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Poverty Research in a Development Policy Context

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Abstract

Little is known about the extent to which science is addressing worldwide poverty and hunger; thus the present study provides a unique evaluation of this problem based on the literature contained in the Thomson Reuters' Web of Science Citation Index (1980 to 2008). The ongoing need for poverty/hunger research is related to the first United Nations Millennium Development Goal and agenda setting in a specific type of development policy context. We focus on the *Netherlands Foundation for the Advancement of Tropical Research* (2006) *Science for International Development (WOTRO) Strategy Plan 2007-2010*, although similar policies from other countries might also be assessed. Our data shows that poverty/hunger research has grown steadily over time in many disciplines, most significantly in the field of *Environmental Sciences and Technology*. Much of this research is hidden; hence the construction of an internationally recognized open access database is recommended so that scientists can easily identify critical research gaps related to scientific capacity building.

1. Introduction

In September 2000 world leaders came together at United Nations Headquarters in New York to commit their nations to a new global partnership concerning 8 Millennium Development Goals (MDGs). An unprecedented effort was set to focus on a range of third-world issues, including the reduction of extreme poverty to halting the spread of HIV/AIDS and providing universal primary education, all by the target date of 2015.

With the introduction of the 8 MDGs, scholars have been giving attention to two main points of interest: 1) progress towards the achieving the goals (e.g., Palma-Solis et al., 2008; Sahn & Stifle, 2003; Satterthwaite, 2003), and 2) the evaluation of development policies and aid programmes constructed by individual countries or organizations (e.g., Maxwell, 2003; Weiss, 2008). A third area of interest, which is quite specific to the first MDG is the role that science and technological innovation can play in poverty reduction (see Wetmore, 2007). Science policy or more specifically "science-for-development policy" is integral to development policy, given that it is difficult if not "impossible to make sustainable progress towards the [MDGs] without harnessing the potential of science and technology" (House of Commons Science & Technology Committee, 2004, p. 3).

Raymond Apthorpe (1999) has been critical of development policy in past years, claiming that it is too oriented towards “a mainstream economics-based agenda” and often fails “to study and recognise the importance of social and political processes and patterns of poverty.” In an address to the Development Studies Association a suggestion was made that development studies has had its day and should be replaced by poverty studies (Apthorpe, 1999). Clarke (2002) acknowledges this suggestion; noting that it may indeed be useless to talk in terms of *development* when “the gaps between rich and poor, and the numbers living in absolute poverty, have continued inexorably to rise” (p. 2). Today, even the modified term “‘international development’ suggests more relevance to globalization and multinational business expansion” than it does for “improving the standard of living of people in poor countries” (p. 1). Maxwell (2003) confirms that there is a new poverty agenda, and although he is positive about its strengths, he believes that it is at risk of becoming too target-based. Target setting and the use of performance indicators pose a risk because “they can encourage a reductionist approach to complex problems, privilege quantitative indicators at the expense of qualitative indicators, distort resource allocation, and undermine professional motivation and responsibility” (p. 12).

Development-oriented research has often been scrutinized, but for some time, there has been a lack of political discourse surrounding science policy and the issue of social inequality. Woodhouse & Sarewitz (2007) state that the “knowledge and innovation wants of the affluent world tend to be quite different from those of most people living in poorer countries. The history of science policy is very much a history of interests vying for power and influence over resources and agendas, and those with little economic, political, and scientific clout are not likely to have much say over what science gets done and who benefits from it” (p.141). Currently, the type of initiatives “designed to address the problems of poor or disenfranchised people around the globe [are] contestable, and nobody has a very good estimate of how much contemporary R&D presently is targeted in this direction” (Woodhouse & Sarewitz, 2007, p. 143). Cozzens (2007) believes that science and technology policy “needs to know whether it produces benefit for the disadvantaged as well as for the advantaged...” (p. 93). She admits that it is “difficult to implement a general assessment of the balance of benefits” but suggests that “the science indicators profession perhaps should take this measurement on as its special moral responsibility” (p. 93).

In 1964, President Lyndon Johnson declared an “unconditional war on poverty” in the United States, leading to a new federal policy and budget designed not only to increase public spending on social welfare, but to finance research “on the nature of social problems and evaluation of programs designed to remedy them” (p. 31). Robert Haveman (1987) investigated the outcomes of this war on poverty and found that the reallocation of federal spending was having a substantial impact on the social sciences. At the time, Haveman did not have access to bibliometric databases and sophisticated measurement techniques, yet he found the following:

- In the discipline of economics, almost no poverty-related research (0.5 percent) was published before 1965. From 1971 to 1973 (the US ‘post-War-on-Poverty period’) there was a large increase: 6.5 percent of the articles and pages published in the journals focused on the problem of poverty (the largest increase was in the *Journal of Political Economy*).

- In sociology the 1962 to 1965 base level of poverty-related research was substantially higher than in economics: 2.4 percent of articles and pages, as compared to 0.5 percent. From 1971 to 1973 (the peak period) the level of research was also greater in sociology than it was in economics – 6 percent in terms of articles, and 9 percent in terms of pages, compared to the percent stated (5 percent articles, 5 percent pages) in economics.
- Between 1978 and 1980 sociological interest grew persistently: 8 percent of the material in sociological journals was devoted to poverty research, compared to somewhat less than 4 percent in economics (Haveman, pp. 43-45.)

Much of the latest research concerning poverty, famine, tropical diseases, etc. can be found in Thomson Reuters' Web of Science database. Currently little is known about the extent to which this body of work has had an impact. Scholars from the Scientometrics community have contributed—see Arunchalam's (2004) work on science from developing countries, Lewison et al.'s (2002) bibliometric estimation of malaria research, and Wagner et al.'s (2001) index of Science & Technology capacity. Lewison and Srivastava (2008) found that most malaria research is taking place in developed countries, where people are not likely to be affected by the disease. Arunachalam's (2004) concern is that scientists in developing countries "have access to only a tiny fraction of the information they need" and that "their contribution to science is hardly noticed by others" (p. 163), while Wagner et al. (2001) suggest that new measures need to be built into collaborations between developed and developing country scientists to "enable funders and participants to see what works well in producing both good science and scientific capacity" (p. 63).

