

Bibliometrics for public and private foundations

A toolbox for assessing research proposals
and results of research projects



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Presentation at the Workshop "Evaluating Research Outcomes and Impacts",
EFC - European Forum on Philanthropy and Research Funding, Brussels 5 November 2008

Outline

Research assessment methods and tools

Introduction to bibliometrics

Examples of bibliometric evaluations

Netherland Diabetes Foundation

H-index

Towards a bibliometrics-based management tool?

Food for thought

general conclusions and some recommendations

Managerial background

Scientific research has often become so complex and specialized that personal knowledge and experience are no longer sufficient for making decisions on funding, monitoring trends and evaluating results

Need for accountability, and to better manage investments, is increasing

Evidence-based management and decision-making in resource allocation

What kind of assessment?

Ex ante

Prior to research – to assess potential significance and likelihood of success

Interim

During the research process – to assess and monitor progress

Ex post

Once research has been completed – to assess outputs, outcomes and impacts

Formative function

Judgments on performance of an entity that elicits evidence that yields construct-referenced interpretations; forms the basis for (recommended) action in improving performance

Summative function

Making judgments in comparison to other (similar) entities; focus on the consistency of criteria and meanings across contexts

Qualitative

Expert opinions and other sources of other non-statistical information

Quantitative

Statistical information and numerical data

'Quantitative' or 'qualitative' methods and tools

'Quantitative' approaches

Collection of quantitative *statistics or other quantifiable systematic information* from 'internal' sources such as managerial information systems, (large scale) surveys among stakeholders, applicants or grant holders, and other participants

Collection of quantitative data and statistics from independent 'external' sources such as research literature (*'bibliometrics'*)

'Qualitative' approaches

Collection of opinions and impressions from internal sources such as managers, stakeholders and others, through direct observations, document analysis, (small scale) surveys, interviews or case studies

Collection of qualitative (or partially quantifiable) information from impartial 'external' sources such as experts and consultants (*'peer review'*)

Peer review

expert analysis of research proposals

Active research scientists, who are familiar with the kind of research being proposed, are the best judges of the feasibility and prospective impacts of a research proposal

“... the fate of a particular application is roughly half determined by the characteristics of the proposal and the principal investigator, and about half by apparently random elements which might be characterized as “the luck of the reviewer draw”.

Report by Cole et al. for NSF (1981)

Limitations of peer review

- Ideally, experts in the field should scrutinize published scientific results.
- Difficult for small groups of experts to evaluate fully and fairly the wide range of research
- In practice, however, committees with general competence, rather than specialists, often evaluate primary research data

Quality control systems based on peer review are not infallible

The most important shortcoming of peer review as a method of research assessment is that it is subjective, and may be insufficiently systematic and transparent

This may result in:

- A bias in favor of those who are better known and contribute to research in a large number of sub-disciplines
- A bias in favor of those at an institute because of the good reputation of the whole institute
- Dishonest reporting when peers have a stake in the evaluation outcome

Bibliometrics

**“the application of quantitative analysis and statistics
to research publications
and their accompanying citation counts”**

Bibliometric indicators

Bibliometrics is a source of evidence-based quantitative information to complement and/or challenge peer review opinions (objectifying peer review assessment)

The research literature provides an international frame of reference

Possibility for systematic cross-country, cross-discipline and cross-institution comparisons and benchmarking

Past performance is an acceptable estimator of current research potential and often a leading indicator of scientific achievements in the near future

Bibliometric measurements are also peer review based

- Basic assumption: important contributions to (international) scientific and scholarly progress are communicated in research publications sooner or later
- Bibliometric results are also based on a large number of “peer judgements”
(peer-review accepted publications and citations from peers)
- Bibliometrics is non-reactive measurement instrument
(decisions to accept papers or cite papers are not – or much less - affected by the possibility of future evaluation)
- Due to the large number of peer votes, and their international scope, the knowledge base is expanded
(biases and misconceptions of local experts are also countered)

Added value of bibliometrics

finding experts for review panels and committees

Checking research performance and achievements of the:

- Individual principal investigator(s)

.. through bibliometric analysis of

Research publication output

How many? And in which field(s) of science?

Citation impact

Highly cited papers? H-index > 10 ?

