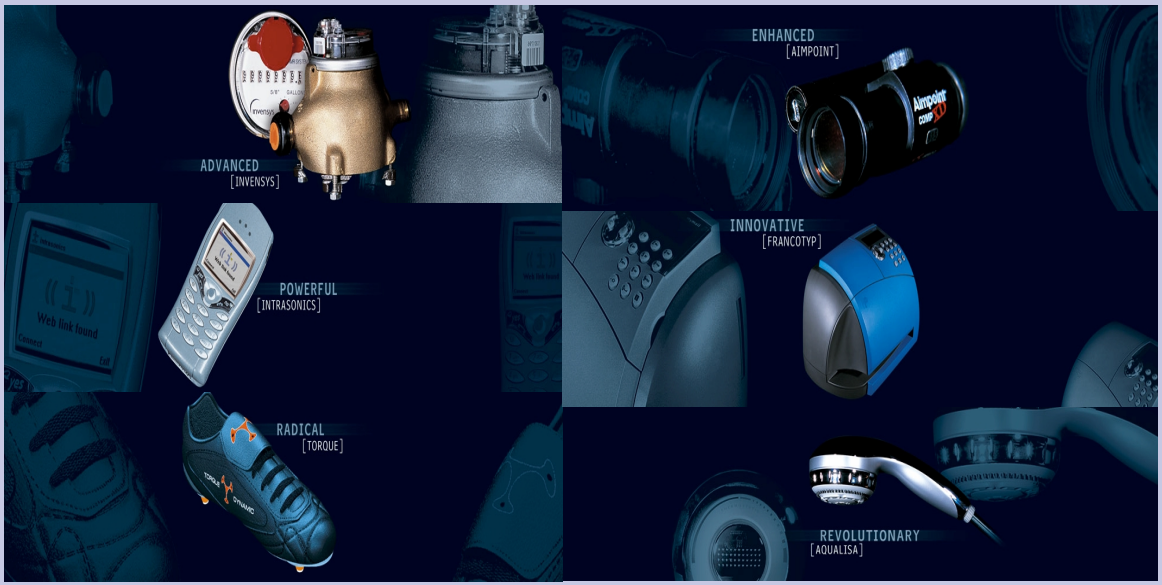
Adding Value to R&D

Gordon Edge



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Adding Value to Research and Development

Proposition:

- That output metrics are inappropriate in R&D
- A cultural process model is essential to optimise R&D
- That relative effectiveness drives relative added value and competitiveness
- That culture dominates organisation in maximising effectiveness

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General Technology Model

(Networks)

