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Using semantics to reveal knowledge divides in Dutch development cooperation: the case of the Millennium Development Goals

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The paper is a first effort at examining the potential of scientometrics analysis to the field of development in the expectation that this type of analysis will make general patterns of knowledge within development more visible. In particular, we assume that it will reveal information on these patterns and in particular on knowledge divergences and divides within the sector. Semantic maps make it possible to compare semantics across the three domains under study, and reveal implicit frames within them. This methodology is tested using a pilot study comparing the semantics around Millennium Development Goals (MDGs) in three domains involved in development: policy, science and the mass media. In particular, it compares the semantics on MDGs in the website of the Dutch Ministry of Foreign Affairs, in scientific articles authored by Dutch scholars, and in Dutch newspaper articles. In conclusion, the semantic maps method provided fruitful insights into comparing the semantics of the debate around MDGs in the three separate knowledge domains involved in the debate.

Introduction

> The biggest single problem in communication is the illusion that it has taken place.
>
> George Bernard Shaw

In this article, we will introduce a new methodological approach to research into knowledge divides in the development sector. The development sector is governed by several knowledge domains, each with their own actors, agendas and semantics of communication. All of these domains are generating knowledge which is applied in development but they have a different focus that can be made visible and comparable by mapping the semantics of text documents produced in the domains.

The main knowledge domains within the development sector are those of practice, science and policy (see e.g. Laxmi Pant 2009). Although there are overlaps between these domains, there are divides between them. Various non-governmental organizations (NGOs) are focused on the practical implementation of development and their employees are concerned with the practice of development. Science, represented by universities and research institutes, provides academic communications on development, while the government apparatus, in the form of ministries, guides the policy on development. So far, the

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role of the mass media, in guiding the public appreciation of development has not been considered as a separate domain for development research.

We will be concentrating on debates around the term 'Millennium Development Goals' (MDGs) in the period 2005–2008. We have chosen the term because it is one that has been at the cornerstone of development efforts during this period. We will present the method via a pilot study on comparing the semantics around Millennium Development Goals in three domains involved in development: policy, science and the mass media.[1] In particular, we will systematically compare the semantics on MDGs in the website of the Dutch Ministry of Foreign Affairs, in scientific articles authored by Dutch scholars, and in Dutch newspaper articles. We hypothesize that the communications in the different domains are disjointed. This hypothesized disjuncture reflects divergences or divides in the knowledge system between these domains. We would also expect any disjuncture we find to be echoed in communications at global level although this is beyond the current focus of our study.

The domain of practice is expected to be the largest contributor to development knowledge but the complexity and heterogeneous nature of the communications in the domain of practice, published mainly in grey literature. Proceedings and organization-based internal reports, makes this domain less easily accessible for the analysis of semantics – the semantics of practice are likely to be divided internally to a wide variety of practices (instead of one practice). Our focus in this pilot case study is methodological, and therefore, we have left the domain of practice outside of our analysis. In further case studies, the domain of practice should be included.

Semantic maps make it possible to compare semantics across the three domains under study, and reveal implicit frames within them. As far as we are aware, this approach is new to the development sector. The paper is a first effort at examining the potential of scientometrics analysis to the field of development. This type of analysis will make general patterns of knowledge within development more visible. In particular, we are assuming that it will reveal information on these patterns and in particular on knowledge divergences and divides within the sectors.

In the following section, we will first discuss the development sector as knowledge intensive sector that requires intensive cross-domain activities, and consists of several knowledge domains. We will then give a background on the development sector in general, the Dutch situation in particular, and the MDGs as a further focus. Thereafter, we will specify the method and data sets used for the analysis. After discussing the results, we will discuss the main results in the concluding section.

Context

Knowledge and development

The development sector is highly knowledge intensive. Indeed, it has been described as a 'knowledge industry' (Powell 2006, p. 519). The complex and dynamic context within which development is taking place requires, more than ever, a well-developed ability to reflect on the activities, policies and vision within the sector, to improve, innovate and develop solutions, and to discover what works and what does not (Stremmelaar *et al.* 2009).

Knowledge is often seen as crucial because of its role in the 'effectiveness' and 'efficiency' of development (Powell 2006) and because of the role it plays in avoiding duplication, overlap and fragmentation, which are often cited as the rationale for more integrated approaches to knowledge (Ho *et al.* 2009). These reasons for identifying the crucial nature

of knowledge to development, however, do not recognize the fundamental importance of knowledge to resolving development. Two models that can assist in understanding of the role of knowledge in development are 'wicked problems' and the Triple Helix.

Development can be conceptualized as a 'wicked problem' or series of wicked problems. Wicked problems were first defined by Rittel and his colleagues (cited in Brown 2008) and are characterized by their paradoxical nature: without any final solution but nevertheless urgently requiring an answer; requiring unprecedented solutions which have to be considered in the light of existing solutions; containing an imperative to change but offering no assurance which direction to chose. In Brown's approach (2006), wicked problems can only be addressed by the resolution of different types of knowledge. Thus, development can be seen to require resolution of different knowledges.