Use 'finger print' profiles of researchers to find 'independent' experts in peripheral, overlapping or adjacent (sub)fields of science

No publications in accessible sources !!!!

(does a researcher without (recent) publications actually qualify as an expert ?)

Added value of bibliometrics

ex ante assessment of research proposals, applications and applicants

Checking previous research performance and achievements of the:

- Individual principal investigator(s)
- Individual research team(s)
- consortium

.. through bibliometric analysis of

Research publication output

How many? In top quality outlets?

Co-publication analysis of PIs, research teams and consortium

The same partners? Domestic and international partners? Private sector partners?

Citation impact

How many citations?, disciplinarity dispersion of impact, geographic dispersion of impact; 'early' impact vs long-term impact

No publications ! (on record, or in accessible databases) ... *no previous achievements?*

Added value of bibliometrics

monitoring and mid-term reporting of progress

Checking research performance and achievements of the:

- Individual principal investigator(s)
- Individual research team(s)
- consortium

.. through bibliometric analysis of

Research publication output

Reports? Manuscripts?

Co-publication analysis of PIs, research teams and consortium

All partners involved?

Citation impact

Citations in reports or manuscripts to recent literature? Self-citation biases?

No publications ! ... why not ?

Added value of bibliometrics

ex post evaluations of outputs, outcomes and impacts

Checking research performance and achievements of the:

- Individual principal investigator(s)
- Individual research team(s)
- consortium

.. through bibliometric analysis of

Research publication output

How many? What kind? Manuscript submitted to top quality outlets?

Co-publication analysis of PIs, research teams and consortium

All partners involved?

Citation impact

Citations in reports or manuscripts to recent literature? Self-citation biases?

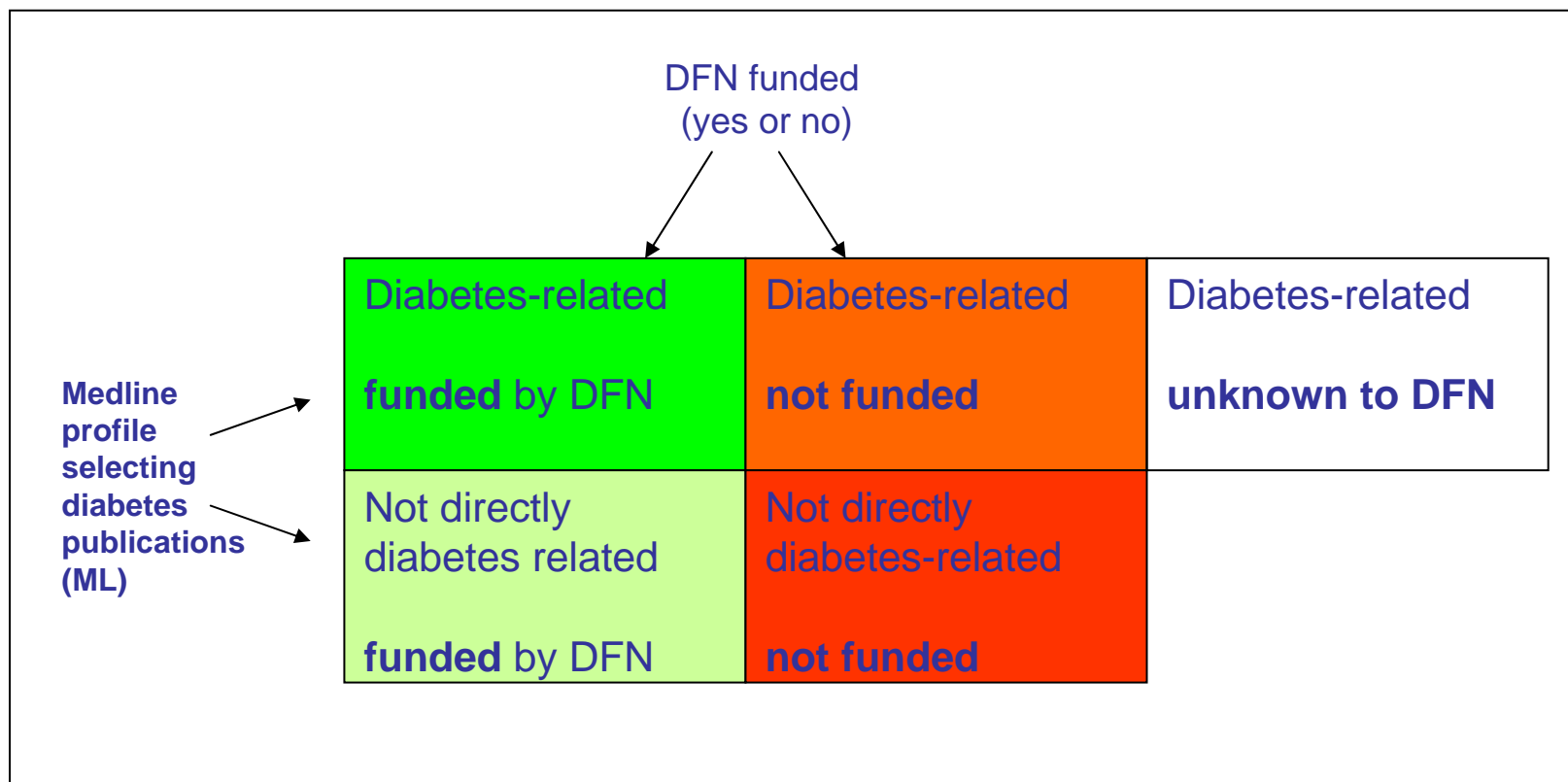
Still no publications !!!! ... why not !? Too early for citation impact?

