

# Biotechnology in the news

*Lessons from a quantitative analysis of news articles on  
biotechnology  
between July 2005 and June 2010*

Augustus 2011

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## Voorwoord

De COGEM heeft sinds 2005 over een reeks van jaren onderzoek laten uitvoeren naar de aandacht voor biotechnologie in de media. Het doel was om geïnformeerd te zijn over eventuele verschuivingen in het belang dat media toekennen aan dit onderwerp, om eventuele verschillen in aandacht tussen landen en continenten op te sporen en om te zien welke onderwerpen in een bepaalde periode in het bijzonder door de media worden belicht. De achterliggende gedachte is dat de berichtgeving in de media een beeld geeft van de maatschappelijke discussie over biotechnologie en inzicht kan geven in eventuele kansen die uit het beeld naar voren komen voor internationale onderhandelingen. Bovendien is de aandacht die de media aan een onderwerp geven door de *framing* die daarvan uit gaat een eigenstandige factor geworden voor het beleid. De inzichten vormen ook nuttige informatie bij het periodiek opstellen van de Trendanalyse Biotechnologie voor regering en parlement.

Tot nu toe is over dit onderzoek tweemaal gerapporteerd. De eerste rapportage betrof het ontwikkelen van een methode om verschillen tussen landen zichtbaar te maken.<sup>1</sup> Daarbij zijn media berichten op basis van de aard van de daarin beschreven actie gescoord op wiens maatschappelijk belang ermee wordt gediend: dat van het bedrijfsleven (private belangen) of van de overheid (collectieve belangen), dan wel of de ontwikkeling door technologische of maatschappelijke belangen is gedreven.

Vervolgens is op basis van de ontwikkelde methode een kwantitatieve analyse van mediaberichten een aantal jaren in gang gezet en de rapportage daarover opgedragen aan LIS Consult, daarbij ondersteund door een aantal student-assistenten bij de Universiteit van Tilburg. Over de resultaten betreffende de periode juli 2005 - juli 2007 is bericht in 2008.<sup>2</sup> Na bespreking in de Subcommissie Ethiek en Maatschappelijke aspecten van de COGEM heeft de COGEM deze studie hetzelfde jaar met een signalerende brief aangeboden aan de minister van VROM (CGM/081007-04).

Inmiddels is het onderzoek tot een afronding gekomen. Hoewel was beoogd in 2009 opnieuw met een rapportage te komen is er voor gekozen wat later te rapporteren en dan de uitkomsten over de gehele onderzoeksperiode in kaart te brengen. Het nu voorliggende rapport geeft het resultaat daarvan weer.

De resultaten over de periode 2005-2010 geven interessante trends te zien in de positionering van biotechnologie, de onderwerpen die in het debat domineren, van verschillen tussen de grote handelsblokken in de wereld maar ook tussen landen in bv de EU. Opvallend zijn ook de fundamentele verschillen in het debat dat rond landbouwkundige dan wel medische biotechnologie in de media wordt gevoerd en daarbinnen zijn er weer grote verschillen tussen de VS en de EU. Ook zijn verschillen tussen blokken vaak minder groot dan die tussen bv EU lidstaten. Over de industriële biotechnologie vindt nauwelijks publiek debat plaats. Ook wordt in deze analyse aan ontwikkelingen in Azië aandacht besteed, dat zich bij veel onderwerpen tussen de EU en de VS blijkt te plaatsen.

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<sup>1</sup> W.Vos & B.Zoeteman, 2007, Posities van Wereldblokken inzake Biotechnologie. Een verkenning van het monitoren van verschillen en trends op basis van mediaberichtgeving en ordening volgens een scenario- en actoren methode, onderzoeksrapport COGEM 2007-04.

<sup>2</sup> H. De Vriend, 2008, Posities van Wereldblokken inzake Biotechnologie. Een kwantitatieve analyse van mediaberichten over biotechnologie over de periode van juli 2005 tot en met juni 2007, onderzoeksrapport CGM 2008-04.

Met het verschijnen van dit overzichtrapport hoopt de COGEM een belangrijke bouwsteen bij te dragen voor het begrijpen wat de drijvers zijn voor het maatschappelijk debat over biotechnologie op verschillende plaatsen in de wereld.

De voorzitter van de begeleidingscommissie

Prof Dr B.C.J. Zoeteman

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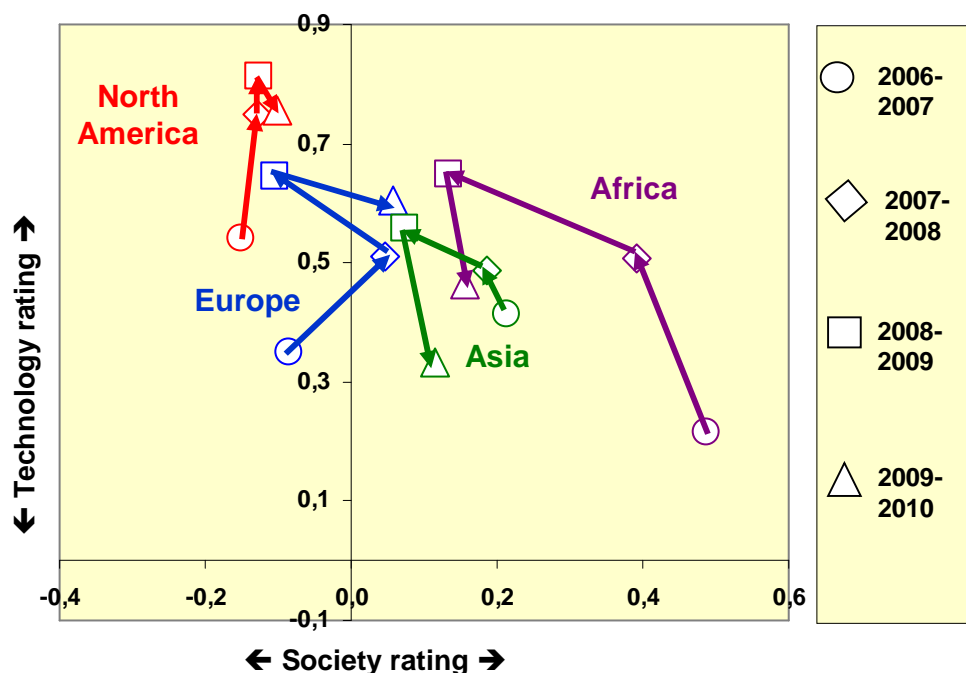
## Executive summary

Assuming that the media reflect to a large extent the public debate about biotechnology, both in reporting about this public debate and shaping it, we have analyzed more than 22,700 news articles about biotechnology collected from a wide range of sources between July 2005 and July 2010. These articles were stored in a database with attached information concerning the source, the type of biotechnology, geographical information about the event and major interests described in each article. A pilot study with 3,460 articles collected during the first year confirmed the feasibility of an method of analysis that demonstrates differences in positioning of agricultural and medical biotechnology between continents and countries by plotting the average rating of a large number of articles on a diagram that visualizes the level of technology push in developments and dominance of private vs. public interests in decisions taken. This pilot study also suggested the potential for further analysis of a shift in positioning of actors in countries over time. An additional 19,250 news articles were collected during four years following the pilot study and were stored in the database in a slightly different way. The results presented here mostly concern the July 2006 – July 2010 period.