In this study, our objective is to assess a body of international research strictly concerning poverty and hunger and relate this to the Netherlands Foundation for the Advancement of Tropical Research (NWO), Science for International Development (WOTRO) Strategy Plan 2007-2010 (2006). Similar policies from other countries might equally be targeted for evaluation; thus it is not our intent to serve the interests of WOTRO exclusively, but to use this particular policy as a case example in order to introduce readers to the value of our bibliometric method. To be clear about poverty and hunger, we refer to The United Nations Office of the High Commissioner for Human Rights definition: extreme poverty is "a human condition characterized by the sustained or chronic deprivation of the resources, capabilities, choices, security and power necessary for the enjoyment of an adequate standard of living and other civil, cultural, economic, political and social rights" (see Office of the High Commissioner for Human Rights, 2009). Hunger relates to poverty in terms of the poor person's "space of vulnerability": where there is a lack of food security, hunger is the body's way of signaling that it is running short of food (see Watts, 1993). Severe hunger or famine is associated with long-term undernourishment and malnutrition (see World Food Programme, 2008). Here the objective is to investigate the following: 1) What is the multidisciplinary landscape and growth rate of poverty and hunger research? 2) To what extent has this research been an internationally collaborative effort? 3) What is the Netherlands contribution to this effort and what does it mean in light of this country's science-for-development policy?

2. Data Collection

Bibliographic data associated with a set of journal articles published from the period of 1980 to 2008 were extracted from the Web of Science database. A search for documents pertaining to a specific issue (i.e., poverty) can be done in two ways: 1) a title word search or, 2) a topic search for words in the abstract, title or keywords fields of a record. We experimented with different options, and found that title-related searches yielded the most relevant records. Topic related searches resulted in a higher recall of records, with much less precision.

Focusing only on the issue of poverty and hunger (as per the first MDG), a title search was constructed using the following terms: *poor, poverty, hunger, malnutrition, famine, food security* and *food insecurity*. A total of 12,151 records were downloaded from the Web of Science and transferred to Microsoft Access for data cleansing. A filtering procedure was used in Access to remove a number of non-relevant articles – for example, research papers featuring the words *poor or hunger* that were not connected to the issue of poverty (i.e., poor memory, hunger strikes, air hunger, animal hunger etc.). Following this procedure, we obtained a final working set of 9,919 journal articles, published by scientists/scholars in 142 different countries.

3. Data Analyses and Results

Since poverty-related research does not constitute a true scientific field, but an issue that has been investigated by scholars/scientists from many fields, we approach this study step-by-step, as if peeling the layers of an onion. Sections 3.1 to 3.2 outline the bibliometric methods used to evaluate this body of literature and section 3.3 details the Netherlands past contribution, including this country's strategy for financing new research.

3.1. What is the multidisciplinary landscape and growth rate of poverty and hunger research (1980-2008)? Every article from a set of 9,919 unique articles has been published in a journal assigned to one or more Web of Science subject categories. All categories have been collapsed into broader subfields (see Netherlands Observatory of Science and Technology, 2010). The subfields listed below are ordered in terms of the largest output in our dataset:

- ***Economics & Business***
 - e.g., Business, Finance; Economics; Industrial Relations & Labour
- ***Clinical Medicine***
 - e.g., Tropical Medicine; Obstetrics & Gynecology; Surgery; Pediatrics; Gastroenterology& Hepatology
- ***Management & Planning***
 - e.g., Management; Planning & Development; Area Studies
- ***Agriculture & Food Science***
 - e.g., Agronomy; Soil Science; Agriculture, Dairy & Animal Science; Food Science & Technology
- ***Sociology & Anthropology***
 - e.g., Sociology; Anthropology; Family Studies; Women Studies

- ***Environmental Sciences & Technology***
 - e.g., Forestry; Biodiversity Conservation; Urban Studies; Ecology; Water Resources
- ***Social & Behavioral Sciences, Interdiscip.***
 - e.g., Social Sciences, Interdisciplinary; Demography; Social Issues
- ***Political Science & Public Administration***
 - e.g., Political Science; Public Administration; International Relations
- ***Health Sciences***
 - e.g., Nursing; Rehabilitation; Health Policy & Services; Substance Abuse; Social Work
- ***History, Philosophy & Religion***
 - e.g., History; Philosophy; Religion; Medieval & Renaissance Studies
- ***Other Disciplines***
 - e.g., Statistical Sciences; Mathematics; Information & Communication Sciences; Psychology; Educational Sciences; Engineering, Electrical; Engineering, Civil; Engineering, Geological; Biology; Biochemistry & Molecular Biology; Zoology; Pharmacology; Plant Sciences etc.

A fractional counting system was used to assign the articles to one or more of the subfields ('fields') noted above. For instance, if Article A was published in a journal belonging to the *Social & Behavioral Sciences* as well *Clinical Medicine*, a count of 0.5 was applied to each subfield. In a table listing the eleven subfields, all of the fractional counts were summed for a given year (e.g., 1980, 1981, etc., up to 2008). Figure 1 indicates that approximately 50% of research concerning poverty and hunger has come from journals published in *Economics & Business*, *Clinical Medicine*, *Management & Planning*, and *Agriculture & Food Science*.

Table 1, below, summarizes for each subfield the average number of articles per year, an index number for comparing the decline or growth in the number of articles between the subfields, and the compound annual growth rate of articles for three different time periods. The index number (with the year 1994 as index 100) allows for appropriate comparisons between subfields by correcting for differences in publication scale. The compound annual growth rate measures the average growth rate over a period of several years and was calculated as follows: $(\text{periods last year index} / \text{period's first year index})^{1/\text{length of period in number of years}} - 1$. Note that almost all combinations of subfield and time period show a growth in poverty-related research. The highest growth occurred between the years 2000 to 2007 for both *Agriculture & Food Science* and the *Environmental Sciences*. Some fields of research have also declined to grow in certain time periods (e.g., *Social & Behavioural Sciences, Interdisciplinary* 1981-1989), while others have maintained fairly steady growth rates (e.g., *Clinical Medicine* and *Economics & Business*).