Performance evaluation with bibliometric indicators

Examples

CWTS study for *Diabetes Foundation Netherlands* (2001)

Classification of research publications in the Netherlands



DFN – Diabetes Foundation Netherlands
ML : Medline-defined research publications

CWTS study for *Diabetes Foundation Netherlands*

Bibliometric performance measures by publication category (1991-1995)

	Output P	Citation rate (C/P)	Normalised citation score CPP/FCSm
Diabetes research - DFN funded	294	5.2	1.4
Other research - DFN funded	1 833	4.6	1.5
Diabetes research - not funded	221	3.0	1.0
Other research - not funded	1 344	3.1	1.1
Diabetes research - unknown to DFN	81	9.2	2.0

DFN – Diabetes Foundation Netherlands
ML : Medline-defined research publications

Hirsch index (H-index)

A publishing entity

(scientist, scholar, journal, country, etc.)

has an index value h ,

if h of the total of N papers have at least h

citations each,

and the other $(N-h)$ papers have no more than

h citations each

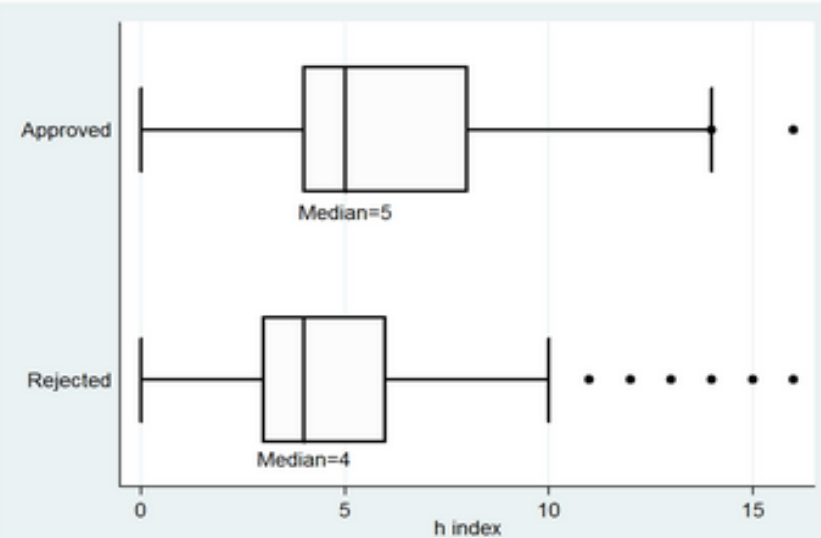
Publications	Citations
1	24
2	15
3	9
4	6
5	4
6	3
7	1
8	0
9	0
10	0