The results of the analysis suggest:

### 1. Stable technology dominance and shift towards private interests

World-wide, on average the news about biotechnology was clearly dominated by technology-push oriented events. Mid 2006, private and public interests (the society rating) were more or less balanced on average, but shifted in Asia and particularly Africa in the direction of private interests in later years.



## **2. Europe is closer to North America than Asia**

Although the level of technology dominance was lower and there was slightly more focus on public interests in Europe, in terms of media reporting the gap between Europe and North America was not as big as differences in innovation and authorization policies suggest.

## **3. Significant differences within Europe**

The media reporting about biotechnology in The Netherlands rated pretty close to the US' media reporting, suggesting a more pro-Atlantic attitude than in other European countries such as France as well as the United Kingdom. Over time, the Netherlands' biotechnology positioning shifted even closer to that in the US.

## **4. Growing difference between the two largest emerging economies**

China's positioning was characterized by a constant high level of technology orientation and a non-consistent shift towards more private interests. At the same time, India's biotechnology positioning shifted radically to much lower levels of technology dominance as a result of ongoing protests against cultivation of GM crops, reaching its climax with massive protests against market authorization of Bt egg-plant in spring 2010.

## **5. Little distinction between agricultural and medical biotechnology in North America, large distinction in Europe**

In Europe the difference in positioning of agricultural and medical biotechnology is large. While the focus of articles about European medical biotechnology on private/company interests is even stronger than in North America, articles about agricultural biotechnology are characterized by significantly more focus on public interests and less focus on technological possibilities. By contrast, the distinction between news reporting on North American medical and agricultural biotechnology is minimal, although there is slightly more technology dominance in medical biotechnology.

## **6. Considerable gap in agricultural biotechnology positioning**

Consequently, the gap between North America's and Europe's positioning in agricultural biotechnology is considerable. On average, agricultural biotechnology in Asia, Africa and Oceania is portrayed quite the same as in Europe.

## **7. A number of issues had a significant impact on the biotechnology debate**

Issues concerning stem cells had a significant effect on the positioning of medical biotechnology in the direction of public interests in 2006/2007, especially in North America. This effect was significantly reduced in the subsequent years. Events concerning cancer research had an equally significant but opposite effect on the positioning of medical biotechnology. Cloning issues, which had an effect similar to that of stem cell issues, more or less disappeared from the news. A wide range of other medical biotechnology issues took over.

The moratoria/ban and contamination & coexistence issues were quite significant in pulling the positioning of agricultural biotechnology in the direction of NGO interests in 2007/2008. Their significance decreased in the subsequent years. The moratorium issue did not only play a role in Europe but also in Oceania.

Events related to Monsanto were quite significant for the positioning of agricultural biotechnology, especially in North America. Their significance in pulling the agricultural biotech positioning towards company interests peaked in 2009 and then stayed at a quite high level.

The authorisation of Bt aubergine was an issue that raised a lot of protest in India. This attracted a lot of attention in Indian media and had a significant impact, pulling India's agricultural biotechnology positioning strongly in the direction of public interests.



## 1. Introduction

### 1.1 Using the media to detect (inter)national positions

Governments expect their advisory committees to provide early warning of new trends in technology and social perceptions and indications that can support the continuous policy negotiations in EU and UN frameworks. The Netherlands' Commission on Genetic Modification (COGEM) advises and informs the Dutch Government on the ethical and social aspects of genetic modification and how to include these aspects in decision-making. COGEM has recently commissioned a study to develop a new instrument to map differences and commonalities in individual countries and negotiating blocks by looking at how both scientific and technological advances in biotechnology and societal developments that shape their application. This instrument uses a detection system of publications in the media and applies a scheme of categorization that enables a positioning of the actions described in the publications. In this way relative positions of countries as a result of the total of published actions and can be described as trends in time. This paper gives an overview of the results of the application of the research instrument over a five year period that allows to draw first conclusions on differences between nations and specific types of biotechnologies which are relevant for government agencies as well as businesses and NGOs.

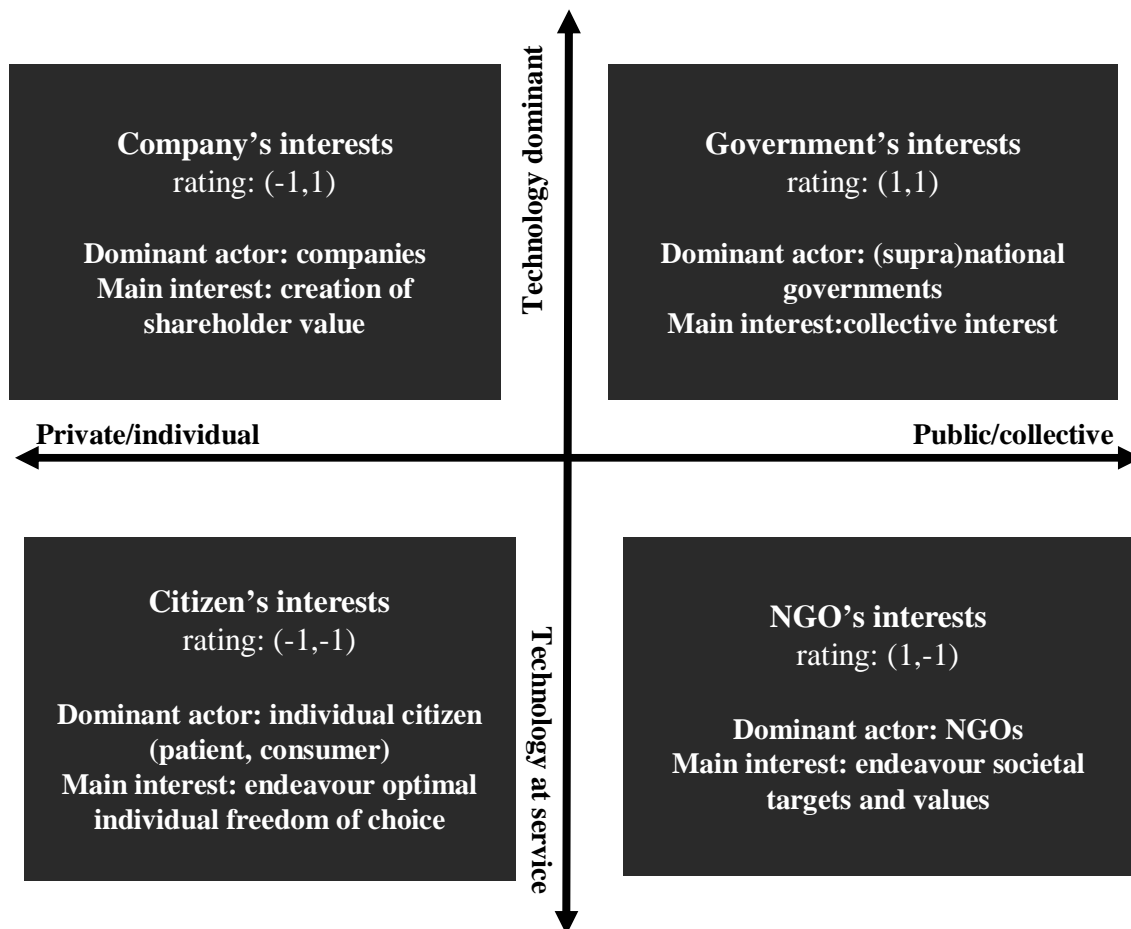
### 1.2 The research instrument and its assumptions