Vertical Markets

system technologies

Horizontal Markets

product technologies

materials technologies

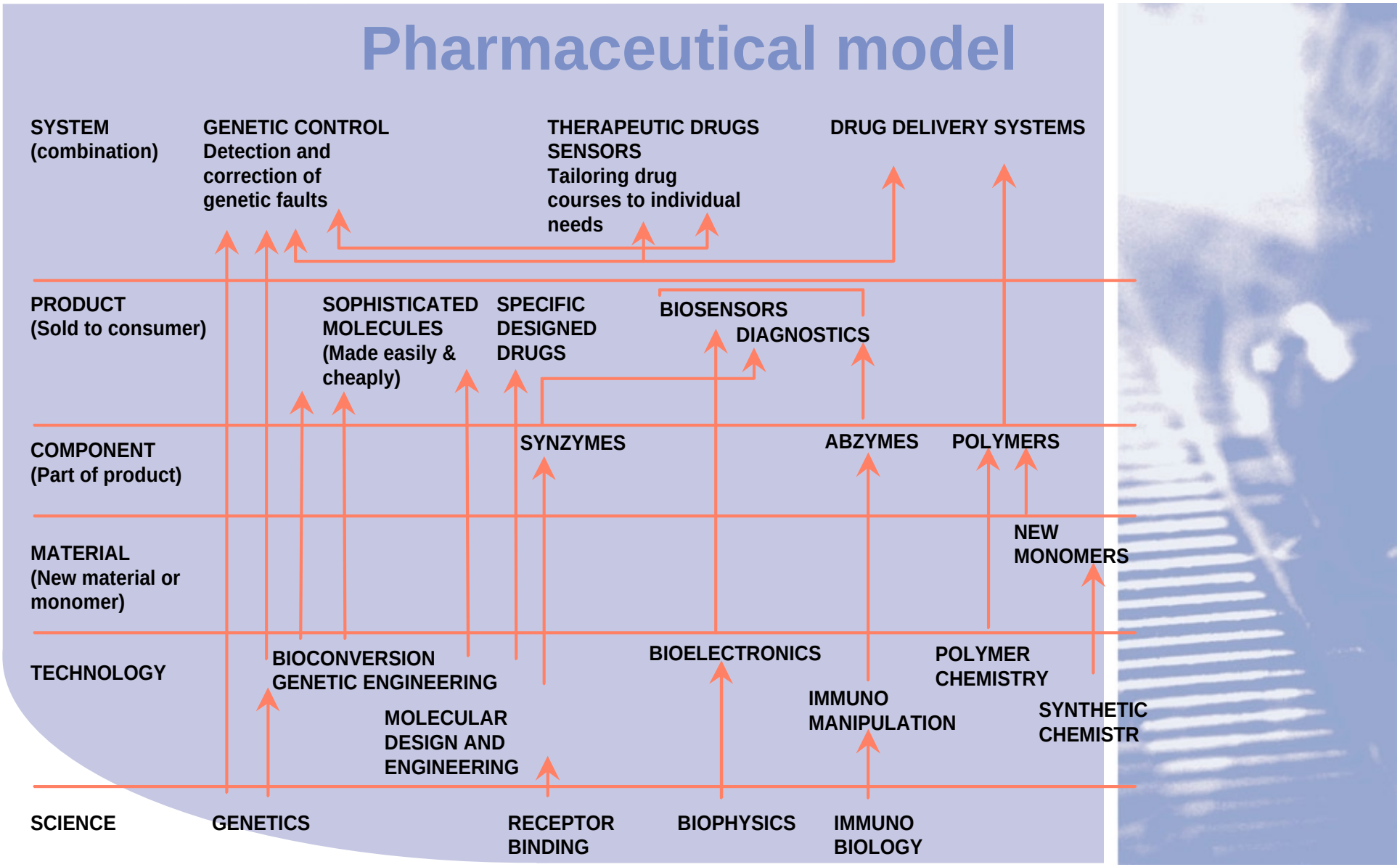
Technology Base

Emerging Science

(Education)

GENERICS

Pharmaceutical model



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Problems with platforms: Titanium Dioxide

- Case 1: Titanium Dioxide as pigment – incremental
  - Refractivity
  - Scattering
  - Diffraction
- Case2: Titanium dioxide as metal precursor – disruptive
  - The Fray (FFC) process
- Case 3: Titanium dioxide as conductor - segmental
  - The Atraverda process

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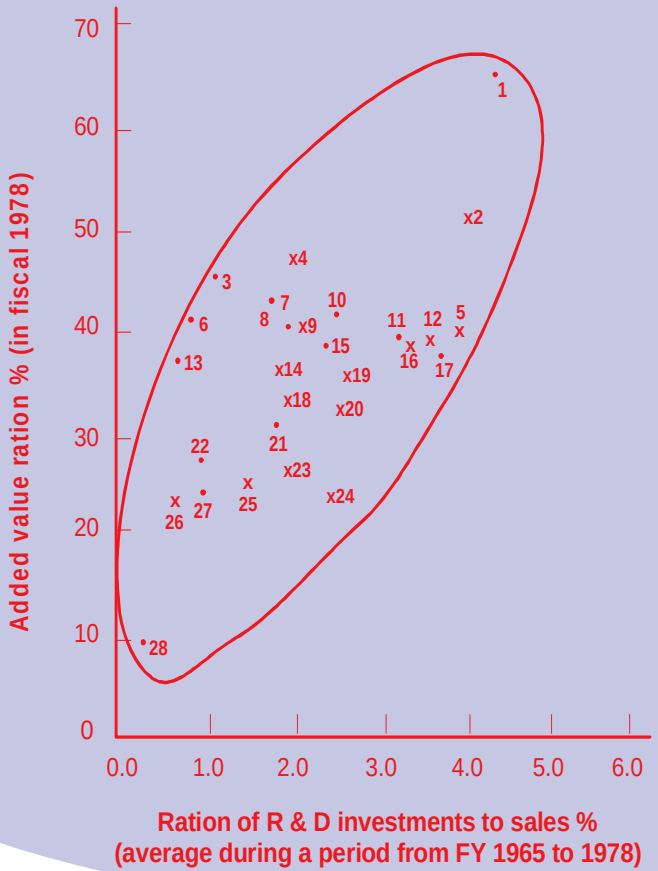
R&D and Added Value