H-index = 4

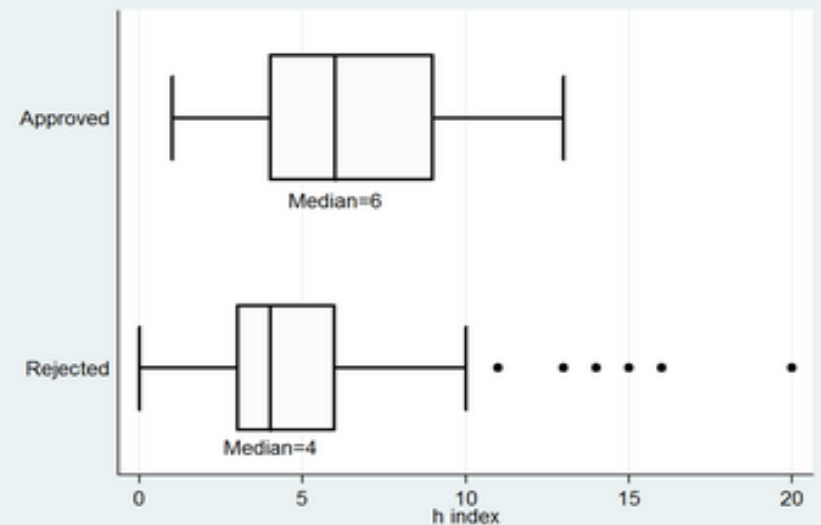
Using the H-index to compare the research performance of approved and rejected applicants

Source: Bornman et al., Does the Committee Peer Review Select the Best Applicants for Funding?, *PlosOne*, October 2008