Each day, newspapers, journals, tv stations and internet media publish a large number of articles about biotechnology. On the one hand, apart from informing us about new technological and scientific developments, these media tell us how different actors deal with biotechnology. On the other hand, the way the media report about biotechnology plays a role in shaping the public image of biotechnology. We assume that the mix of news items from a wide range of sources, covering decisions by public authorities, companies, NGOs and citizens, reflects the state-of-the-art of the social debate on biotechnology. Systematic analysis of biotechnology reporting in the media over a longer period can tell something about the positioning of biotechnology in the complex social reality. It can tell us whether biotechnology is primarily driven by technological possibilities and commercial opportunities, or by the needs of citizens (consumer, patients, voters). It also reflects to what extent the biotechnological development is directed by state interventions (regulation, innovation policies) or by influential non-governmental organizations (NGOs). The result is an impression of the social positioning of biotechnology, how this differs between continents and countries, and how this is changing over time. It may show clear trends, which can be used to define future policies.

In 2006, COGEM asked TNO Netherlands to develop scenarios as a basis for exploration of future biotechnology developments and its social context. Assuming that biotechnology development is driven by a) technological opportunities and b) social culture, TNO developed four scenarios based on a technology and a society axis (see Annex I). Next, the COGEM assumed that news articles give a good impression of the forces that drive biotechnological development and policies. In 2007, a pilot study was done to explore several methods to rate more than 3,460 news articles collected between July 2005 and July 2006 on the two axis of the TNO scenarios. This resulted in a relatively straight-forward 'actor method' that first checks whether an article reports about a well-defined activity and whose interest this activity serves. Activities that serve the interests of companies are put in the *Tech World* scenario, which is characterized by a private interest oriented society and a dominant role of technology (technology-push). Activities that serve the (supra-)national interest are put in the *National*

*Champions* scenario, also characterized by a technology-push and a public interest oriented society. Activities that serve the interest of citizens are put in the *Techno Consumer* scenario, which is characterized by a private interest oriented society and technology based on the social needs (technology-pull). And finally, activities that serve the NGO interest are put in the *Network Society* scenario, which is characterized by a public interest oriented society and technology-pull (see Annex II). By assigning a quantitative rating to the position on the axis for each article (from -1 to +1) average ratings can be calculated and plotted on the two axis like in figure 1. Average ratings can be calculated and plotted for countries, continents, different types of biotechnology and over time, resulting in a visualization of the positioning of biotechnology.

**Figure 1: The rating of activities on a technology axis (vertical) and a society axis (horizontal)**



In addition, information about geography and the type of biotechnology is attached to each article, as well as keywords that provide information about specific applications or issues, such as field trials with genetically modified crops, moratoria, stem cell and cancer research, gene therapy, labelling and bio-fuels. Provided that sufficient numbers of rated articles are available, these indicators and ratings allowed quantitative analysis pinpointing shifts in positioning over time, geographical differences and differences between types of biotechnology.

### 1.3 Questions studied

This methodology was applied to an additional 19,250 news articles collected between July 2006 and July 2010 and used to see how biotechnology was positioned in media reporting and how this has evolved over a period of five years.

Although we expected to find a relatively high level of technology dominance because of the focus on biotechnology, we wanted to know how this dominance evolved over time. We also wanted to know what type of interests the media tend to focus on: is it the public / collective interests represented by governments and NGOs or rather the private / individual interests of companies and individual citizens/consumers that prevail?

In the second place, we wanted to learn about differences in geographical positioning of biotechnology in the media. Is the difference between Europe and North America (dominated by the United States) as big as it is usually suggested? Is Asia closer to Europe, in terms of public debate and media reporting, or to North America? What about Latin America, Africa and Oceania? From the Eurobarometer surveys we also learned that there is important differences in public appreciation of biotechnology<sup>3</sup>. How do we see those differences reflected in the way the media report about biotechnology events in different countries? How does the positioning of those countries relate to the US positioning? What about the large emerging economies in China, India and Brazil?

A third question concerned patterns over time. How does the positioning of biotechnology develop in different continents and countries over time? Is there a pattern, maybe even a consistent trend that would allow for predictions?

Since this could have consequences for global biotechnology policies, it is interesting to see whether the geographical patterns for biotechnology in general appear in the same manner when we split the data in different types of biotechnology: agricultural, medical and industrial. Do Europe and North America differ in the same way for medical and agricultural biotechnology or is there a difference?

Finally, we wanted to find out about dominant issues in the biotechnology debate. How have these issues evolved, and what was their impact on the positioning of biotechnology? What impact can a single issue have on the public debate in a specific continent or country?

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<sup>3</sup> See LIS Consult (2005). Hoe Europeanen denken over biotechnologie en genetisch gemodificeerd voedsel in 2005, <http://www.lisconsult.nl/images/stories/Downloads/samenvatting%20eurobarometer%202005%20-%20gm%20voedsel.pdf>

## 2 Results

Presented here are the major results of interest for policy makers. It concerns:

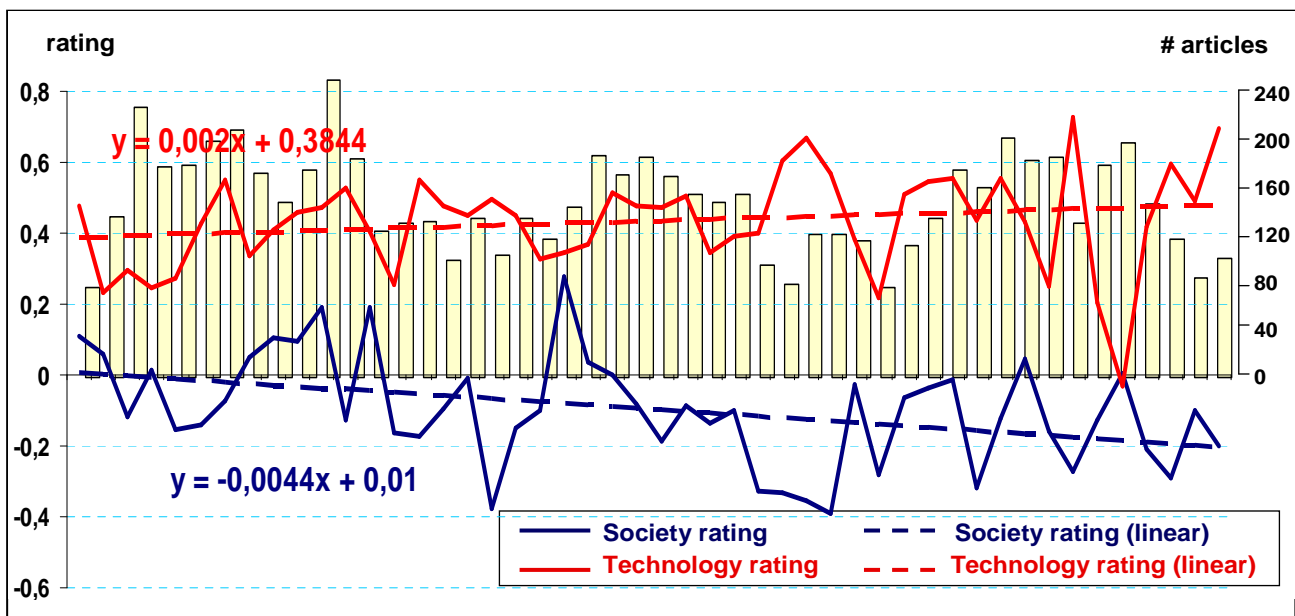
1. the trend in the world-wide positioning of biotechnology between July 2005 and July 2010,
2. the positioning of continents and industrialized and developing countries between July 2006 and July 2010,
3. the shifts in positioning of continents between July 2006 and July 2010,
4. the shifts in positioning of a number of European countries, the U.S., China and India between July 2006 and July 2010,
5. the positioning of medical, agricultural and industrial biotechnology in 2009/2010 and changes since 2006/2007,
6. the rating and positioning of a number of biotechnology issues.