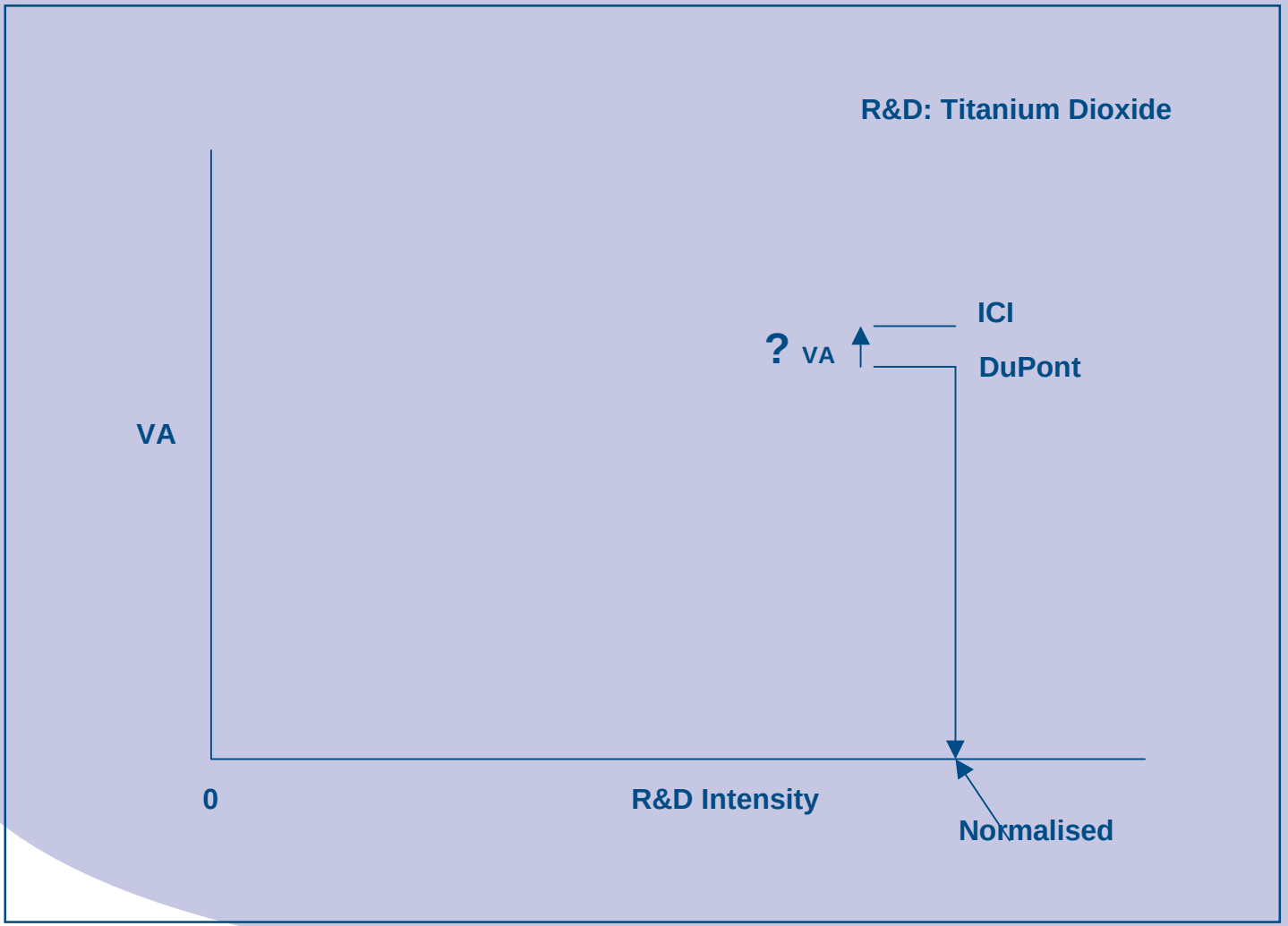
Added value ration = added value/shipped product value x 100%
(added value and shipped product value based on industrial statistics)



