

Some Thoughts on Citations: Do They Matter? Are they Fair? What Can We Do to Increase Our Citations?

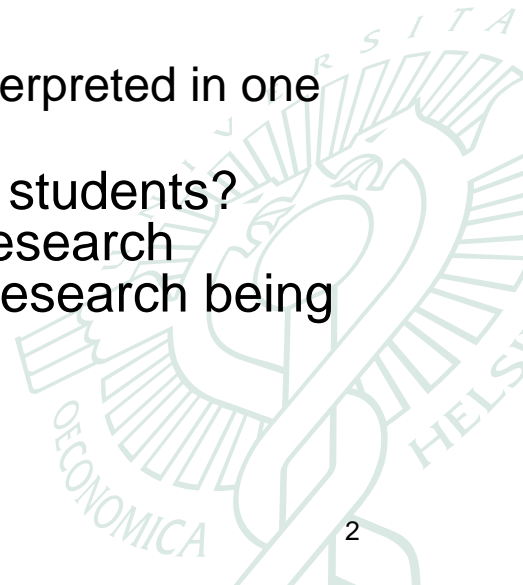
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Making and Risk Management 5-7.12.2007

Who cares?

- Citations matter to journal editors
- Rectors, Deans, Department Heads -- colleagues
- Awards Committees (as one piece of information)
- Are they fair? ... not necessarily (and hard to compare across fields) – surrogate measure of impact of research
 - “Good” research papers earn citations, but so do
 - Review papers
 - Polemic papers
 - Papers containing mistakes

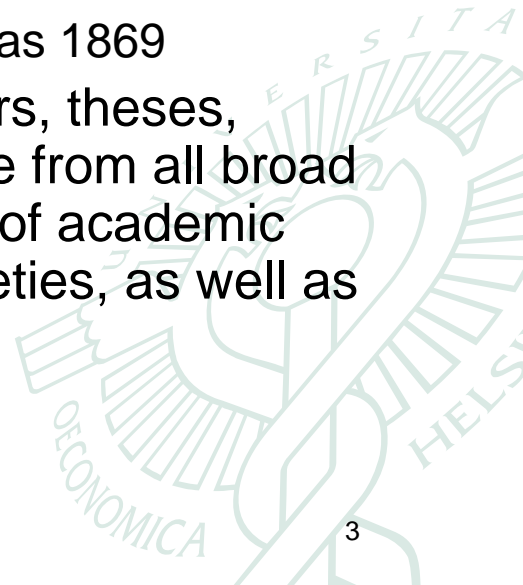
(Absence of citations can, however, only be interpreted in one way ...)
- Other measures of impact: Success of your students? Number of first rate publications? Outside research funding generated? To what extent is your research being applied?



What Citations Are We Talking About?

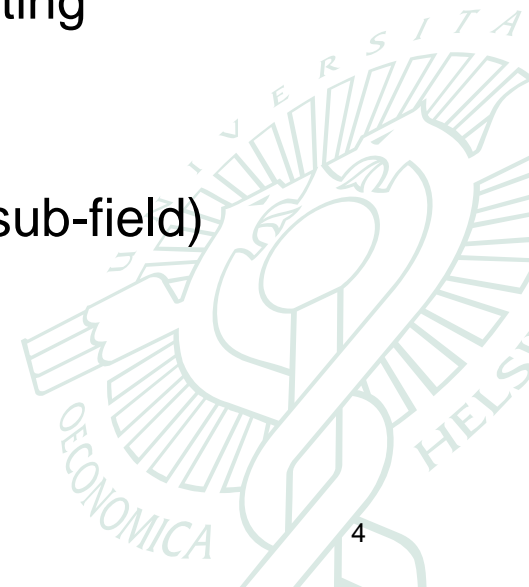
ISI (Thomson Scientific), Scopus (Elsevier), Google Scholar (Google) – differences in coverage and time span

- The **ISI** database covers over 8650 journals: 1955+ for Science Citation Index Expanded; 1975+ for Arts and Humanities Citation Index; 1973+ for Social Sciences Citation Index
- **Scopus** covers: 15,000 journals (Over 1,000 Open Access journals, 500 Conference Proceedings, 600 Trade Publications, 25 Book Series)
 - 16 million records going back to 1996
 - 17 million pre-1996 records going back as far as 1869
- **Google Scholar** covers: peer-reviewed papers, theses, books, abstracts, and other scholarly literature from all broad areas of research. Works from a wide variety of academic publishers, universities and professional societies, as well as scholarly articles available across the **web**.