### 2.1 Trend in world-wide positioning: Stable technology-push, increasing private interests

Before starting an analysis of the geographical differences in positioning of biotechnology it is useful to have in mind what the general baseline looks like. Where does biotechnology in general stand, world-wide? What type of interests prevail in the news: public or private interests? Is the news dominated by technology push, or is the technology put in a context of societal demands? And is there a general trend?

Figure 2, below, shows the fluctuation in average monthly ratings for all types of biotechnology, world-wide<sup>4</sup>. Statistical analysis has been used to calculate a linear trendline.

**Figure 2: The number of articles rated and the monthly average rating of technology push and social public vs private related events on biotechnology world-wide (July 2006 – July 2010)**



<sup>4</sup> Analysis of monthly average ratings between July 2005 and July 2010 resulted in a very unstable pattern during the first year (see Annex 1), which is probably due to a systematic different approach in rating and a relatively low number of rated articles during the pilot study of the first year. For this reason, it was decided that inclusion of the results of the first year would produce a false baseline, and analysis was limited to the four following years.

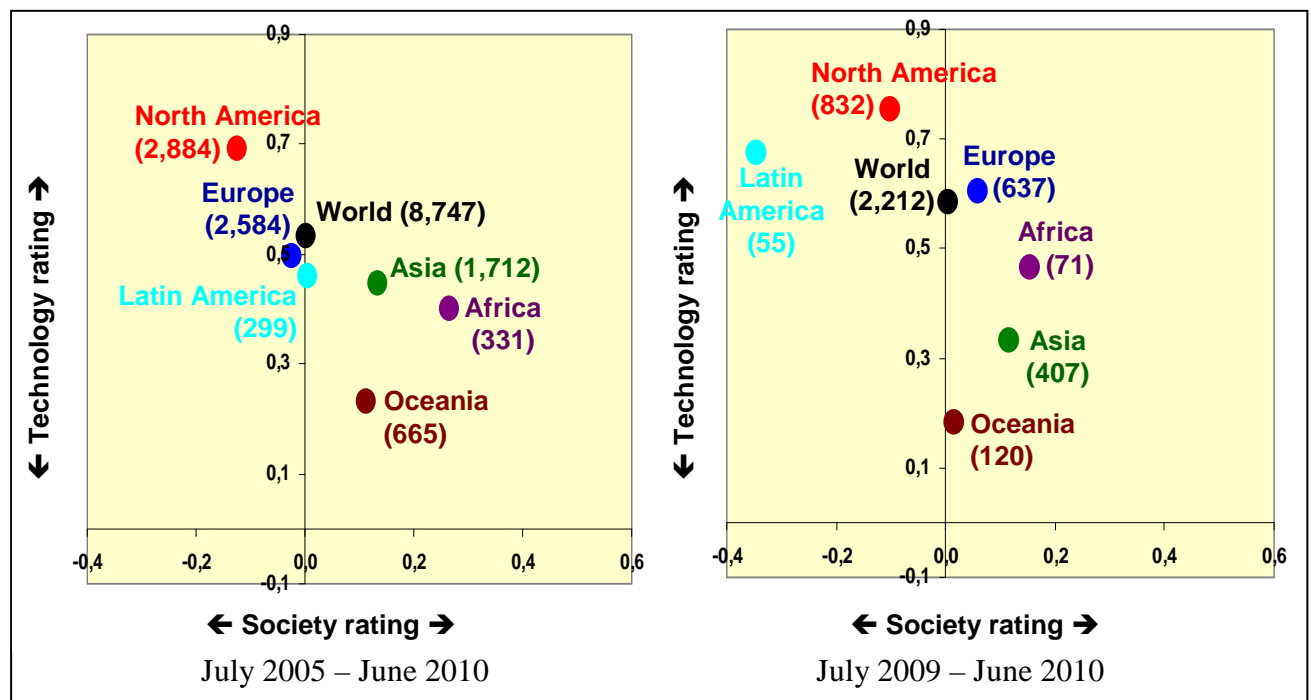
As we can see now, world-wide, on average the news about biotechnology is clearly dominated by technology-push oriented events. Over time, this dominance of technology has even become slightly stronger. At the start, mid 2006, private and public interests (the society rating) were more or less balanced, but shifted considerably in the direction of private interests (i.e. a lower society rating). Additional calculations in which the number of rated articles per month was included in a weighted rating (Weighted Rating = Rating \* Number of articles) resulted in a similar pattern: A more or less stable level of technology orientation (a very slight decrease) and an almost similar increase of private interests.

## 2.2 Geographical differences in positioning

More detailed analysis of geographical differences in positioning has been done for the average ratings of five years. A separate analysis of the 2009/2010 period gives an impression of the most recent situation. The result for the continents are presented in the two graphics below (Figure 3), with the technology rating on the vertical axis and the society rating on the horizontal axis. These graphics demonstrate that:

- the level of technology-push in North American biotechnology is higher than anywhere else in the world. Also, private interests are most dominant in North America, reflecting the advanced commercial climate for biotechnology in the United States and Canada;
- the news about European biotechnology is less dominated by the technological opportunities and inclines more towards a balance between public and private interests;
- although in 2009/2010 private interests in Latin America were far more dominant than in Europe, the five year average shows similar positioning of biotechnology in both continents. Latin America's shift towards more technology dominance and private interests (i.e. company's interests) is not surprising because of the dominant role of Argentina and Brasil in Latin America, two countries that cultivate GM crops on a large scale;

**Figure 3: The positioning of continents in biotechnology: overall average (July 2005-June 2010) and most recent results (July 2009 – June 2010, number of articles between brackets)**



- on average, in Asian news the technology dominance is at about the same level as in European news, but national interests are far more dominant. The news from this continent is dominated by China and India, both countries with a tradition of strong government interference. The considerably lower rating on the technology scale in 2009/2010 is most probably caused by the extensive debate about the authorisation of Bt egg-plant (brinjal) in India,
- most of the news articles about African biotechnology are about agricultural biotechnology. Since agriculture and food production is generally considered a public interest in this part of the world, African biotechnology rates higher on the public interest scale than any other continent,
- the positioning of biotechnology in Oceania is strongly influenced by the relative high number of articles on agricultural biotechnology and an ongoing debate in Australia about regional bans on GM crops.