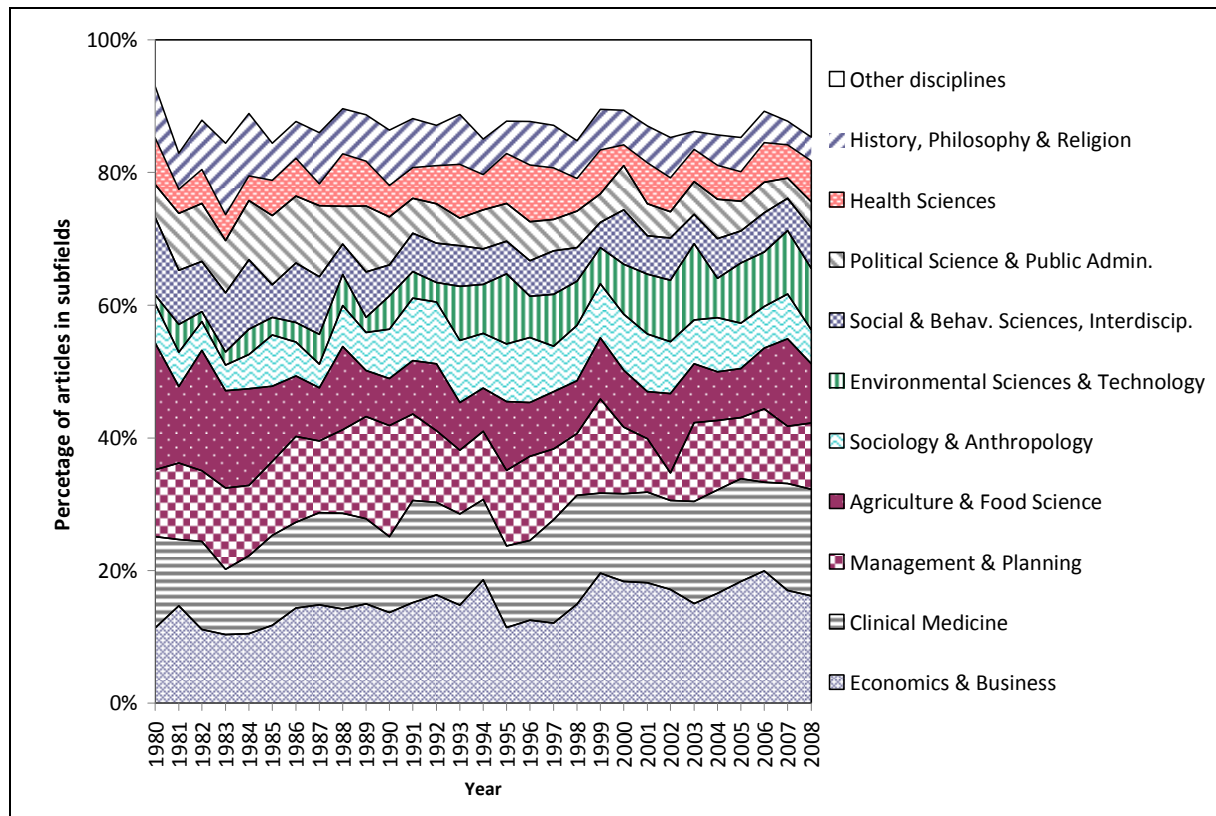


Figure 1. Percentage of research in 11 Journal subfields.

Figure 2 illustrates the index of the number of publications per selected field, based on three year moving averages. The moving averages have been introduced in order to normalize or correct for extreme fluctuations from year to year. Here we see a selection of research fields that fit more closely with the “norm” – i.e., the total growth rate of poverty-related research (see Figure 2). Figure 3 highlights research fields with more variable growth trends.

When constructing this type of evaluation, consideration must be given to the fact that growth rates pertaining to journal articles may in part be an artifact of the Web of Science database. Throughout the 28-year time frame (1980 to 2008) new journals have been added to and/or removed from the database, including the assignment or re-assignment of journals to new categories. A test was carried out to determine the extent to which there is a ‘database’ effect, by calculating the ratio of poverty-related papers to non-poverty-related papers published each year for all of the ten subfields, including *other disciplines*. Using the ratio measures we then re-calculated both the index (1994=100) and 3-year moving averages. A re-charting of the data produced a similar growth trend, thus confirming that scientists are giving more attention to poverty-related problems, and that the database effect is minimal.

Table 1. Average number of articles per period compared to index and compound annual growth rate.

	Average no. of articles per year for given time period			Index of the no. of articles (based on a 3-year average and with year 1994 as index 100)						Compound annual growth rate		
	1980-1989	1990-1999	2000-2008	1981	1989	1990	1999	2000	2007	1981-1989	1990-1999	2000-2007
Economics & Business	26.6	47.3	90.4	34.2	53.9	64.1	103.1	116.6	193.5	5.8%	5.4%	7.5%
Clinical Medicine	26.2	42.9	77.7	52.6	74.5	90.3	122.6	124.5	260.2	4.5%	3.5%	11.1%
Management & Planning	24.6	37.3	49.1	53.8	101.4	116.5	117.6	120.1	197.2	8.2%	0.1%	7.3%
Agriculture & Food Science	25.2	26.5	48.4	128.7	94.6	92.3	142.3	146.7	325.1	-3.8%	4.9%	12.0%
Sociology & Anthropology	10.9	27.1	36.1	32.1	54.7	76.4	108.7	118.8	148.7	6.9%	4.0%	3.3%
Environmental Sciences & Tech.	6.2	20.6	46.5	16.1	37.6	41.5	96.3	116.2	252.9	11.2%	9.8%	11.8%
Social & Behav. Sciences, Interdisc.	16.3	17.0	30.0	87.2	70.2	87.4	116.6	129.7	216.7	-2.7%	3.3%	7.6%
Political Science & Public Admin.	17.9	17.1	23.7	65.5	91.5	99.4	100.9	104.3	134.9	4.3%	0.2%	3.7%
Health Sciences	10.8	20.4	27.1	51.1	85.2	80.7	98.7	115.6	222.6	6.6%	2.3%	9.8%
History, Philosophy & Religion	15.1	20.1	23.0	66.0	96.3	114.0	113.4	121.2	148.3	4.8%	-0.1%	2.9%
Other disciplines	26.2	40.3	69.2	41.5	55.0	66.0	86.1	88.2	176.5	3.6%	3.0%	10.4%

Table 2. Impact indicators for poverty-related versus non-poverty related research.

		P	% of P	CPP-sc	%Non-Cited	JCSm	CPP/JCSm
Economics & Business	Poverty	2006	0.73%	7.49	27.12%	6.95	1.08
	Non-Poverty	272576	99.27%	9.78	30.83%	9.33	1.05
Clinical Medicine	Poverty	1648	0.04%	12.26	19.78%	13.33	0.92
	Non-Poverty	4343752	99.96%	14.35	19.54%	14.01	1.02
Management & Planning	Poverty	1599	1.16%	5.03	31.39%	4.08	1.23
	Non-Poverty	136693	98.84%	8.24	33.07%	8.05	1.02
Agriculture & Food Science	Poverty	1123	0.16%	9.79	26.54%	10.27	0.95
	Non-Poverty	714754	99.84%	8.24	27.70%	8.19	1.01