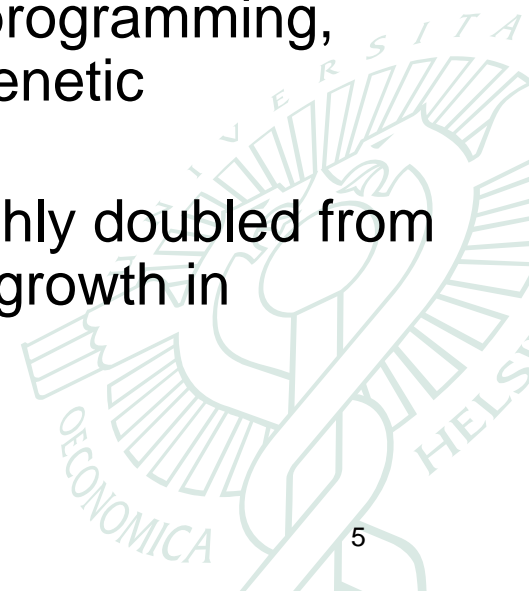
Focus on ISI – the oldest (existed prior to the electronic era)

- What information can we find from ISI? We can do all kinds of searches based on: author names, keywords, affiliations, years (articles and citations)
 - Journal articles
 - Citations to a paper, author (numbers as well as information about the papers actually citing somebody's paper)
 - Information who cites you
 - Basic statistics (about an author, field, sub-field)