### **Europe between Asia and North America**

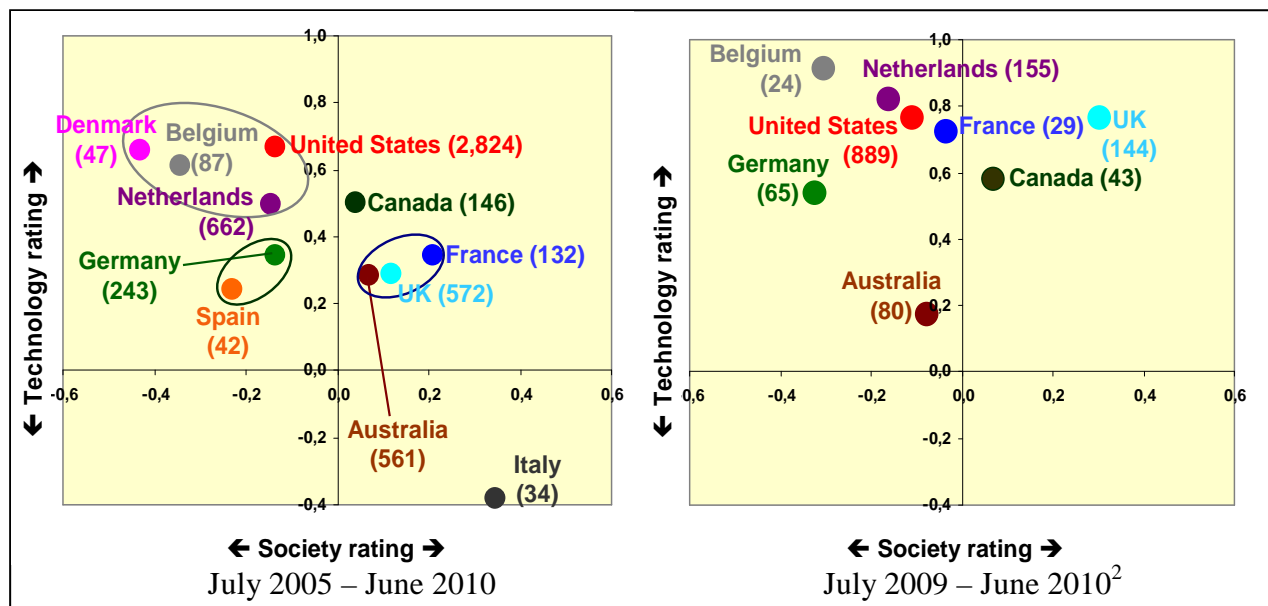
Often, a big difference between the US and Europe concerning the role and positioning of biotechnology in society is suggested. Our analysis confirms the existence of such a difference between the two continents. Articles about North America (and, more recently, Latin America) tend to focus more on company interests and the possibilities of the technology. Europe is positioned halfway North America and Asia, with Asian news tending to focus more on national or collective interests.

Of course, there are regional differences within the continents because of cultural diversity, especially within Europe and Asia. More detailed analysis resulted in the two graphics below, which reveals geographical differences at the level of countries. We analyzed both the five-year average and the most recent situation (2009/2010)<sup>5</sup>.

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<sup>5</sup> Denmark, Italy and Spain are not represented in the 2009-2010 graphic because the number of rated articles was less than 15.

**Figure 4: The positioning of industrialized countries in biotechnology: overall average (July 2005-June 2010) and most recent results (July 2009 – June 2010, number of articles between brackets)**



These graphics show that we can distinguish:

- A high-tech block (technology ratings consistently  $>0.5$ ) of four countries where private interests prevail with the United States and three smaller European countries: Denmark, Belgium and the Netherlands;
- Two countries with relatively low technology dominance that tend towards private interests: Spain, and –surprisingly- Germany;
- A block with countries with relatively low technology dominance that tend towards public/national interests: The UK, France and Australia. The news in those countries frequently deals with NGO protests against GMOs and government’s response to those protests;
- Canada, where public and private interests are more or less balanced and technology is relatively dominant;
- Italy: The tiny bits of news about Italy that were collected mainly concerned protest against GMOs.

#### Europe: small NW European countries more pro-Atlantic than others

The data suggest that the Netherlands (and to a certain extent Belgium and Denmark, but the number of rated articles is too low for solid conclusions) have a more pro-Atlantic positioning, close to Canada and the United States, than France and -quite surprising- the United Kingdom. The United Kingdom, that is well represented in the database and France rate considerably higher on collective interests, which is probably due to the ongoing debate in the British media, and the French policy that is traditionally oriented on national interests.

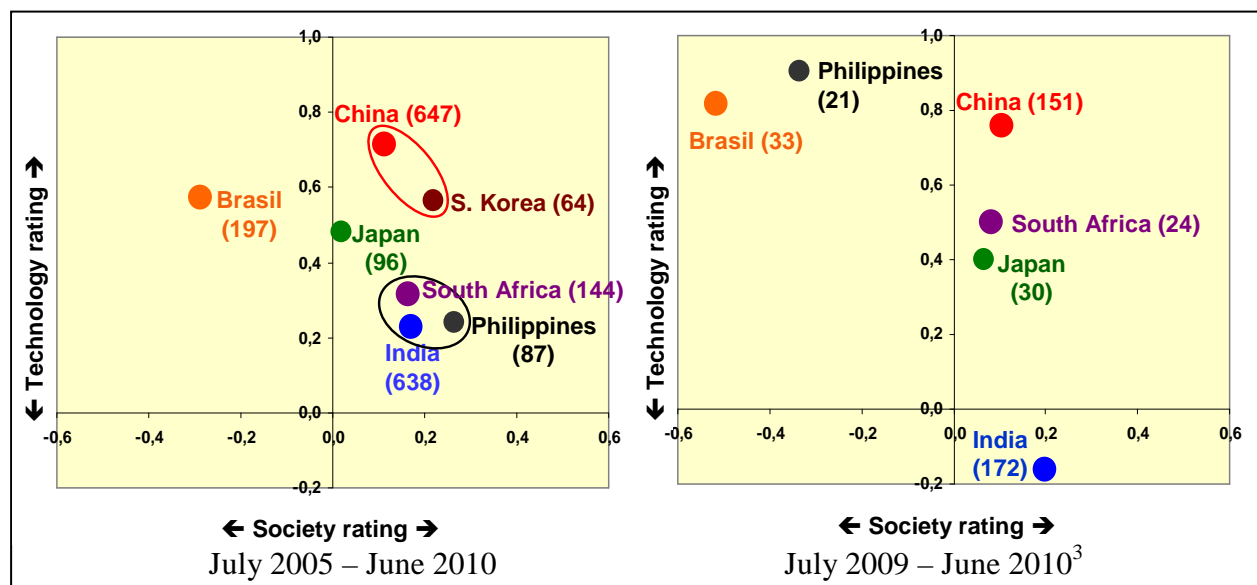
These results can be interpreted in two ways. At first glance, The Netherlands seems the ideal country for bridging cross-Atlantic differences in biotechnology policies. On the other hand, the country risks to be valued too pro-Atlantic by other, much larger member states that have significant influence on political decisions on the EU level.