The Triple Helix metaphor/model provides a framework to analyzing the institutional dynamics between government, industry and higher education in order to consider innovation with the knowledge-based economy. Innovation – new modes of communication – is taking place at the interfaces between these institutions. In the Triple Helix model, for example, in these new forms of communication, science is no longer valued only as a quest for truth but also from the perspective of utilization

These two models of knowledge and innovation are not in conflict with each other but, rather, we would argue that they comprise different ways of looking at the same phenomenon: interaction between different types of knowledge is required to bring about development and for the innovation and change required for development.

Development sector

The development sector comprises a large and diverse industry, spread across the world and in which huge resources are circulating. Official Development Assistance reached a record level of USD119 billion from the countries of the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD) in 2008, and this level is expected to reach USD121 billion in 2010 (OECD 2009). However, these are pre-financial crisis predictions which may not become the reality.

The sector comprises a range of actors, both organizational and individual, working to achieve development as has been elaborated in the MDGs (Ferguson and Cummings 2008, p. 76). Organizational actors include the international organizations, such as multilateral organizations (United Nations, World Bank, World Health Organization, etc.) and the bilateral donor organizations in developed countries (also called the global North in development terminology), and their government counterparts in developing countries (the global South). Bilateral donor organizations include, for example, Directorate-General of Development Cooperation (DGIS), part of the Dutch Ministry of Foreign Affairs (BuZa) and the Department for International Development (DFID) of the United Kingdom. The range of development organizations also include the so-called civil society actors, such as non-governmental organizations (NGOs) which range from large multi-country operations, such as the Save the Children Fund, to small NGOs and community-based organizations (CBOs) directly working on the ground in developing countries. In terms of individuals, it includes a wide range of professionals, ranging from policymakers in the international organizations and at national level, researchers at universities and research organizations, and development practitioners, including health professionals, knowledge and information managers, extension agents, and many more, such as journalists and activists (Ferguson and Cummings 2008, p. 76).

The development sector thus comprises a broad and diverse range of organizations, individual professionals and activists. However, Ferguson and Cummings (2008) argue that:

> development efforts often transcend organizations, professional constituencies, and geographical boundaries, making knowledge management increasingly relevant because of its power to cross these divides. (p. 79)

Although this is the case for knowledge management, as described in the quote above, it is also even more important for the role of knowledge within the sector as a whole where sharing across organizations and various knowledge divides is of key importance. In this sense, it is possible to conceptualize knowledge in the development sector as not only the knowledge encompassed by the range of actors but it also includes the space between these actors and sector-wide or system-wide knowledge.

Development sector in the Netherlands

The Netherlands is a prominent donor country: in 2008, it was one of five countries which exceeded its UN target of 0.7 percent of Gross National Income (GNI) with an aid contribution of 0.8 percent. In addition to this, it is the sixth highest DAC country donor at USD6.9 billion in 2008. The development sector in the Netherlands is one sub-sector of the development sector. Like the global sector, it is inhabited by a broad range of development organizations, including bilateral organizations and NGOs. For the purpose of this study, we have identified the following knowledge domains within the development sector in the Netherlands:

- Policy: BuZa
- Research: universities and research institutes
- Public: news media

As mentioned previously in this article, we have been unable to include development practice in this analysis, despite the fact that it is an important domain, because its knowledge is fragmented and not accessible using the tools we are using here.

One of the impediments to development approaches in the Netherlands is commonly felt to be the fact that the different knowledge domains are not working together to create new development knowledge. Knowledge development and the management and sharing of knowledge across domains within the sector is hampered by a number of limitations (Stremmelaar *et al.* 2009):

- The domains of policy, research and practice have the tendency to work in isolation focusing on their own domain-related interests
- Learning across the sector-wide knowledge system takes place only on an *ad hoc* basis
- While ultimately Southern interests and demands should be the basis for and guiding initiatives to create and articulate knowledge in development, this is too rarely the case.

The Millennium Development Goals

The Millennium Development Goals (MDGs) were adopted in September 2000 at a gathering of 147 heads of state at the United Nations (UN) headquarters. At this gathering, the

heads of state signed the Millennium Declaration which set numerical targets and deadlines to measure performance in achieving the goals. As stated on the World Health Organization (WHO) website:

> The United Nations Millennium Development Goals are eight goals that all 191 UN member states have agreed to try to achieve by the year 2015 . . . . The Eight Millennium Development Goals are: 1) to eradicate extreme poverty and hunger; 2) to achieve universal primary education; 3) to promote gender equality and empower women; 4) to reduce child mortality; 5) to improve maternal health; 6) to combat HIV/AIDS, malaria, and other diseases; 7) to ensure environmental sustainability; and 8) to develop a global partnership for development. (WHO)

The MDGs have received much criticism in recent years, and there is currently much doubt about whether they will be achieved at all:

> Progress towards the goals is threatened by sluggish – or even negative – economic growth, diminished resources, fewer trade opportunities for the developing countries, and possible reductions in aid flows from donor nations. (UN 2009, p. 4)

Despite these growing reservations, the MDGs 'have become all-important, not just within the UN, but also as the zeitgeist of the global development enterprise' (Attaran 2005, no page numbers). Given this centrality to global development efforts, they are a suitable term to analyze semantic differences between the knowledge domains.