1. Pharmaceuticals
2. Physical and chemical appliances
3. Ceramic industry
4. Medical equipment
5. Household electric appliances
6. Metal
7. Rubber
8. Machinery
9. Electronic parts
10. Precision
11. Electric
12. For power generation
13. Fabrics
14. Aircraft
15. Fats and oil
16. Optical
17. Communications and electronic
18. Inorganic
19. Watches and clocks
20. Office equipment
21. Chemical
22. Steel
24. Automobiles
25. Electric wires and cables
26. Steel
27. Non-ferrous
28. Petroleum

Source ; SPR

Relative Added Value enhances competitiveness



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Skill-based Competition

- Skill intensity and added value are strongly correlated
- Relative skill intensity and relative effectiveness underpin competitive advantage
- Maximum effectiveness and efficiency in the skill base are therefore key
- Effectiveness factors include creativity, innovation, optimal time to market and quality
- Culture is a dominant factor in optimising effectiveness

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What Do We Mean By Culture?

Strictly, a culture is a set of beliefs and behaviours of the community within a firm e.g.:

- **implicit communication between individual and groups - multidisciplinary and interdisciplinary**
- **emphasis on innovation**
- **emphasis on effectiveness**
- **a skill-based meritocracy**
- **an homogenous organisation**
- **minimal explicit hierarchies**
- **an absence of status factors**
- **diversity of behaviour, knowledge, background and ethnicity**

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Culture: Non rational management – the lexicon

Calculating	Enjoying
Measuring	Inspiring
Planning	Flexible
Stable	Chaotic
Training	Intuitive
Productive	Effective

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Why the Emphasis on Skills?

- Because product lifecycles are becoming shorter, whereas skill lifecycles are becoming longer

- Because of the profound consequences:
  - inter-firm competition can be analysed in terms of skills rather than products
  - the value reaped from a skill must exceed the cost of building up that skill
  - the analysis of skill demands a longer timescale than most businesses are prepared to consider

Culture and Science

- Interdisciplinary working is probably the most important cultural concept
- A culture of innovation is probably next in importance
- Neither of these are organisational concepts
- Nor is innovation a process
- Goal orientation is a strong cultural value

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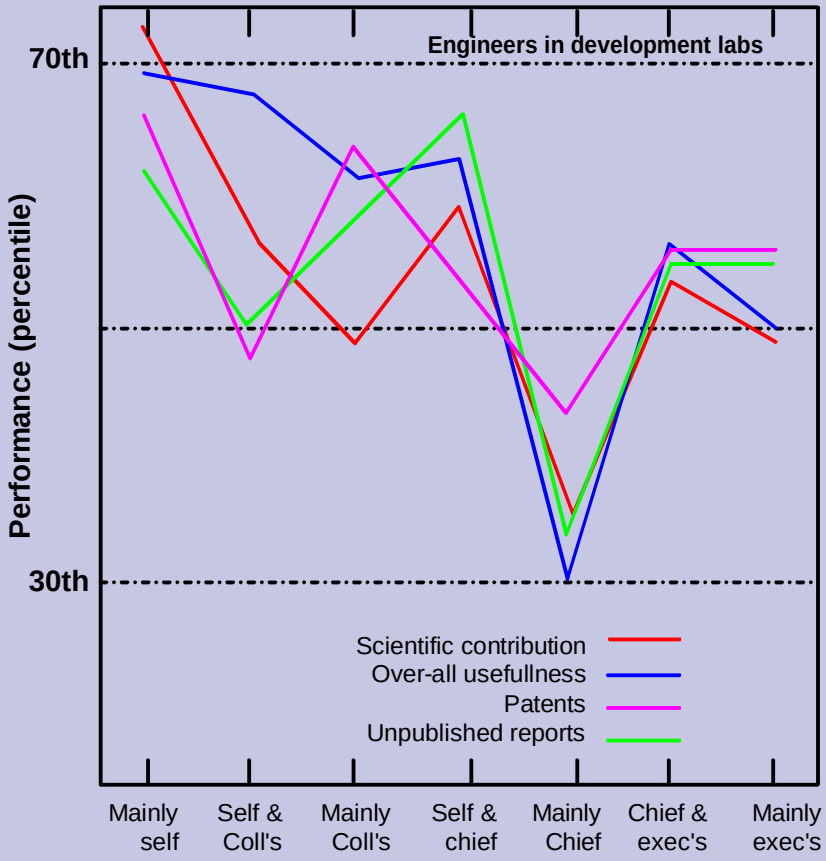
Culture: Effectiveness and Source of Direction