Although the number of rated articles is low (19 over three years), we also mention Italy, with a majority of reported events that focus on NGO interests.

A similar analysis made for a number of countries in Asia, South Africa and Brasil resulted in the graphics in Figure 5. Here, we can distinguish the following blocks:

- F. Brasil is the only ‘developing’ country where the biotechnology events in the news tend to focus on industry interests concerning cultivation of GM crops and biobased fuels. This country actually belongs to the high-tech block of industrialized countries and is positioned close to the United States and the Netherlands. In 2009/2010, the country’s positioning has even further shifted in the direction of companies’ interests;
- G. A high-tech block (technology ratings consistently >0.5) with China and South Korea, where public interests prevail (strong government interference). China’s biotechnology news is even more dominated by technology than the biotechnology news about the U.S.;
- H. A block of relatively low-level technology dominance (average technology ratings between 0.2 and 0.4) and predominantly public interests: India, South Africa and the Philippines. The news about biotechnology in these countries is more dominated by social debate, criticism by NGOs and farmers’ resistance against GM crops. In 2009/2010, however, the biotechnology news in the Philippines was dominated by a number of introductions of GM crops, which explains the sudden shift of the country’s positioning. Meanwhile, the positioning of biotechnology in India shifted in the opposite direction due to extensive protests against the introduction of Bt egg-plant;
- I. Japan’s biotechnology positioning is similar to that of Canada: technology is moderately dominant and public and private interests are more or less balanced.

**Figure 5: The positioning of Asian countries, Brasil and South Africa in biotechnology: overall average (July 2005-June 2010) and most recent results (July 2009 – June 2010, number of articles between brackets)**



The positioning of South Africa is similar to that of Australia, the UK and France.<sup>6</sup>

<sup>6</sup> South Korea is not represented in the 2009/2010 presentation because the number of rated articles was lower than 15.

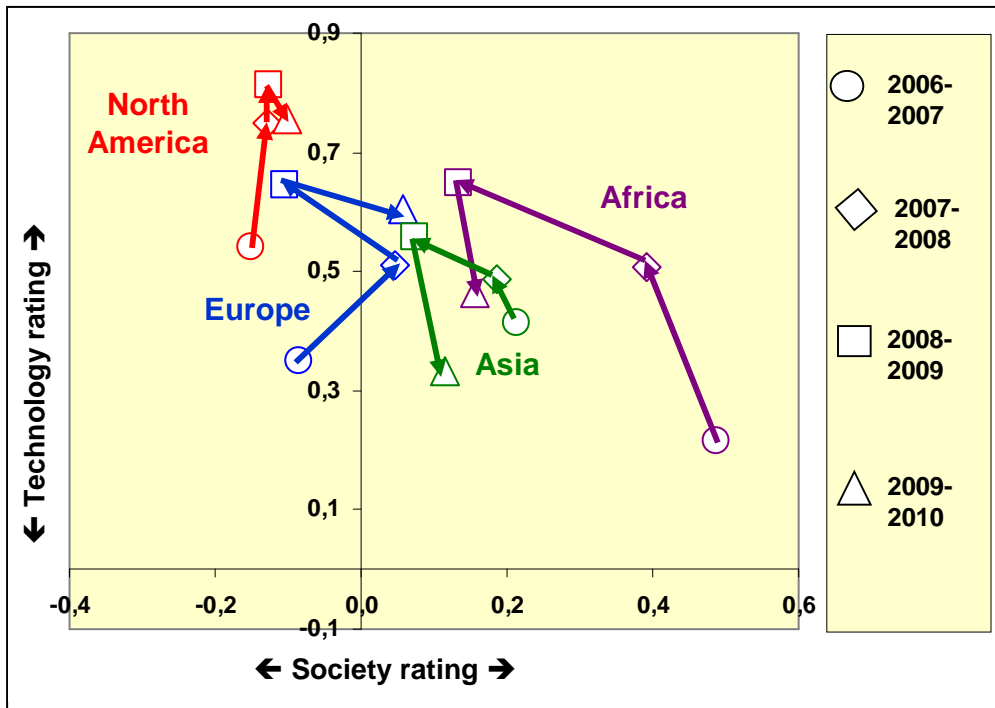


### 2.3 Shifts in positioning of continents and countries (2006-2010)

In the graphic below we have plotted the average positioning of four continents for four subsequent years<sup>7</sup>. We added arrows to indicate the shift from one year's positioning to another.

The global positioning of biotechnology articles is shifting towards more focus on technology-driven developments, maintaining at a stable and moderate level of technology orientation during the last two years. Public and private interests were more or less balanced during the whole period of four years. Although we should be careful to draw conclusions, after four years this seems a consequent trend. But if we look at different continents, we see shifts in different directions.

Figure 6: Shifting positioning of four continents in biotechnology (July 2006 – June 2010)



#### Continents moving to similar positions, then drifting apart again

Analysis of biotechnology related news articles over four years indicates that the positioning of Asia, Africa, Europe and North America show different patterns. During the first three years, technology domination increased in all cases. Because Asian and African news shifted considerably from public to private interests, the continents seemed to move in the direction of similar positions.

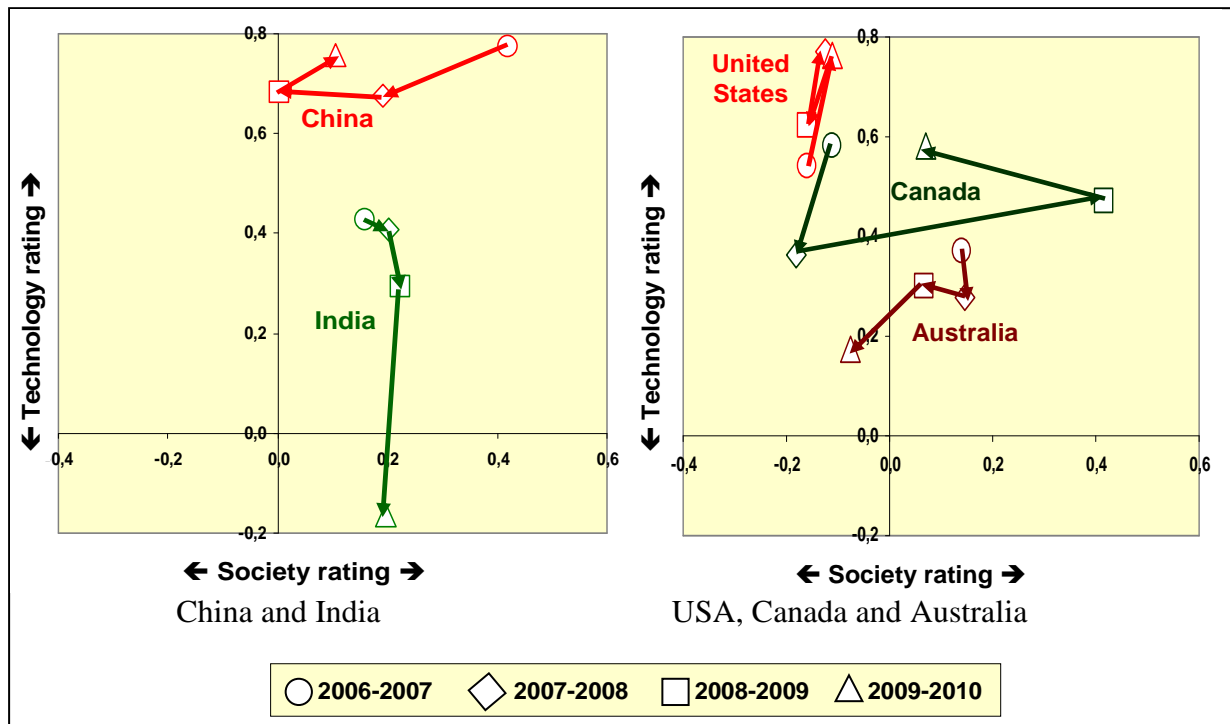
This pattern changed all of a sudden during the last year. Technology dominance decreased, only slightly in North America and Europe, but strongly in Africa and Asia. At the same time, the focus of the news shifted slightly in the direction of public interests, only slightly in North America, Asia and Africa, but strongly in Europe. Thus, the four continents seem to drift apart again.