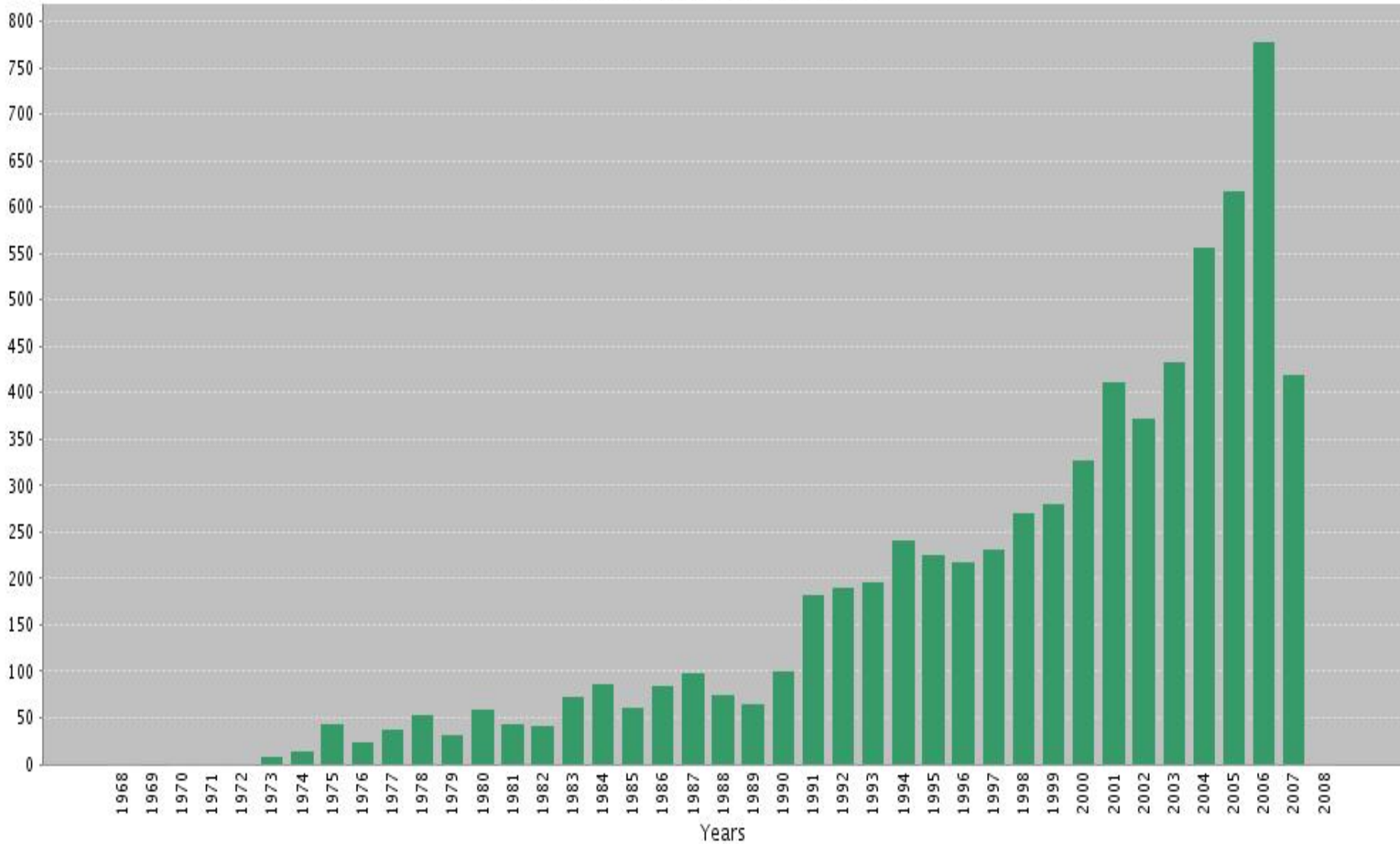


Bibliometric Analysis of MCDM/MAUT

- We have conducted a bibliometric study of MCDM/ MAUT using the ISI database. The ISI database covers over 8650 journals. It found 6910 MCDM/ MAUT publications covering years 1970-2007.
- We report basic statistics regarding how our fields have developed based on variations of the following key words: multiple criteria decision, multiattribute utility, multiple objective programming/optimization, goal programming, Analytic Hierarchy Process, evolutionary/genetic multiobjective, and vector optimization
- The # of pubs included in the SCI has roughly doubled from 1992 to 2006 – interesting to compare the growth in MCDM/MAUT



Published Items in Each Year



Citations in Each Year

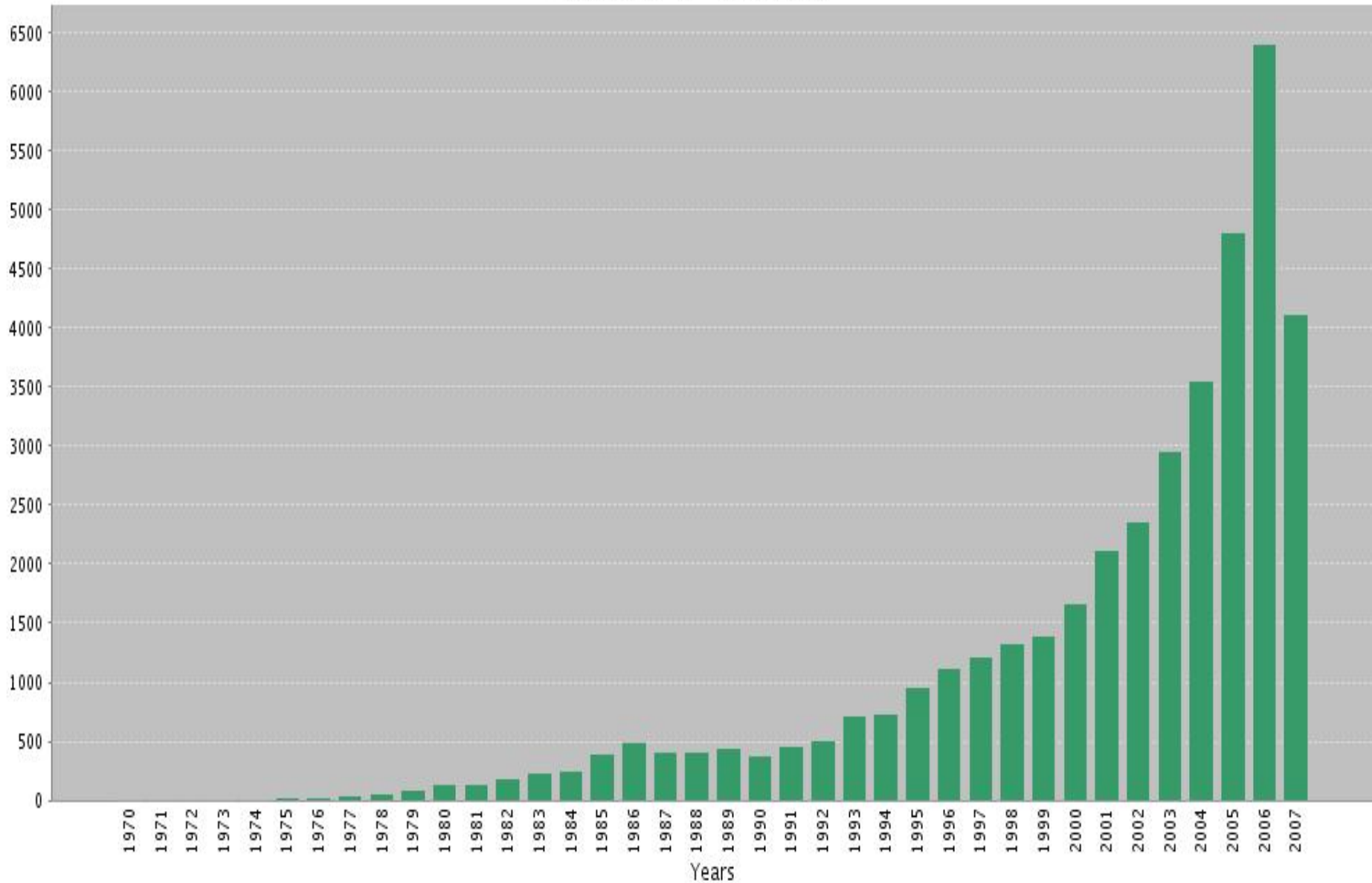
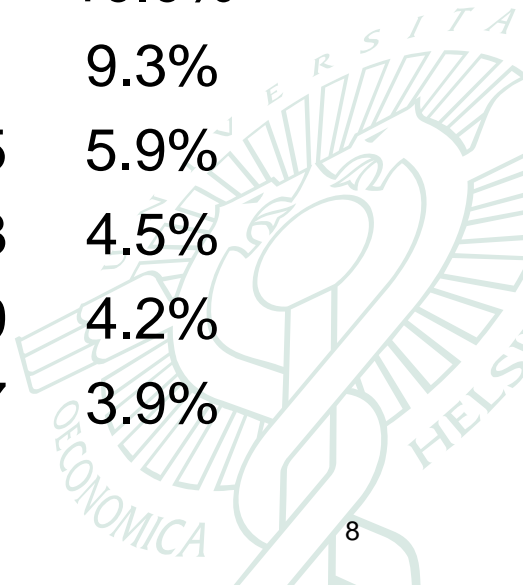