Ironically, the debate around the MDGs also highlights the gulf between the policy and scientific domains which this article is aiming to illustrate. While UN scientists have apparently been trying to correct inadequacies in the scientific data which is measuring their achievement, particularly where the health MDGs are concerned, corrective measures have been held up by political interference, including interference from the UN's senior leadership (Attaran 2005, no page numbers).

Given that the MDGs have been central to global development initiatives for some years, we would expect the three domains – policy, science and mass media – to play some attention to the MDGs and that the eight themes of the MDGs will be represented as sub-themes in the various domains. However, we hypothesize that the domains will do this in different ways, reflecting their fundamental divergence. While the newspapers are expected to follow external events around MDGs (e.g. political decisions, popular events), the scientific articles are likely to focus in-depth on a restricted number of these goals. The policy domain is expected to represent the national decision-making around MDGs. We would also expect the media to take a restricted, more superficial approach.

In the hypotheses, we are trying to orient ourselves on the value of scientometric methods – described in more detail below – to the field of development. We hypothesize that the method will be useful in revealing some of the hidden structures and disconnections of knowledge creation in the three domains.

Methods

In this paper we will focus on semantic differences across the various domains involved in development, in particular the debate around MDGs in the Netherlands. We will apply a relatively new automated method for detecting underlying semantics in a set of texts in the three domains. The so called semantic maps method has been developed as reaction to an increasing amount of textual data available for scholarly research in digital sources such

as the websites of ministries, Web of Science, (Social) Science(s) Citation Index and newspaper databases.

The semantic maps method is used for detecting differences in the codification across various domains as well as changes over time within one domain. The method has previously been applied (with success) to the analysis of codification in scientific texts on nanotechnology (Lucio-Arias and Leydesdorff 2007), comparison between several discourses on stem cell research (Leydesdorff and Hellsten 2006), tracing the development of one debate over time as well as comparing one single text to a set of texts (Leydesdorff and Hellsten 2006) and detecting emerging frames within one debate over time (Hellsten *et al.* in press). Currently, it is also applied to the debate on care farms in the Netherlands (Iancu and Hellsten, in press.)

The method builds upon science and technology studies, in particular co-word analysis and automated text analysis traditions. Early efforts to automate the analysis of public debates proposed using words and co-occurrences of words for mapping empirically the translations in the dynamics of science, technology, and society (Callon *et al.* 1983). In the 'sociology of translation' (Law and Lodge 1984, Callon *et al.* 1986), co-occurrences of words (co-words) have been considered as the carriers of meaning across different domains. Words, however, are ambiguous and languages contain both polysemous and homonymous words. In other words, words are contained within sentences that provide them with meaning (Bar-Hillel 1955, Hesse 1980, Leydesdorff 1995, 1997). The semantic maps approach measures the meanings of words in their contexts, and results in visualizations of word networks. The *relations* between co-occurring words at different levels (within sentences, paragraphs, documents, sets of documents) span a network with an architecture in which words are also *positioned* (Burt 1982).

Words co-occur in text documents at several levels. They may co-occur within sentences and paragraphs in a document, but words can also co-occur across various documents, and sets of documents. The dynamics of co-evolving words in sets of documents that deal with the same topic, such as Millennium Development Goals, at all these levels may reveal systematic information on latent aspects in communications. Distances between the words in the semantic maps are based on similarity in the distributions of words in documents and not on the relations among words (Leydesdorff and Vaughan 2006).

The semantic maps method builds upon the following procedure. The sets of documents were saved as text files. Both full texts (in the case of Web of Science abstracts) and lists of titles or headlines were downloaded, separately, for further analysis. A stop word list of words that were considered irrelevant for the analysis (such as *het*, *de*, *toe*, *aan*, *in*, *op* in Dutch and the, a, in, on, at etc. in English) was created manually for each set of documents. Word frequency lists were produced for each set of texts using the concordance program Text STAT.[2] The texts and words were inputted into dedicated software programs freely available at http://users.fmg.uva.nl/lleydesdorff/software.htm. These programs produce the asymmetrical word/document matrices and the subsequent co-word matrices, and the cosine-normalized similarity matrices among the words (Leydesdorff and Vaughan 2006). The output files of the programs can be imported in the visualization program Pajek[3] in order to visualize the results in the form of co-word networks based on similarities among the word distributions.