There is a striking similarity of patterns between Asia and Africa, where an initial upward shift towards company interests was followed by a radical shift in the direction of NGO interests, due to increasing protests against the introduction of GM crops in India and South Africa.

<sup>7</sup> We did not include the data of the pilot year 2005-2006 because of methodological differences in rating.

The same kind of analysis has been made for individual countries. Again, there is no unidirectional development: the country's positioning shift in very different directions. Except for Japan, for which the number of data is actually too low for reliable analysis, and the United Kingdom (see Figure 8), the positioning of all selected countries is not following a solid trend (a shift in direction of the arrows).

**Figure 7: Shifting positioning of countries in biotechnology** (July 2006 – June 2010, number of articles between brackets)



The graphic on the right presents the shift in average annual ratings of the United States, Canada and Australia. Where the United States and Canada seemed to share more or less similar positions during the first year, the two countries drifted apart in the two following years due to increasing debate about the environmental, agronomic and economic impact of GM crops (emergence of herbicide tolerant weeds and the impact of the introduction of GM wheat on the country's trade position) in Canada. In the final year of our analysis Canada shifted back in the direction of its original position.

### Technology push in China, protests in India

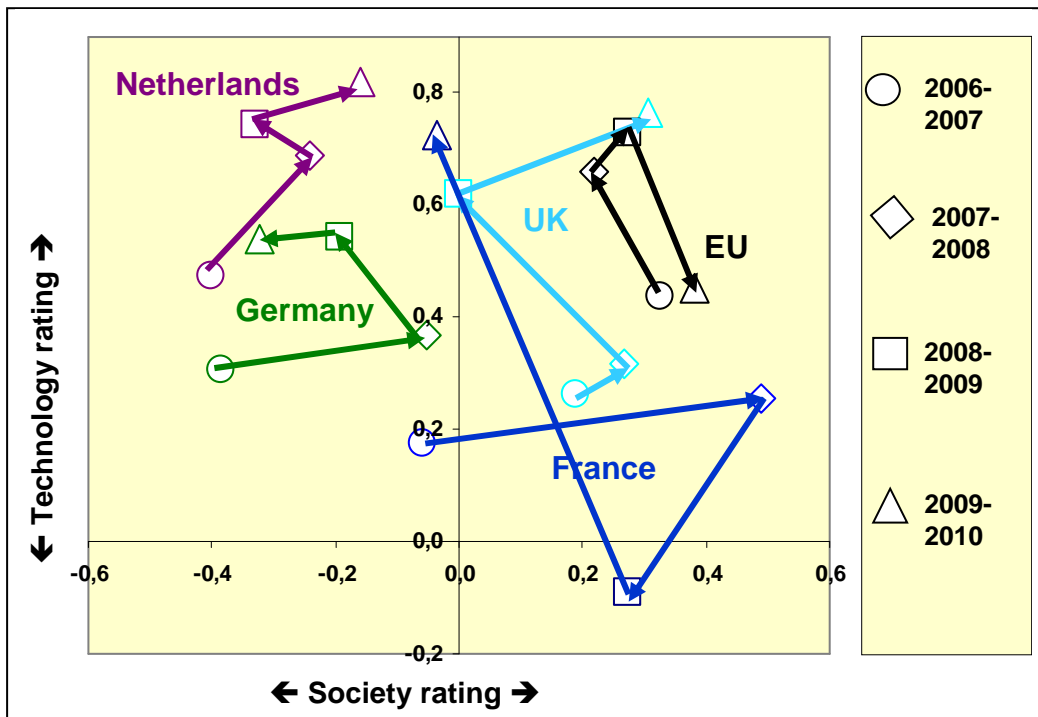
China's positioning is characterized by a constant high level of technology orientation. The country's biotechnology positioning shifted radically from a strong orientation on public interests to private interests between July 2006 and July 2009, reflecting decreasing government interference and increasing opportunities for (semi-) commercial activities. This was followed by a slight change in the direction of public interests in 2009/2010, seemingly the result of governmental policies meant to secure national interests. There is a remarkable difference in pattern with the other big Asian economy: India. While adoption of GM Bt cotton by Indian farmers has increased to about 90% of the total cotton acreage in 2010, the Indian biotechnology news has become more and more dominated by protests against cultivation of GM crops, reaching its climax with massive protests against market authorization of Bt egg-plant in spring 2010.

**Australia: drought and moratoria**

The news in Australia has been strongly dominated by debates about moratoria on GMO cultivation versus the relevance of GM (drought resistant) crops for Australian agriculture. This is most probably what caused the shift of Australia's positioning away from technology dominance. In recent years, several states started relaxing their moratoria, resulting in a shift towards more private interest oriented news articles.

The graphic below, presenting the results for a number of European countries, shows a very mixed picture. The only country with a more or less consistent trend is the Netherlands: the media reporting has gradually become more technology and public interest oriented. This brings the Netherlands even closer to the positioning of the United States. A similar pattern was found for the UK, with more focus on public interests. The shift in rating of articles about biotechnology activities in France reflects an increase in the acreage of commercially grown GM crops until 2008 and the political debate about GM crop cultivation that followed, resulting in a ban on GM maize in 2008. After shifting towards a higher level of technology orientation for two subsequent years, the media reporting about biotechnology at the EU level returned to its original position in 2009/2010.