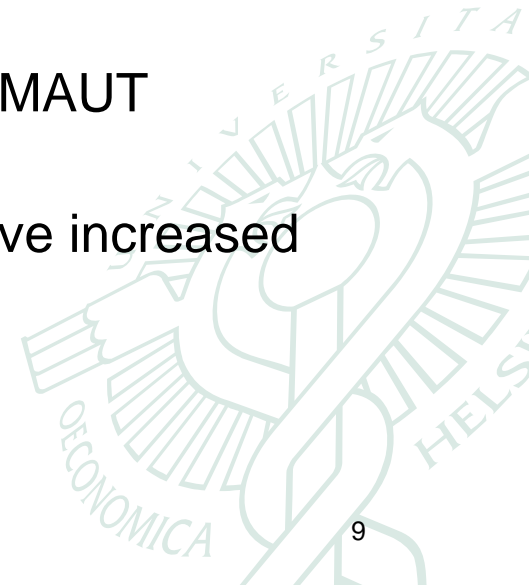
TABLE 2: Sub-topical Areas

OR and MS	2415	34.9%
Computer science, AI and IS	829	30.4%
Management and business	1587	23.0%
Applied mathematics, interdisc.	1066	15.4%
Environmental	689	10.0%
Industrial engineering	641	9.3%
Manufacturing engineering	405	5.9%
Economics	308	4.5%
Civil Engineering	289	4.2%
Energy and water resources	267	3.9%