Number of individuals	36	21	23	34	30	29	50

*Statistically significant

Source: Pelz & Andrew

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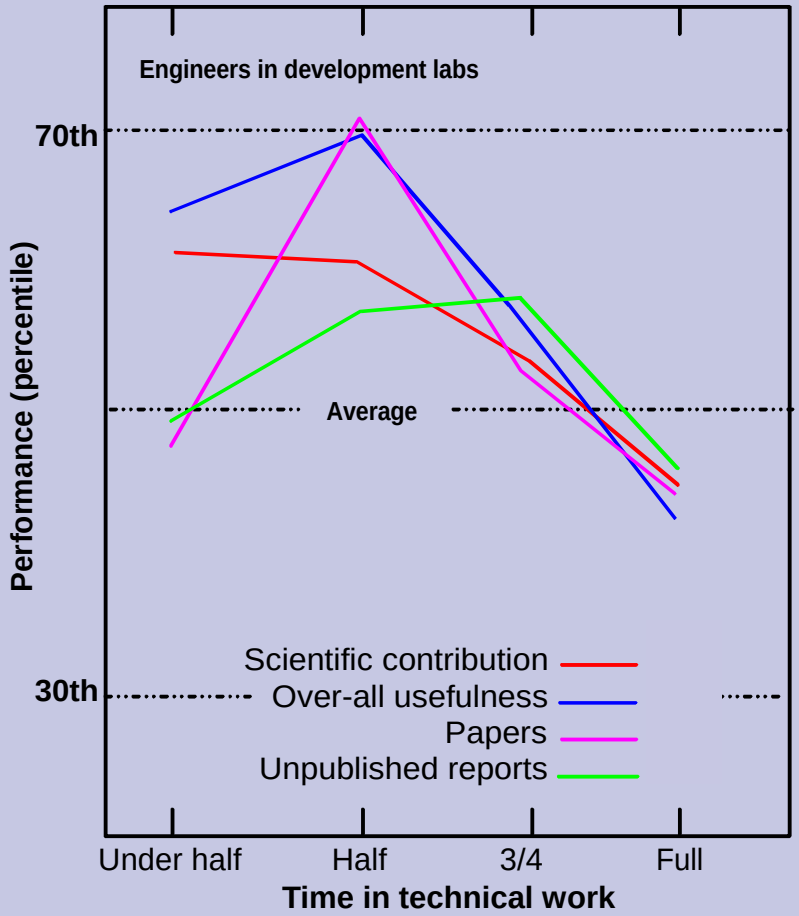
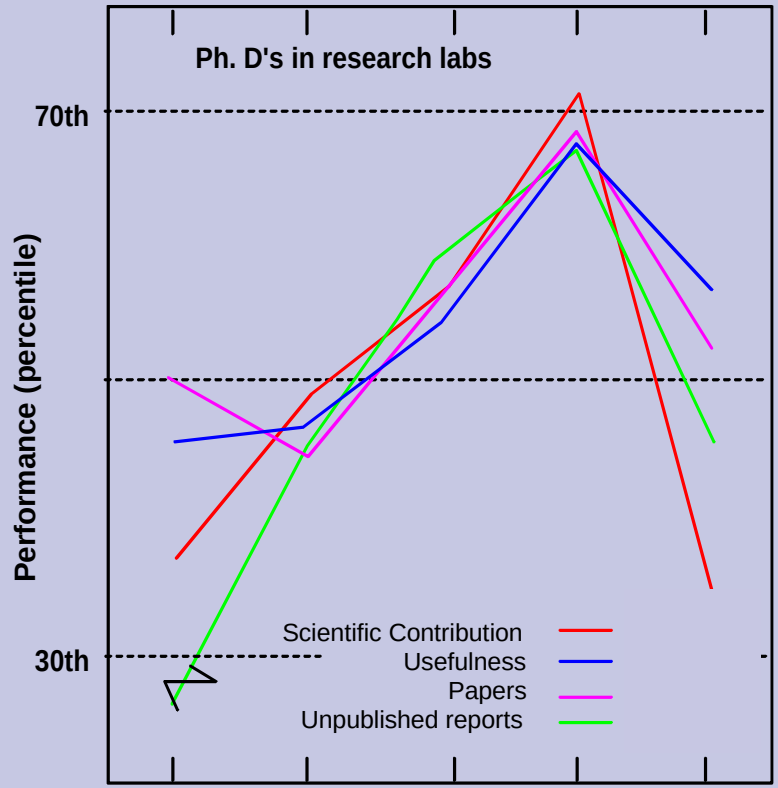
Culture: Effectiveness and Time