Approximately 100–150 words at the maximum were included in the analysis. Although including many more words is possible, the reading of the semantics maps in this case becomes problematic. The size of the nodes is proportional to the logarithm of the frequency of the word occurrences in the matrix. Separate clusters of words are shown with different node colors. Finally, the Dutch words were translated to English.

Data

First, we downloaded news briefings from the website of the Dutch Ministry of Foreign Affairs (www.minbuza.nl) to analyze the domain of policy. Second, the Web of Science (http://apps.isiknowledge.com) (including *Science Citation Index*, the *Social Sciences Citation Index* and the *Arts & Humanities Citation Index*) was consulted for collecting articles published between 2005 and 2008 in which at least one of the authors is affiliated in the Netherlands to examine the domain of research. Third, the LexisNexis newspaper database (www.lexisnexis.com) was used for harvesting news in Dutch newspapers between 2005 and 2008 to consider the public domain. We used the exact phrase 'Millennium Development Goals' (in Dutch and English) or the acronym MDG anywhere in the texts in each of the domains. The results were manually checked to exclude texts in which the acronym MDG may have referred to another topic.

The Dutch Foreign Ministry published 24 news and press briefings on the Millennium Development Goals; Dutch scholars published 27 articles, indexed in the Web of Science ISI-database; and Dutch newspapers published 93 newspaper items on Millennium Development Goals between 2005 and 2008 (Figure 1).

We will first take a look at the semantics in the policy domain (Dutch Foreign Ministry), then in scientific publications (Web of Science) and last at the newspaper debate (Dutch newspapers). For each domain, we have analyzed the title or headline words in the documents.

Results

Policy domain

The Dutch Foreign Ministry published in its open access Web page news about latest political decisions and official reactions to current events. The news is intended for wide audiences, but reflects the official opinion of the ministry.

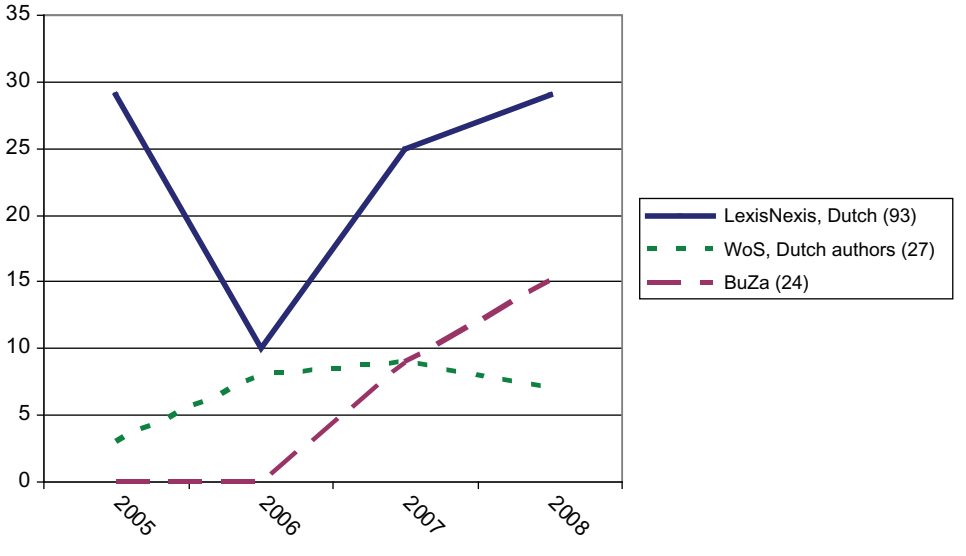

Figure 1. 'Millennium Development Goals' in newspapers (LexisNexis database), scientific articles (Web of Science: Science Citation Index, Social Sciences Citation Index and the Humanities Citation Index) and in the Foreign Ministry online news and press briefings.