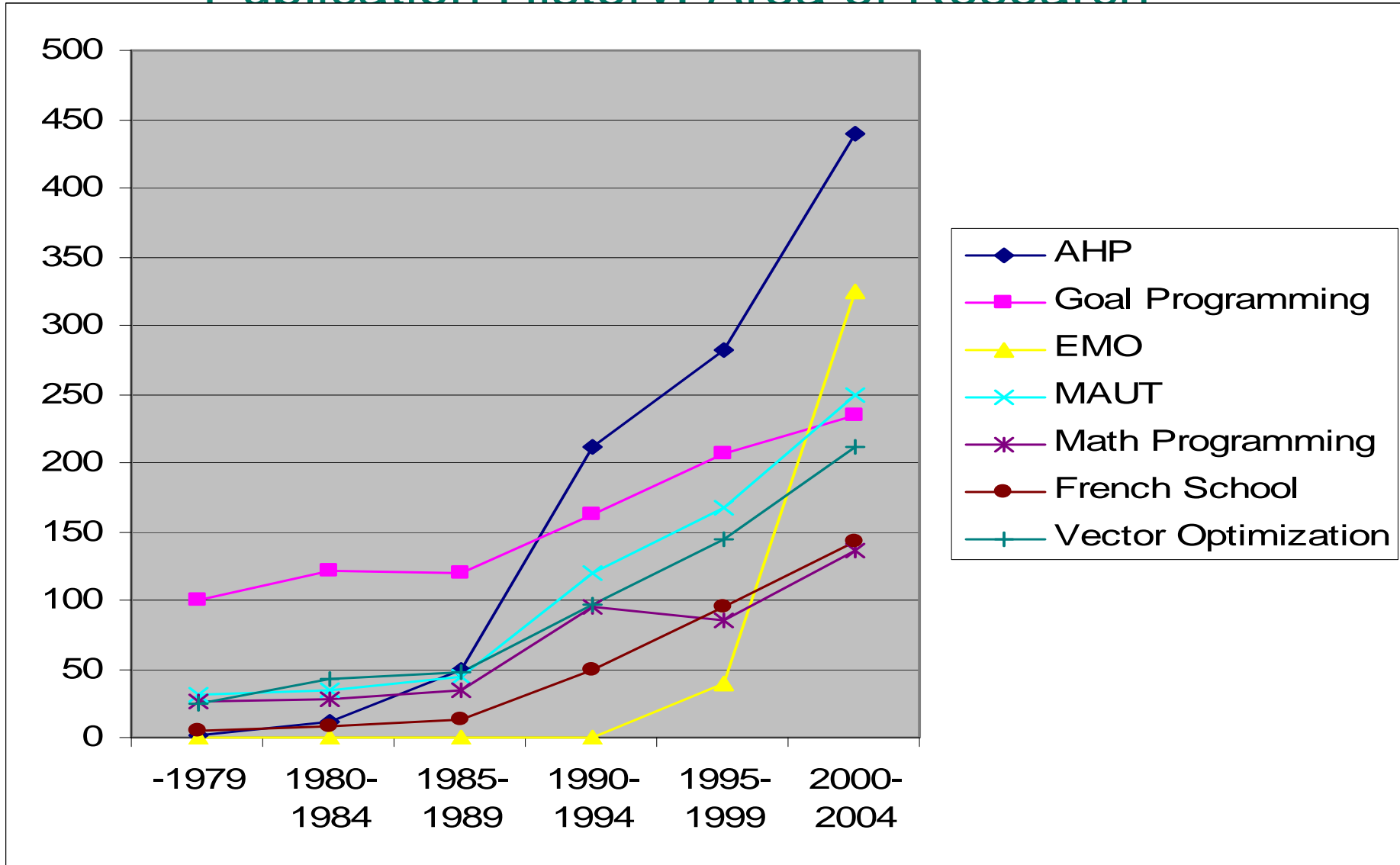


Sub-topical Areas: changes over the years

- We also compared ISI publication figures for years 1970-1990 and years 2002-2006. Clear shifts are noticeable:
 - The relative share of OR/MS and Mgmt & Business topics has decreased about 40%
 - The share of computer science has increased by some 20%
 - The share of environmental ISI MCDM/MAUT publications has doubled
 - All engineering areas (except for IE) have increased considerably