Number of persons	**16**	**48**	**78**	**73**

***Statistically significant**

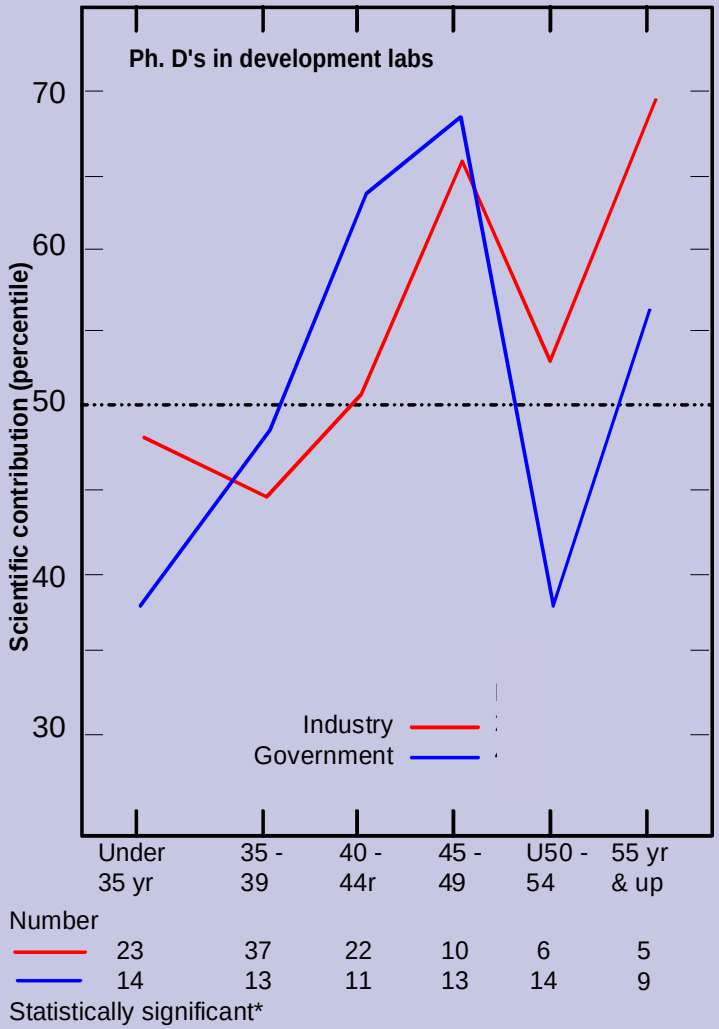
Culture: Effectiveness and Interdisciplinary working



Number				
5	22	18	8	3
8	30	20	9	4

*Statistically significant

Culture: Effectiveness and Age



- Thus an R&D process model based upon effectiveness and efficiency should give optimal results under most industrial situations
  - Culturally driven
  - Emphasis on skill quality
  - Interdisciplinary
  - Emphasis on effectiveness (rather than efficiency)

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References

- Pelz & Andrews - “Scientists in Organisations”, Wiley, 1986
- Klein, Edge & Kass - “Skill-Based Competition”, Journal of General Management, Summer 1991
- Edge - “Skill-Based Competition - An enhanced approach based upon equivalence in product, organisation and culture (EPOC)”, Joseph Black Lecture, University of Bath, June 1996

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