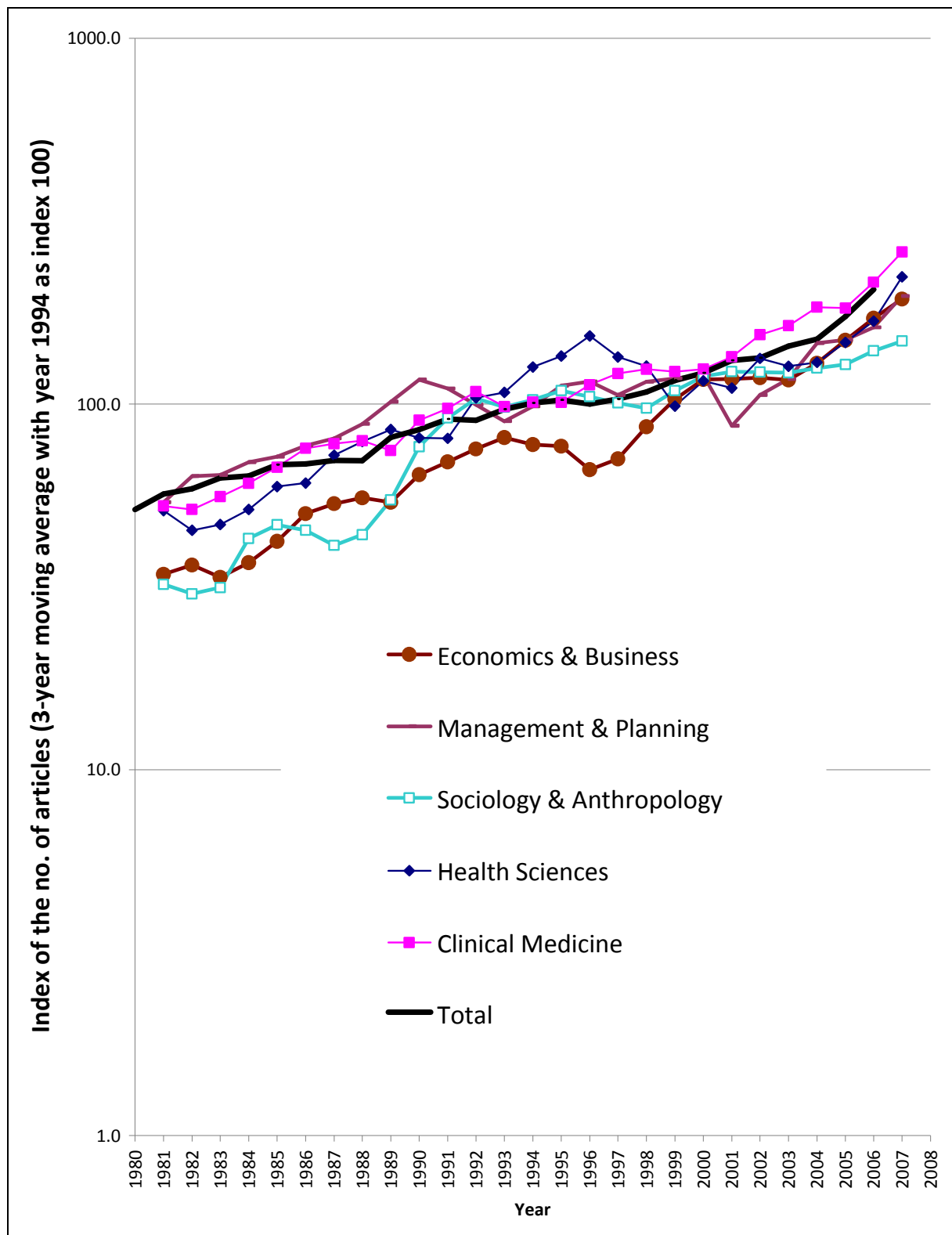


Figure 2. Index of the number of publications for 6 selected fields, 1980-2008
(1994=100; three-year moving averages)

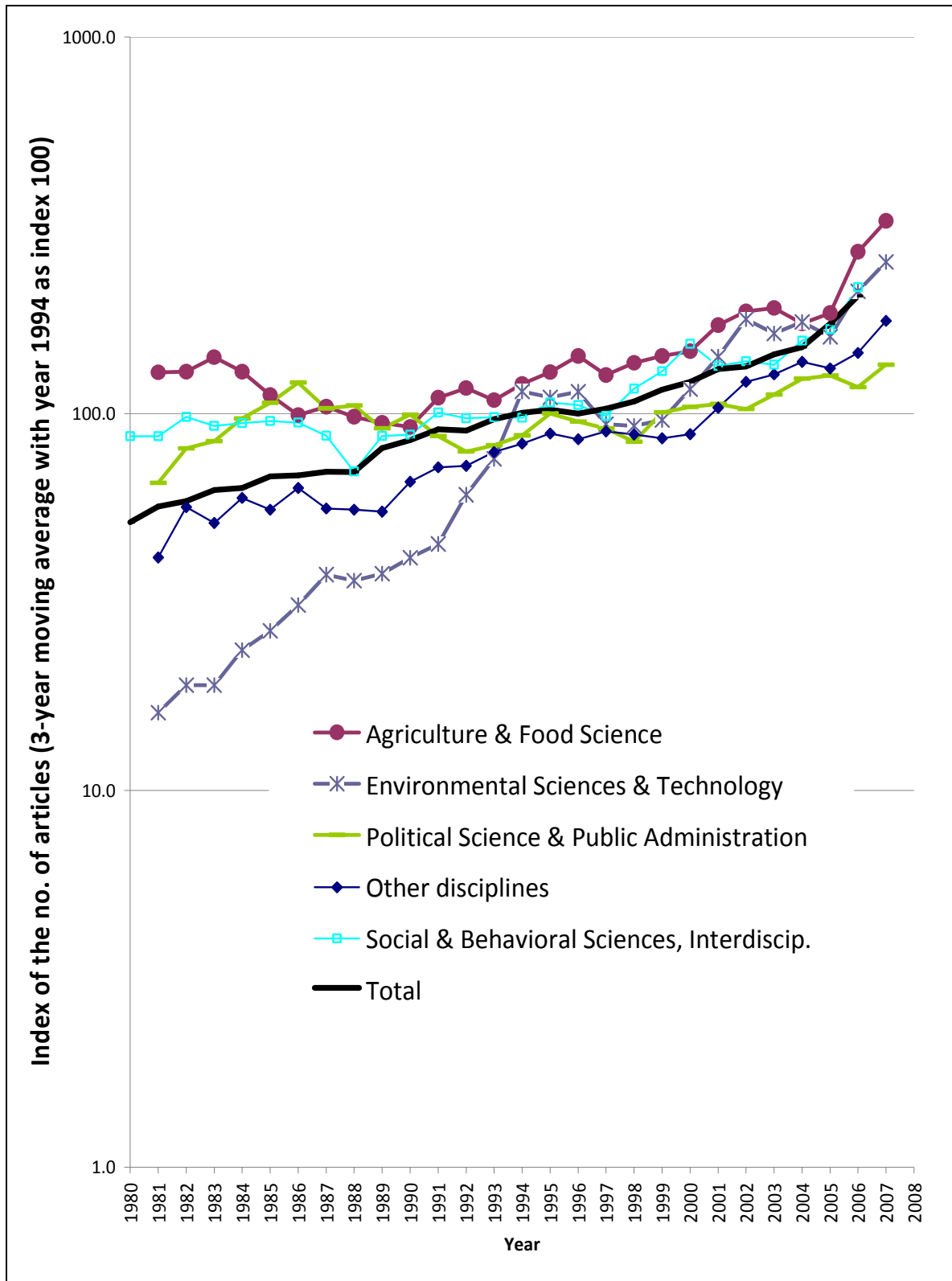


Figure 3. Index of the number of publications for 6 selected fields, 1980-2008 (1994=100; three-year moving averages)