LTF programme

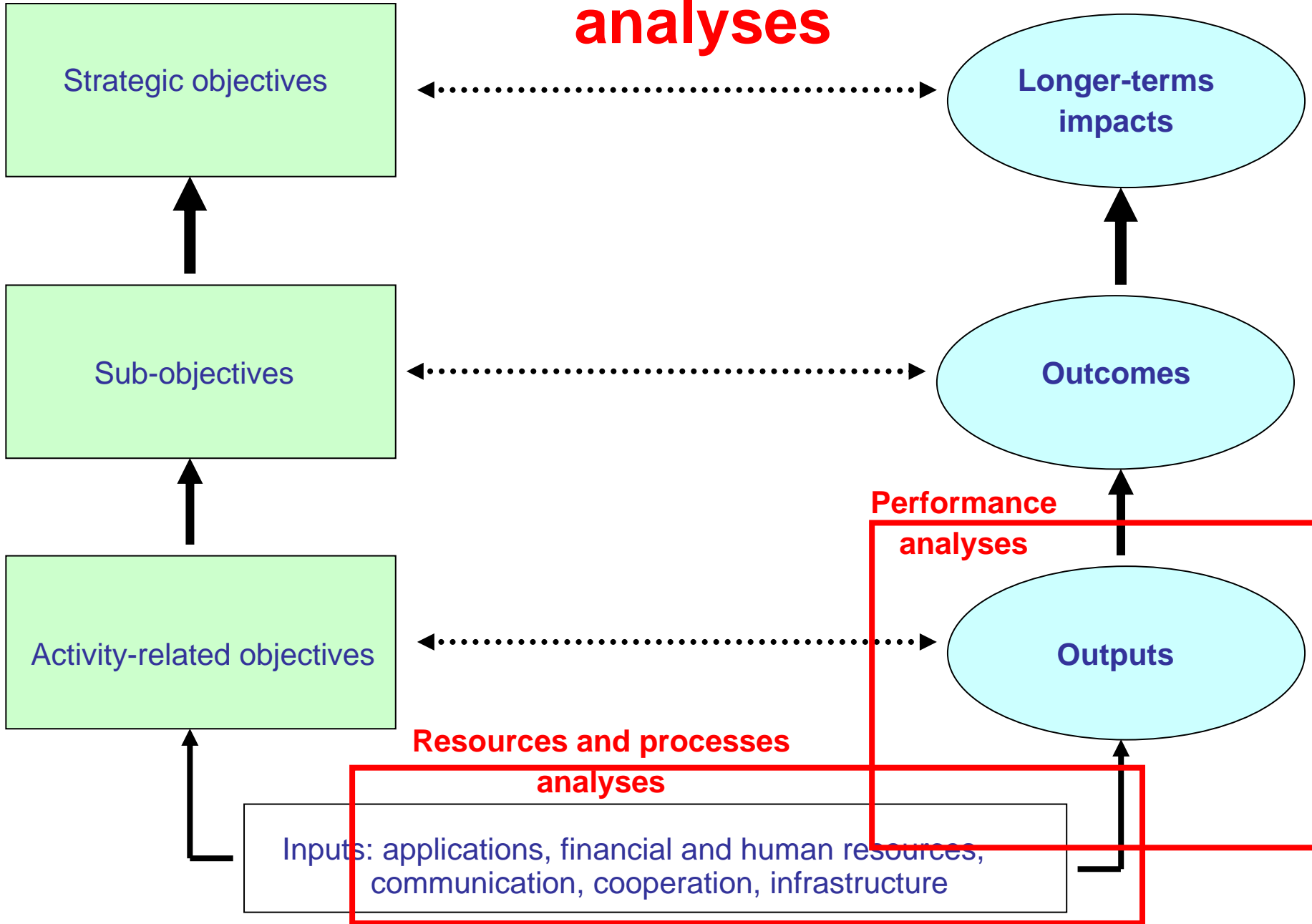


YI programme



Towards a bibliometrics-based
management tool
for research assessments?

Bibliometric analyses



Comparison of information sources

for citation impact analysis of individuals or institutions

Source	Coverage	Identification of researchers institutions	Citation counts	Transparency
<i>Google Scholar</i>	Research outputs on the web	By name (variants) in keywords	Individual, not all hits are displayed	Very limited documentation of algorithm and selection criteria
<i>Web of Science</i>	Core journals	By specific searchable fields	For individual items	Sources fully documented
<i>Scopus</i>	Core journals + web sites	By specific searchable fields	“citation tracker” produces only a limited number of hits	Sources fully documented

“Publish or Perish” software

Google Scholar-based Author Impact Analysis toolkit

Available for free at: www.harzing.com/pop.htm

Retrieves and analyses citations to publications

Performance indicators:

- Total number of papers
- Total number of citations
- Average number of citations per paper
- Average number of citations per author
- Average number of papers per author
- Average number of citations per year
- Hirsch's h-index and related parameters
- Egghe's g-index
- The contemporary h-index
- The age-weighted citation rate
- Two variations of individual h-indices
- An analysis of the number of authors per paper

Online self-assessment?

Towards a bibliometrics-based management tool

Bibliometric tool box at CWTS for strategic analysis (monitoring, evaluation and marketing)

Special web-based facilities for external users; Web of Science database

Resources analysis: Finding experts

Step 1. Define and upload required key-word profile of expert

Step 2. Corresponding research publications are collected

Step 3. Identify leading authors in publications (Europe, worldwide)

Step 4. Download names, addresses en bibliometric profile of researchers

Performance analysis: Publication output and citation impact

Step 1. Collect, select or upload relevant research publications

Step 2. Select bibliometric performance indicators

Step 3. Choose benchmarks (global, specific fields or institutes)

Step 4. Download performance profiles

General conclusions and recommendations

Limitations and drawbacks of bibliometrics

- **Partial view of research outputs and knowledge flows**
- **Biased coverage of research literature (basic research mainly, English-language publications, 'main stream' research)**
- **Most of the performance indicators are retrospective**
- **Statistical results derived from this source should be viewed as indicative rather than definitive**
- **Sometimes difficult to link bibliometric data to input data and qualitative information – requires close interaction with (end)users**

Value for money

Bibliometric data provide a wealth of information

transparent and consistent descriptions of research output
characteristics and systematic assessments of research performance

Bibliometrics is cost effective

especially when compared to information content provided by other
large-scale data collection methods (surveys)

Bibliometric data as a means to an end

Bibliometric performance data alone can be dangerous in decision making processes because they have the appearance of being authoritative

Numbers should help illuminate interesting features or aspects that might otherwise be overlooked

They should help start and fuel focused discussions among the experts; not for stifling debate or merely for window dressing

Bibliometrics is only relevant in those instances where funding and resource allocation is meant to support scientific research !

‘Light touch’ or ‘heavy touch’ bibliometrics?

Use bibliometrics only in those cases where it adds significant value to the transparency and effectiveness of evaluation processes, and its results are acceptable to all (major) stakeholders

Evaluation structures, procedures, methods and indicators should serve, not determine

The same principal applies to other assessment methods and techniques (including peer review)

Thank you for your attention

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