view of science
  - In the Mertonian framework, one is only a scientist to the extent that one publishes her findings and these are accepted by peers
  - Hence, bureaucratization may destroy the Mertonian incentive systems
  - However, the Weberian incentives based on the compulsion of a calling may survive
    - "... if each finds and obeys the demon who holds the fibers of his very life."

# 4. Rethinking Science as a Vocation

## : Meaning of 'Vocation'



JORGE CHAM © 2003

# 4. Rethinking Science as a Vocation

## : Meaning of 'Vocation'

- It is an empirical question whether the new organization of science is consistent with an inner calling to science, and whether such a calling is necessary for the advance of science
- Are we still servants of Minerva?



# 4. Rethinking Science as a Vocation

## : Rationalization of Science (Weber vs. Schumpeter)

- Weber argues that the problem of contributing to the advance of science cannot be easily rationalized
  - Bureaucratization may reduce creativity
  - Division of labor leads to missing key results
  - Smaller team size is associated with the advance of science, while larger teams focus on developing existing results (Milojević 2014)
- Schumpeter (1942) argues that innovation is becoming rationalized, making progress an automatic, self-sustaining process
  - Large enterprises will lead innovation, wiping out the small or medium-sized firms

# 4. Rethinking Science as a Vocation

## : Meaning of 'Vocation'

- The bureaucratization of science raises the following questions:
  - Can we still have vocation in this bureaucratic structure?
  - And, if we do not, can we still have science?
- We may predict three different outcomes from the bureaucratization of science:
  - 1) We keep the vocation
  - 2) We lose vocation and also lose science
  - 3) We lose vocation but keep science

# 5. Future Empirical Work

- Effects of bureaucratization on training
- Bureaucratization and alienation
- Additional empirical questions
  - Hierarchy, standardization and decentralization as well as division of labor
  - Training and career outcomes
  - Gender and supporting scientists
  - Bureaucratization and commercialization of science
- More generally, bringing theories and methods of organization theory and organizational behavior to understand contemporary science and bring new insights to policy debates affecting scientific work

# 6. Conclusions

- Growing bureaucratization of science
- Implications for productivity, but also creativity and pathologies
- As Science is organized on bureaucratic principles, there may be less demand for integrated scientists and more demand for highly-specialized supporting scientists
  - Two-tier system: integrated scientists leading teams of hired hands?
- We are left with the questions:
  - How the changing nature of scientific work is either accommodating or destroying the scientific vocation
  - Whether this vocation is still necessary for the progress of science

# 6. Conclusions

- We are observing the makings of this change in science
- Universities and funding agencies need to embrace this transition and incorporate supporting scientist positions into the formal structures and evaluations systems of universities
- We still have choices
  - About emphasis on productivity versus replicability
  - About tying funding to productivity
  - About organizing the work to emphasize specialization or breadth (especially in training stage)

# Thank you!

Questions, Comments, Suggestions?

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