Table 2 presents the indicators that were used to assess the impact of poverty-related research versus non-poverty-related research worldwide for the citation period of 1980 to 2008 (see Moed et al., 1995). Here we have selected the top-ranking subfields covering at least 50% of our dataset: *Economics & Business*, *Clinical Medicine*, *Management & Planning*, and *Agriculture & Food Science*. The first indicator refers to the total number of publications (**P**) and percentage of publications (**% of P**) in each category: Poverty or Non-Poverty. The second refers to the number of citations per publication (**CPP-sc**), corrected for self-citations (note: a citation is not counted if the author(s) of a journal article have cited their own work). Within each subfield, and comparing poverty versus non-poverty research, we observe somewhat small differences in CPP. For instance, in *Clinical Medicine*, non-poverty research received an average of fourteen citations per paper, while the poverty-related papers received an average of twelve. Overall, it is the non-poverty papers that received more citations, with the exception of papers from the *Agriculture & Food Science* subfield. A possible explanation relates to the fact that the bulk of poverty-related papers were not published until the later half of the assessment period (1980 to 2008). This means that in comparison to the non-poverty research, a large portion of poverty-related articles (i.e., those published after 1995, or even after 2000) may not have had the same cumulative citation advantage.

Also in Table 2, the mean **Journal Citation Score (JCSm)** represents the mean (worldwide) citation rate of the journals in which the poverty-related and non-poverty related papers have been published. The **CPP/JCSm** establishes whether or not the average impact of a poverty or non-poverty paper differs significantly from the average impact of all other papers in the same journal set. In Table 2, note that poverty-related papers published in *Management & Planning* tend to be published in journals with lower mean citation rates. However, relative to all other papers appearing in the same journals, their impact is above the world average¹. The opposite is true in the *Agriculture & Food Science* subfield – here poverty-related papers are published in journals with fairly high mean citation rates, but compared to other papers published in the same journal set, their impact is just slightly less than the world average.

To analyze the landscape of poverty and hunger research in more detail, we constructed a term map. A term map shows the relations between important terms (knowledge topics) in a certain domain (note: similar to co-word maps, see Peters & Van Raan, 1993). In general, the closer two terms are located to each other in this map, the stronger the relation between the terms.

The term map of poverty and hunger research, shown in Figure 4 was constructed according to the following procedure. Using the Web of Science database, we first collected the titles and abstracts of all articles in our data set. Only the titles and abstracts of 6057 of the 9,919 articles were found (note: for convenience, in the following paragraphs we will refer to the abstracts only). We then identified important terms in the abstracts, and given that this process can be both subjective and labor intensive, an automatic term identification approach was taken (Van Eck, Waltman, Noyons, & Buter, 2010). We identified 838 important terms, and counted for each pair, the number of co-occurrences. The number of co-occurrences of two terms is the number of times the terms both occur in the same abstract. Based on the co-occurrence counts, we calculated the similarities of terms using the association strength measure (Van Eck & Waltman, 2009). The similarities were used as input for the VOS mapping technique (Van Eck, Waltman, Dekker, & Van den Berg, 2010), which determined for each of the 838 terms a location in a two-dimensional map. We also assigned terms to

¹ If the ratio CPP/JCSm is above 1.0, the mean impact of all poverty-related papers exceeds the mean impact of all other articles published in the same journal set.

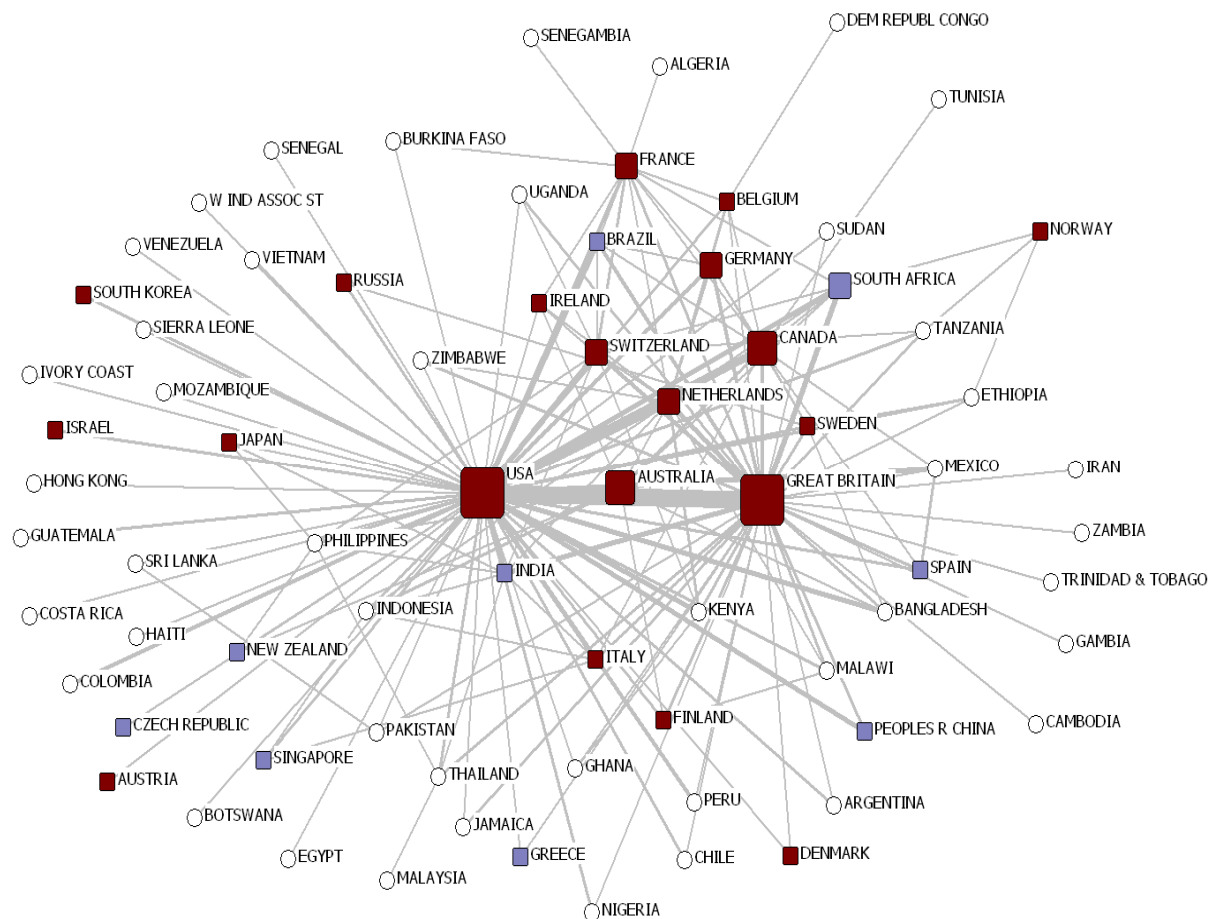
clusters, and to do so, we employed a clustering technique that relies on a multinomial mixture model (similar to Zhu, Takigawa, Zeng, & Mamitsuka, 2009, Section 2.3). The assignment of terms to clusters was again based on co-occurrences in abstracts. Seven clusters were used for the final map, given that this yielded the most easily interpretable results. Finally, we employed a computer program called VOSviewer (Van Eck & Waltman, in press) to visualize both the map produced by the VOS mapping technique and the clustering produced by our cluster technique.