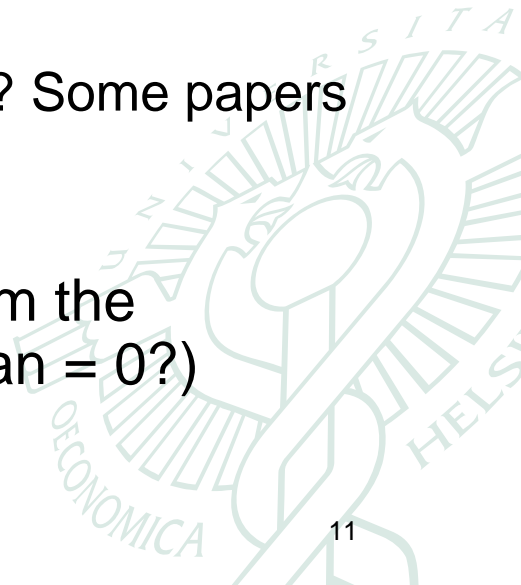


Publication History: Area of Research



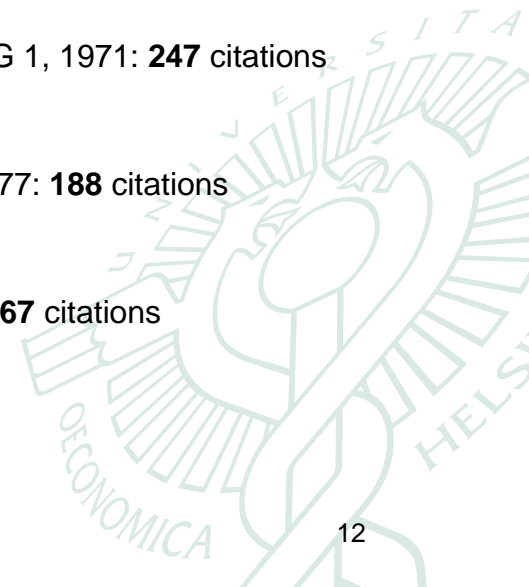
Citation Statistics: MCDM/MAUT

- 7254 publications (By December 4th, 2007)
- Average number of citations 5.89/paper
- Median number of citations 2
- 35% = earned 0 citations
- Best earned 551 citations
- About 25 papers earned 100 or more citations
- What is the life span of an article?
 - 10 yrs? 30 yrs? — normal distribution?? Some papers might get noticed rather late ...
- Note: Have not purged self-citations from the statistics (excluding self-citations, median = 0?)



12 most cited MCDM/MAUT ISI articles -- tentative

1. YAGER RR: On Ordered Weighted Averaging Aggregation ..., IEEE TRANSACTIONS ON SMC 18,1988: **551** citations
2. GEOFFRION AM: Proper Efficiency and ..., J. OF MATH ANALYSIS AND APPLICATIONS 22, 1968: **424** citations
3. GEOFFRION AM, DYER JS, and A. FEINBERG: An Interactive Approach for Multicriterion ..., MANAGEMENT SCIENCE 19, 1972: **337** citations
4. DEB K, PRATAP A, AGARWAL S, et al.: A Fast and Elitist Multiobjective Genetic ..., IEEE TRANSACTIONS ON EVOLUTIONARY COMPUTATION 6, 2002: **320** citations
5. ZITZLER E, THIELE L: Multiobjective Evolutionary Algorithms ..., IEEE TRANSACTIONS ON EVOLUTIONARY COMPUTATION 3, 1999: **317** citations
6. ZIONTS S, WALLENIIUS J: Interactive Programming Method ... MANAGEMENT SCIENCE 22,1976: **263** citations
7. TORRANCE GW, FEENY DH, FURLONG WJ, et al.: Multiattribute Utility Function for a Comprehensive Health ..., MEDICAL CARE 34: 1996, **263** citations
8. BENAYOUN R. et al: Linear Programming with Multiple ... (STEM), MATH PROGRAMMING 1, 1971: **247** citations
9. ZAHEDI F.: The AHP – A Survey ... , INTERFACES 16, 1986: **241** citations
10. EDWARDS W.: How to Use Multiattribute Utility ..., IEEE TRANSACTIONS ON SMC 7, 1977: **188** citations
11. DYER JS: Remarks on the AHP Process, MANAGEMENT SCIENCE 36,1990: **187** citations
12. DYER JS, SARIN RK: Measurable Multiattribute Value Functions, OPER. RES. 27, 1979: **167** citations



What can we do to improve citations, impact?

- Do solid research – something interesting to say
- Choose an appropriate journal (not Proceedings, not national outlet) (journal with a relatively high IF; active and growing fields)
- Write well (not overly technical) – always seeking a broader audience (write from a reader's point of view: whom do you want to read your papers?)
- Promote your work: by contacting scholars who work in the same field, giving talks, conference presentations, etc.
- Collaborate with scholars who have an established research record (and citations)
- Rewrite old pieces of research (which have not earned many citations) – different audience, perhaps with an application
- Also write review papers and books
- Fight the fragmentation of our field (build bridges) – we are no longer a small field, but fragmented