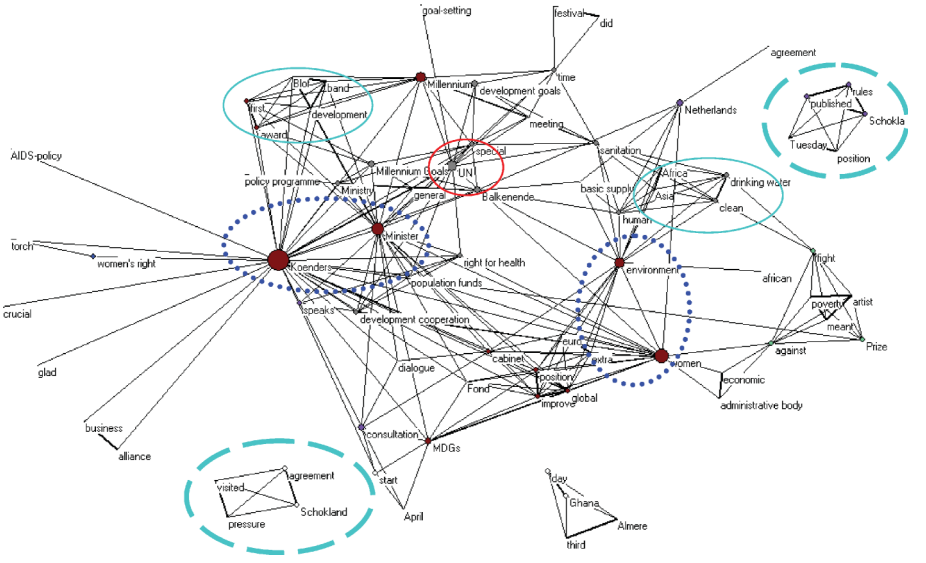

Figure 2. Millennium Development Goals in the news published on the website of the Dutch Foreign Ministry, 24 documents.

The title words used in the news and press briefings at the website of the Dutch Foreign Ministry are highly codified. In fact, the website uses a very restricted vocabulary, which appears to revolve around the Minister of Development Cooperation, Bert Koenders (November 2008–February 2010), important policy decisions, such as the Schokland Accord, and the topics of women and environment (Figure 2).

While Minister Koenders is in the same cluster with words like women, environment and MDGs, the Dutch Prime Minister (July 2002 to present), Jan Peter Balkenende is related to words like UN, development cooperation, development goals and human.

In the policy domain economical words, such as euro, economic, population funds and business alliance are connected to several clusters without a central focus. Local events, such as the third Ghana day in Almere, a suburban city in the Netherlands, are represented in their own clusters, without connections to the wider debate. Specific issues, such as AIDS and women's right are in the periphery, loosely connected to the main foci of the Ministry.

The semantic maps derived from the analysis of the news and press briefings shows that the communication is unstructured, and this probably reflects the fact that it is reacting to events. This demonstrates on the one hand an internal, national focus and, on the other hand, a very narrow focus on two subject themes of the MDGs: women and environment.

Science

In the science domain, represented by articles (co-)authored by Dutch scholars and indexed in the Web of Science, two main topics are dominant: methodological questions related to the effectiveness debate; and key development priorities reflected in the MDGs: health, maternal health, and tuberculosis control (Figure 3).

Taking a closer look by including more words in the visualization, the scientific articles written by Dutch authors show strict separation of clusters around method development on

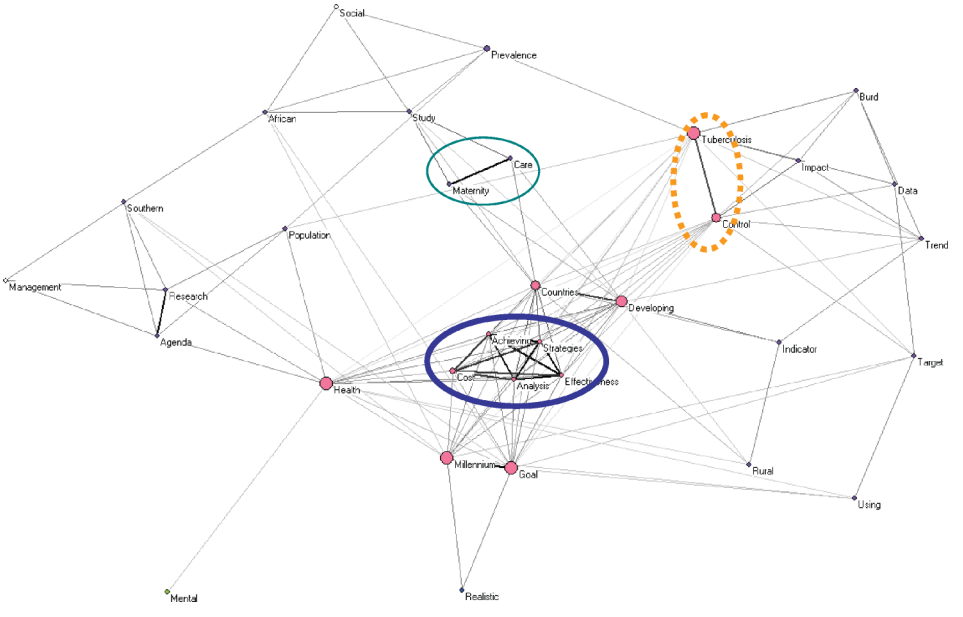

Figure 3. Millennium Development Goals in the Web of Science by Dutch author(s), 2005–2008, 27 documents, 34 title words that occur more than twice.

the effectiveness debate, and around specific locations: Nepal, Bangladesh, Hong Kong, Mexico and Benin, and cities such Lusaka. The clusters represent the various case studies published by Dutch authors (Figure 4).