The resulting term map (Figure 4), provides an overview of important topics related to and studied in poverty and hunger research, and can be examined in full detail using the VOSviewer software at www.vosviewer.com/maps/poverty/terms.php. Terms located close to each other in the map tend to co-occur frequently in abstracts, while terms that are located far away from each other generally do not co-occur. The colour of a term indicates the cluster to which the term was assigned, and the size of a term indicates the number of times the term occurs in the abstracts. By examining the map in detail, four main topics can be identified, namely *Economics and Government Policy*, *Socio-Economic Factors*, *Environmental Factors and Agriculture*, and *Clinical Medicine and Nutrition* (see Figure 4). Looking at the term poverty itself, it is interesting to observe that it takes a central location in between areas pertaining to a variety of socio-economic factors, including government and development policy.

3.2 To what extent has poverty/hunger research been an internationally collaborative effort? Although certain countries and regions around the world experience more extreme instances of poverty than others, it is undeniably a global problem. Here we want to know if poverty-related research is a collaborative effort for three reasons: 1) cooperative work between ‘northern’ (advanced) countries and ‘southern’ countries (developing or lagging) can enhance scientific capacity building in the ‘south’, 2) it can also “help to create a sharper focus and critical mass” of knowledge, and 3) collaborative linkages are generally encouraged, provided that they “enable the voice of the poor and local communities in setting research agenda[s]” (Netherlands Development Assistance Research Council, 2005, p. 1).

Note that each article in the dataset (n=9,919) was written by an author or authors affiliated with different organisations (i.e., located by address) and countries. A co-authorship network, was initially generated from a matrix of 142 countries with $142(142-1)/2 = 10,011$ possible collaborations, and submitted to the Netdraw 2.091 mapping tool (Borgatti, 2002). Each tie or link was weighted on the basis of co-authorship counts, but only counts ≥ 2 journal articles (1980-2008) were included (note: network density = 0.11)². The size of each country node also corresponds to a greater or lesser count of journal publications. Figure 5 presents a final network of 74 different countries. Scientists affiliated with research organizations in the *United States*, *Great Britain*, *Canada*, *India*, *Australia*, *The Netherlands*, *Germany*, *South Africa*, *France*, and *Brazil* have contributed the most to poverty/hunger research overall (7,877 journal publications in total from 1980-2008); however, *Great Britain*, the *United States*, *The Netherlands*, *Canada*, *France*, *Germany* and *Australia* have been the most frequent collaborators (i.e., in terms of co-authorship).

² The maximum completeness for a network density is a value of 1. A valued network with a 0.11 density measure indicates that not all actors are co-authoring with all other actors, but that among certain actors, strong ties are present.



Based on Wagner et al.'s (2001) scientific capacity index, nodes in this network drawn with a square represent scientifically advanced countries, as well as countries that are now considered scientifically proficient. Circular nodes highlight both developing countries and countries lagging in terms of their scientific capacity (see Wagner et al., 2001, capacity index, pp. 10-17).

3.3. What is the Netherlands contribution to poverty/hunger research and what does it mean in light of this country's new Science for Global Development policy? Woodhouse and Sarewitz (2007) believe that science-based policies “designed to address the problems of poor around the globe [are] contestable” (p. 143); however, progress is being made, and some countries seem to be moving in the right direction.³ Here we examine the relationship between our general survey of poverty/hunger research and the Netherlands contribution, including the current role it is playing with the Dutch government's Foundation for the

³ Following the 2000 UN Millennium Declaration, the UK Science and Technology Committee produced a report concerning *The Use of Science in UK International Development Policy 2003-2004* (see HC 133-1). The Department for International Development (DIFD) in the UK is responsible for commissioning research and relies heavily on access to science and technology advice to inform policy-making.

Advancement of Tropical Research Science for International Development (WOTRO)
Strategy Plan 2007-2010 (2006).

Past contributions to poverty/hunger research by Dutch scientists may be illustrated in terms of an egocentric network (see Figure 6). In Figure 6, also generated with Netdraw 2.091 (Borgatti, 2002), we see that the Netherlands is linked to all other countries by a geodesic distance of 1, both to and from the ego node, in black. This means that a researcher(s) from the Netherlands (by country address) has co-authored at least one journal article concerning poverty/hunger with a researcher(s) from another organization (by country address). The ties in this ego network (i.e., $49(49-1)/2=1176$ possible pairs; network density = 0.502) show the extent to which the Dutch have engaged in collaborative research with scientifically advanced and proficient countries (square node), as well as countries that are currently developing or lagging behind in their scientific research capacity (circle node).

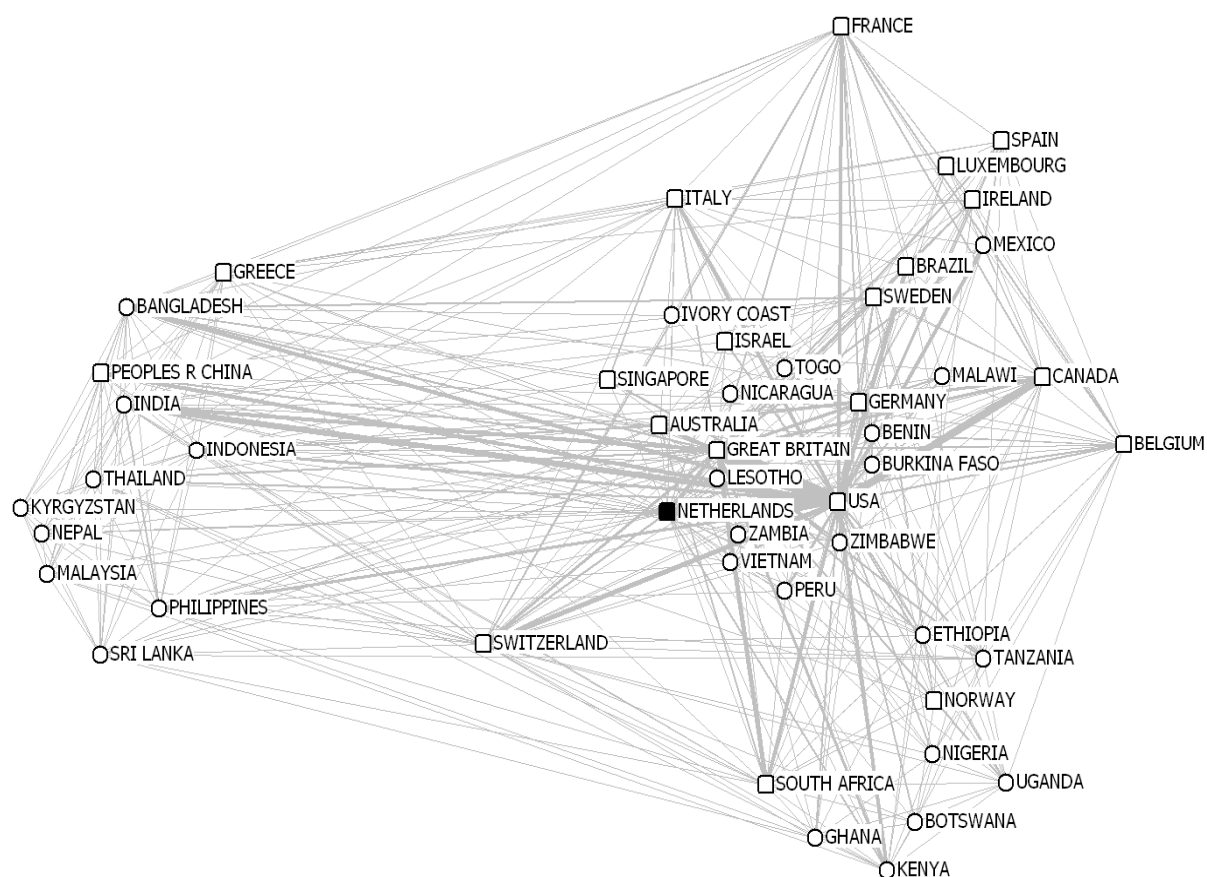


Figure 6. The Netherlands co-authorship network (countries) in poverty/hunger research (1980-2008).

The data used to generate this network is based solely on journal records. Many other documents were not used (e.g., non-Web of Science journals; academic proceedings; government reports); however, it is important to note that journals are one of the most prestigious scholarly communication outlets; providing a strong estimate of the work produced by a country's most prolific scholars. We acknowledge that not all of the fields represented in this analysis have the same adequacy of coverage in the ISI database (see Centre for Science and Technology Studies, 2007); yet knowing these limitations in scope and database coverage, we present the following:

- 1) From our set of 9,919 journal articles (1980-2008) scientists from the Netherlands have contributed a total of 222.
- 2) Previous contributions by Dutch scientists (n=222) to poverty/hunger research are attributed mainly to the following journal subfields:
 - *Economics & Business* (20%)
 - *Clinical Medicine* (16%)
 - *Management & Planning* (13%)
 - *Agriculture & Food Science* (9%)
 - *Environmental Sciences & Technology* (7%)
 - *Social & Behavioural Sciences, Interdisciplinary* (4%)
 - *Sociology & Anthropology* (4%)
 - *Other Fields* (24%)
- 3) Approximately 27% of all of the Netherlands' *Clinical Medicine* research concerning poverty/hunger has focused on affects of the Dutch "Hunger Winter" of 1944 to 1945.
- 4) The Netherlands top ranking collaborators amongst **scientifically advanced countries**: United States (n=45 articles), Great Britain (n=24), Belgium (n=8) and Switzerland (n=6).
- 5) The Netherlands top ranking collaborators amongst **scientifically developing or lagging countries**: Kenya (n=7 articles), India (n=4), Zimbabwe (n=3), Indonesia (n=3) and Malawi (n=3).

With the Dutch government's *Science for International Development (WOTRO) Strategy Plan 2007-2010*, scientists are encouraged to take the policy of the Organisation for Scientific Research and translate it into new research that will help to combat poverty and promote sustainable development (as per the first MDG). The current strategy is to "mobilise top researchers in all relevant disciplines, in the Netherlands and the South, and bring them together in partnerships for problem-oriented scientific research on societal issues of local and global concern" (Netherlands Foundation for the Advancement of Tropical Research, 2006, p. 19). WOTRO offers grants for projects executed by PhD or postdoctoral researchers from the Netherlands and developing countries, which should be "aimed at either development issues in a broad sense or at UN [MDGs]" (see WOTRO Integrated Programmes, 2007). In terms of poverty and hunger, three target areas have been identified: "1) agricultural and institutional innovations, 2) disaster and displacement, 3) critical assessments of policies and interventions" (Netherlands Foundation for the Advancement of Tropical Research, 2006, pp. 34-35).