The results show a number of interesting distributions which are highlighted in circles. First of all, this distribution shows the importance of geographical location to development research: in almost all of the clusters, a country is cited. Second, themes focus on a broad range of themes within the MDGS: maternal and child health, HIV/AIDs. Two themes which are not in the MDGs are also to be found here: water which relates to many of the individual MDGs; and also again the effectiveness agenda (measurement, indicators, costs, impact, indicators, attribution) which is a pervading theme throughout the development sector.

Newspapers

In Dutch newspapers, one of the main clusters focuses on the rock band, Bløf, that received an award, the first Millennium Development Goals Award, in June 2008 at a pop festival (Festival Mundial) in Tilburg, the Netherlands, for their project, *Umoja*. Umoja involved the band playing with musicians from many different countries. This is also connected to a further cluster around the popular Dutch TV discussion program ‘De wereld draait door’ [The world keeps on turning] which is concerned with the appearance of Bløf on that program after receiving the award. Another cluster focused on news relating to the fact that the current Secretary-General of the UN, Ban Ki-moon, scored a barely passing grade of five. One further, unconnected cluster is concerned with the ‘mega fusion’ between drinking water companies in the Netherlands in 2006 and the implications of this for the MDGs (Figure 5). The effectiveness debate is also reflected in the central cluster featuring ‘inefficient’ and ‘NGO subsidizing’ and in a number of critical opinion columns.

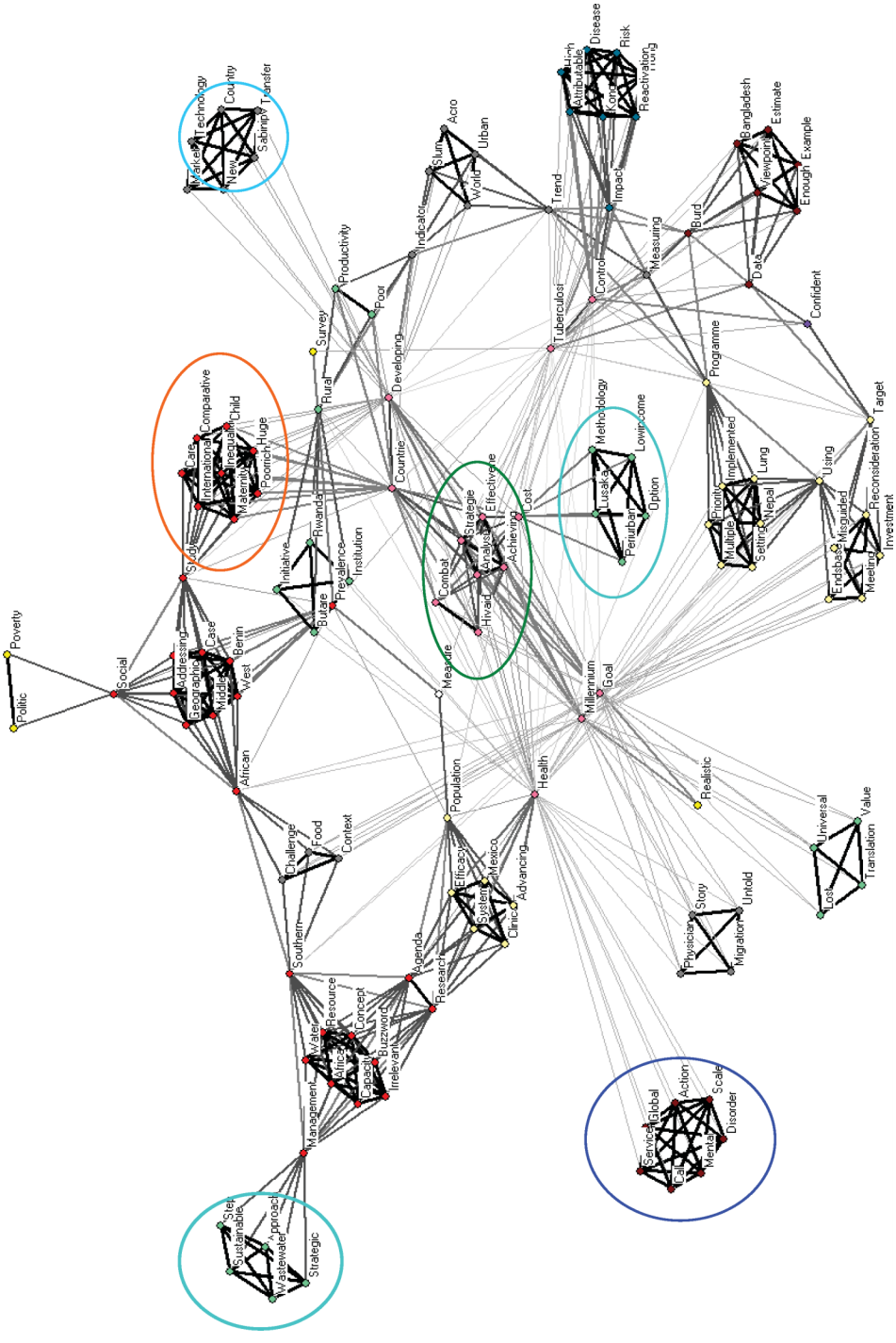

Figure 4. Millennium Development Goals in Web of Science, Dutch authors, 2005–2008, 27 publications, 135 title words.