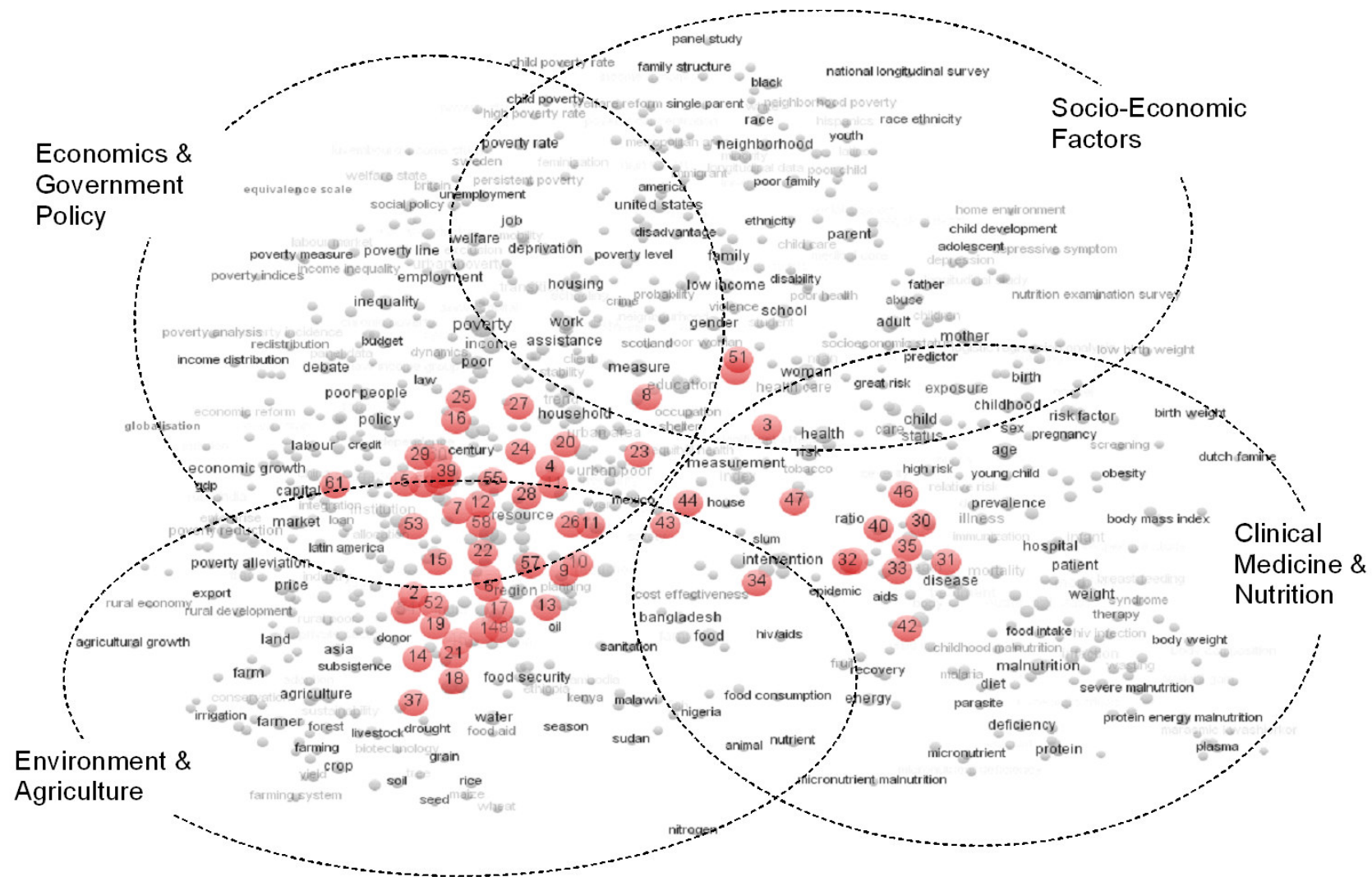


Figure 7. Netherlands WOTRO projects (2000 to 2009) positioned on top of the abstract term map (1980 to 2008).

The WOTRO website hosts a database with metadata pertaining to 476 financed projects. A search using the keywords *poverty*, *famine*, *hunger*, *food security*, *food insecurity* and *malnutrition* produced a selection of 61 projects (note: starting dates ranged from 2000 to 2009). In a specialized mapping approach, again using title and abstract terms, all projects have been added to the original term map (see Figure 4, above) to show a relationship between past poverty/hunger research and current directions taken by Dutch scientists. The resulting map is shown in Figure 7 (Note: examine in full detail at: www.vosviewer.com/maps/poverty/projects.php). Of interest is the bias towards new research related to *Economics and Government Policy*, *Environmental Studies* and *Agricultural Studies* – a confirmation of the scientific community's compliance with WOTRO's prescribed target areas.

4. Conclusions

A general survey of the literature indexed in the Thomson Reuters' Web of Science database shows that research concerning global *poverty/hunger* has been growing over time (see growth line for "Total" dataset, Figures 2 and 3), and has been of interest to scientists/social scientists from a variety of fields. While it is true that there is an economics-based agenda at the root of this research, efforts at problem-solving are not entirely linked to this field; owing to the remarkable growth observed in the field of *Environmental Sciences & Technology* and strong contributions made by *Interdisciplinary Social & Behavioural* scientists, *Agricultural* scientists and *Clinical Medicine* researchers over time. A comparison of the average number of citations per poverty-related paper with citations to non-poverty related papers also demonstrates that a scientist can develop an influential career in line with poverty-related issues, provided that governments are willing to finance further R&D in this direction.

The more critical problem, as evidenced by our collaboration networks, is that scientists with the most resources and knowledge tend to collaborate with each other, rather than with scientists who are challenged in this regard. In the Netherlands, the *Science for International Development (WOTRO) Strategy Plan 2007-2010* has addressed this issue by asking Dutch scientists to capitalize on their research strengths, but transfer knowledge through collaboration, to the benefit of developing nations. The transparent nature of this policy's outcome (i.e., WOTRO's project database) is exemplary and bibliometric term mapping shows us that many scientists have been fulfilling the thematic part of the plan. We do not assess the collaborative outcomes of the Dutch projects; thus acknowledge that this is an important area for further research, in addition to comparative analyses with similar policies in other countries. Bibliometric indicators are often generated to determine how a country's R&D competitiveness is positioned relative to other benchmark countries (see Netherlands Observatory of Science and Technology, 2010). Our intent is to highlight a somewhat hidden body of research requiring more consideration, if not similar treatment in future science and technology indicator reports.

While it has been said that "nobody has a very good estimate of how much contemporary R&D presently is targeted in the direction of addressing the problems of poor or disenfranchised people" (Woodhouse & Sarewitz, 2007, p. 143), this study clearly demonstrates that it is not only possible to obtain an estimate, but to also use this R&D literature for further agenda setting. Ideally, it would be useful to integrate the most comprehensive body of poverty/hunger research documents into an internationally recognized

open access database, searchable by keywords, authors, organizations etc., so that policy-makers and scientists can regularly monitor its content. With this type of resource the international scientific community would be in a better position to identify gaps in problem areas and locate potential collaborators, particularly in countries where a problem is greatest or where scientific capacity-building is most critical. In the next phase of the agenda, tailored measures or feedback mechanisms would have to be developed for profiling both short term and longer term impacts.

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