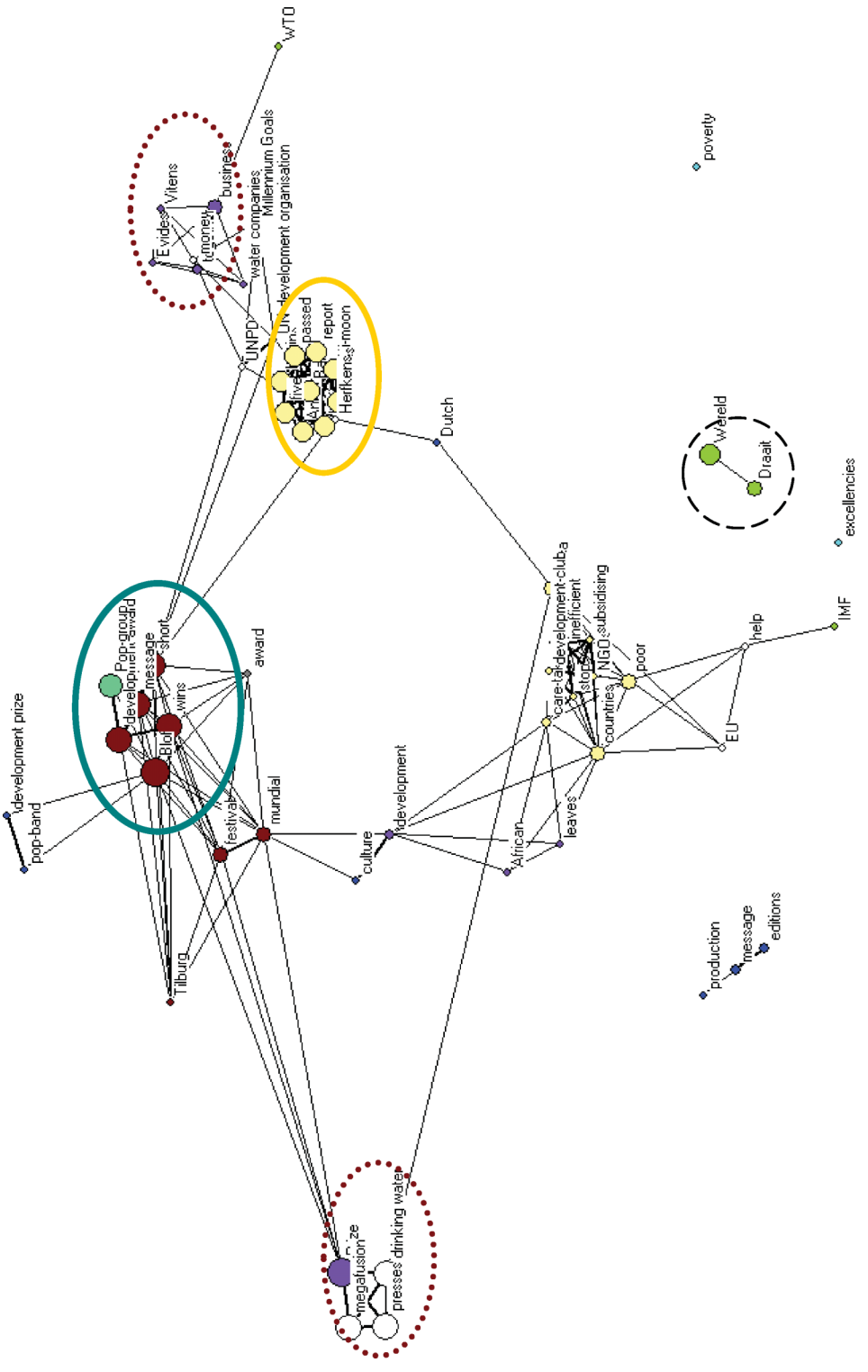

Figure 5. Millennium Development Goals in Dutch newspapers, 93 news items, the main 69 headline words.

Discussion

In summary, the three domains focused on different aspects of the MDG, according to their own priorities. The policy domain, reflected by the news and press briefings from the Ministry of Foreign Affairs provided information on policy decisions, and were highly concentrated around the main, political actor, the Development Minister, Koenders. Further, the Schokland agreement gained prominence in the policy documents. Of the MDGs, those related to women appeared to receive the highest amount of focus in the policy domain.. This is reflected in the priority and publicity that Koenders gave to the role of women during his period in office, and also because women are the focus of two of the MDGs.

The science domain, in turn, was organized around three main issues. First, articles cluster around the effectiveness debate. Second, the publications are about local case studies, for example, in Lusaka (Zambia), Benin, Mexico, Nepal, Bangladesh and the Democratic Republic of Congo, demonstrating the importance of location to development studies. Third, the topics of women and health are most prominent. Of the MDGs, maternity care (women) and tuberculosis control (health) gained most of the attention. Not surprisingly, the clusters reflect an in depth analysis and research of themes related to the MDGs.

In the mass media, the prize won by the pop music group, Bløf and a related television program, the mega fusion around drinking water and the evaluation of the head of the UN, Ki-Moon, gained the main attention. The predominance of these themes demonstrates: the superficial attention to the MDGs in the mass media; and the emphasis on public spectacles (particularly the assessment of Ki-moon and Bløf) were of particular interest to the media. These three themes seemed to reach all of the newspapers and there was much replication with articles of the same name appearing in many different newspapers. It was not clear to us whether this represents the influence of releases from selected press agencies or large press companies repeating articles in their different newspapers. However, it does reflect the superficiality that we noted above. In addition to this, there were many critical articles – we can tell they are critical because of the words appearing in the headlines – which seemed to come predominantly from the opinion columns of newspapers

The various domains involved in the debate on MDGs had all their own foci within the debate. The disjunction in what was considered the most important aspects in the domains supports the hypothesis that the various knowledge domains have restricted communication with different themes, different approaches and different priorities, and that they are all focusing on their own, domain-related priorities.

However, there are several, interesting, points of mutual interest between the three domains. The theme of drinking water and the effectiveness debate related to the MDGs is present in all three domains but receives attention within these domains consistent with their own interest and focus of attention. In addition the award to the rock band, Bløf is discussed at the policy and the mass media domains, probably because Bert Koenders presented the award to Bløf. Further, the topics around health and women are present in the scientific and in the policy domain, but at different levels. While scientific articles take a more specific focus on maternity care and tuberculosis control, the policy documents address these at a general level of women and health (Figure 6).

Conclusion

In conclusion, the semantic maps method provided fruitful insights into comparing the semantics of the debate around MDGs in the three separate knowledge domains involved

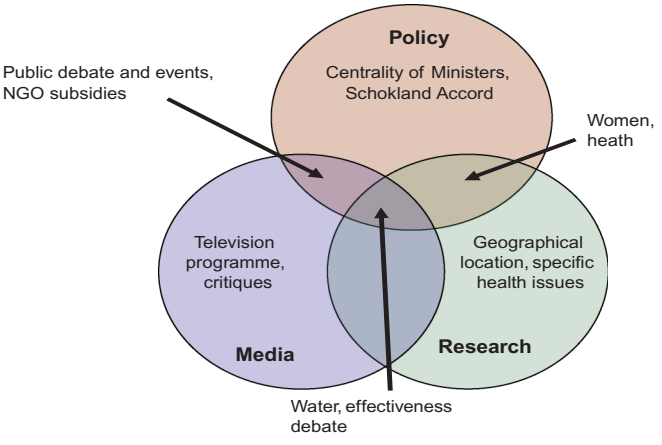

Figure 6. The overlap between the knowledge domains of policy, science and the media.

in the debate. First, the method enabled the comparison of semantics between the domains, second, the results allowed for locating common points of interest in several domains, and third, the analysis provided a systematic way of approaching the debate. The results of this pilot study show that the method is useful for the analysis of knowledge creation in highly complex topics, such as MDGs, that are carried on in several, separate knowledge domains. Although these results are not surprising, we are of the opinion that the method makes it possible to make visible to some extent the domain related interests and priorities in an objective way.

Our pilot study lacks one major contributor of knowledge in development sector, the domain of practice, because communications of practice are very dispersed and often only accessible as gray literature. We are of the opinion that this lack of accessibility is a symptom of the lower status of the communications derived from practice. Although there are efforts to make the communications from practice more accessible – there are a number of initiatives afoot to develop repositories of practice-based documents, for example – these are by no means as developed as those of the other domains we have studied here.

Our results call for further research into the semantic differences between the domains of policy, science, mass media and practice, and using a larger set of data. We would like to addition methods to the analysis which are able to provide access to the less accessible field of practice.

Notes

1. The domain of practice is expected to be the largest contributor to the development. The complexity and heterogeneous nature of the communications in the domain of practice, published mainly in gray literature – proceedings and organization-based internal reports, makes this domain less easy for the analysis of the semantics – the semantics of practice are likely to be divided internally to a wide variety of practices (instead of one practice). Our focus in this pilot case study is methodological, and therefore, we have excluded the domain of practice from our analysis. In further case studies, the domain of practice should be included.
2. TextSTAT is a freeware program from the Free University of Berlin available at http://www.niederlandistik.fu-berlin.de/textstat/software-en.html.
3. Pajek is available at http://vlado.fmf.uni-lj.si/pub/networks/pajek/ as freeware.

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