**Figure 8: Shifting positioning of four European countries and the EU in biotechnology (July 2005 – July 2010)**



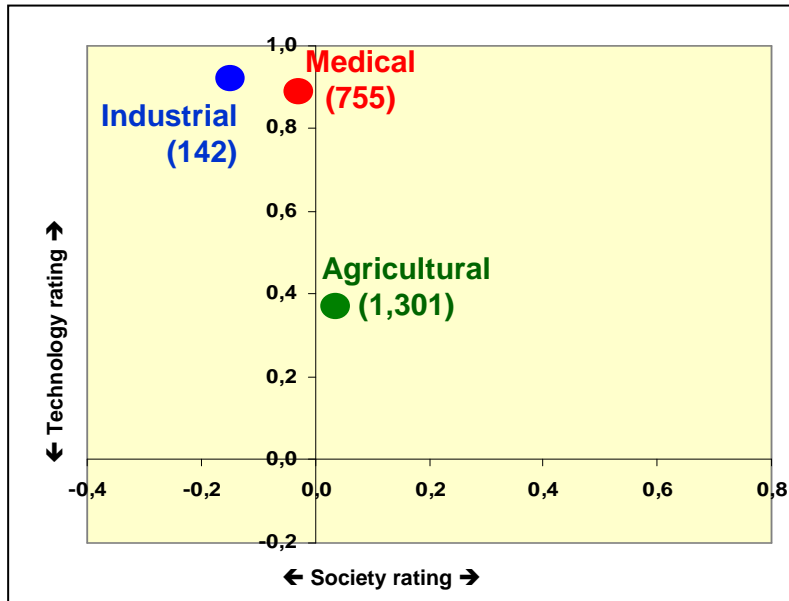
**EU: regulatory issues and de-facto moratorium**

Initially, the shift in the EU's positioning seemed the result of the increasing efforts of the European Commission to lift the de-facto moratorium on GM crops, having an upward effect on the EU's Technology rating. This was followed by an almost equal downward effect in 2009/2010, caused by the debate about the inclusion of socio-economic aspects in national licensing for growing crops admitted in the EU.

The shift of Germany's positioning is difficult to explain because of the limited number of available data. Most probably, the cause of the first shift towards public interests is increasing debate about approvals for GM crop cultivation in Germany, which finally resulted in a political statement by the German minister of Agriculture in favour of a ban on GM maize in 2009.

## 2.4 The positioning of medical, agricultural and industrial biotechnology

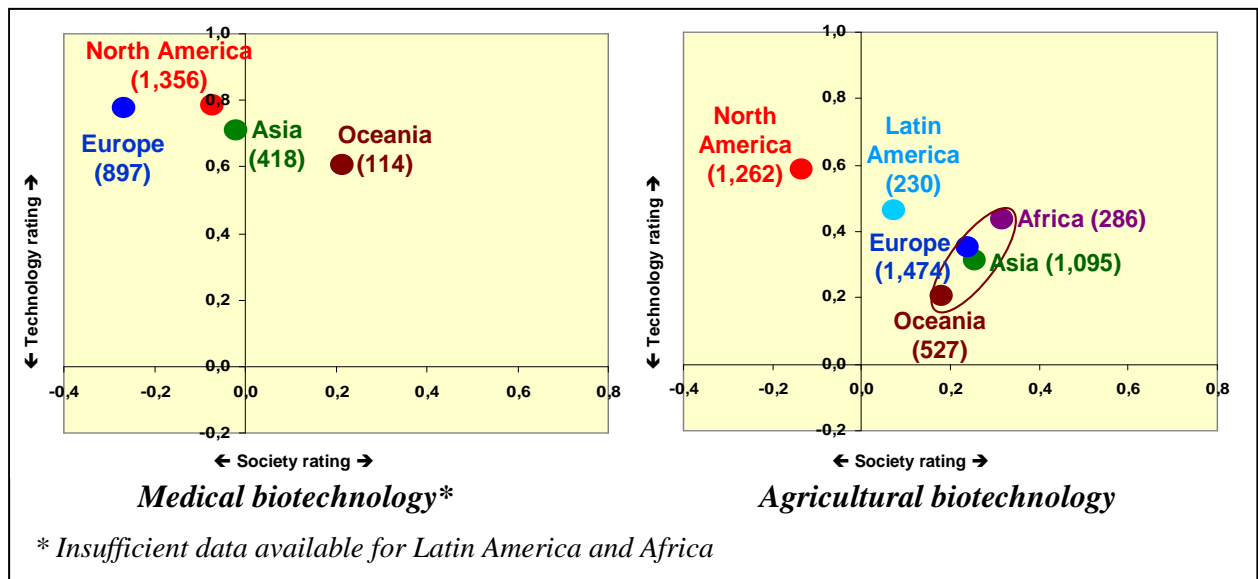
**Figure 9:** *The positioning of medical, agricultural and industrial biotechnology (July 2009 – June 2010, number of articles between brackets)*



So far, controversies about biotechnology usually concerned testing and cultivation of GM crops and other developments in agricultural biotechnology. This is what we see reflected in the most recent positioning (2009/2010) of this type of biotechnology compared with medical and industrial biotechnology. Articles about agricultural biotechnology rate substantially lower on the Technology axis and tend to focus more on public interests. Company interests are less

dominant than in articles about medical and industrial biotechnology.

**Figure 10:** *The positioning of medical and agricultural biotechnology by continent (number of articles between brackets)*



The two graphics presented in figure 10 show the rating of the different continents for medical and agricultural biotechnology<sup>8</sup>. Noteworthy is the positioning of medical biotechnology in Europe, where the articles tend to focus more on company interests than in North America. In the Asian articles the focus on interests is more balanced than in Europe and North America: public and private interest are equally represented. Articles about medical biotechnology in Oceania tend to focus less on the technological possibilities and are more oriented on national interests than articles about the other three continents.

#### **Medical biotechnology in Europe: less attention in the media, more focused on company interests**

The share of medical biotechnology articles in Europe is a little above the world-wide average, and Asia is just below. Medical biotechnology gets relatively little attention in Oceania and Latin America, and in Africa there is only fourteen articles in five years;

In Europe the difference in positioning of agricultural and medical biotechnology is enormous. While the focus of articles about European medical biotechnology on private/company interests is even stronger than in North America, articles about agricultural biotechnology are characterized by significantly more focus on public interests and less focus on technological possibilities.

#### **Little distinction between agricultural and medical biotechnology in North America**

The results demonstrate that globally, medical and industrial biotechnology are positioned more or less the same. The news about agricultural biotechnology is considerably more focused on public issues and less on the possibilities/opportunities of the technology. Government/national interests are clearly more dominant in agricultural biotechnology. On the level of individual continents the picture is quite different, especially for North America, where the distinction between news reporting on medical and agricultural is minimal, although there is slightly more technology dominance in medical biotechnology).

#### **The Asian/European block in agricultural biotechnology**

Concerning the positioning of agricultural biotechnology there seems to be a block of two continents that rate more or less similar: Europe and Asia, flanked by Oceania on the one side and Africa on the other. While Africa is positioned on the public interests side of this block. North America is positioned on the private interests side of this block, also being more technology-driven, and Latin America is positioned close to North America.

## **2.5 The rating of biotechnology issues**

### **Issues**

To a certain extent, further analysis of specific issues provides an explanation for differences in positioning of biotechnology in the continents and for the shifts in positioning over time. During a short brainstorm with the students responsible for uploading the articles in the database the

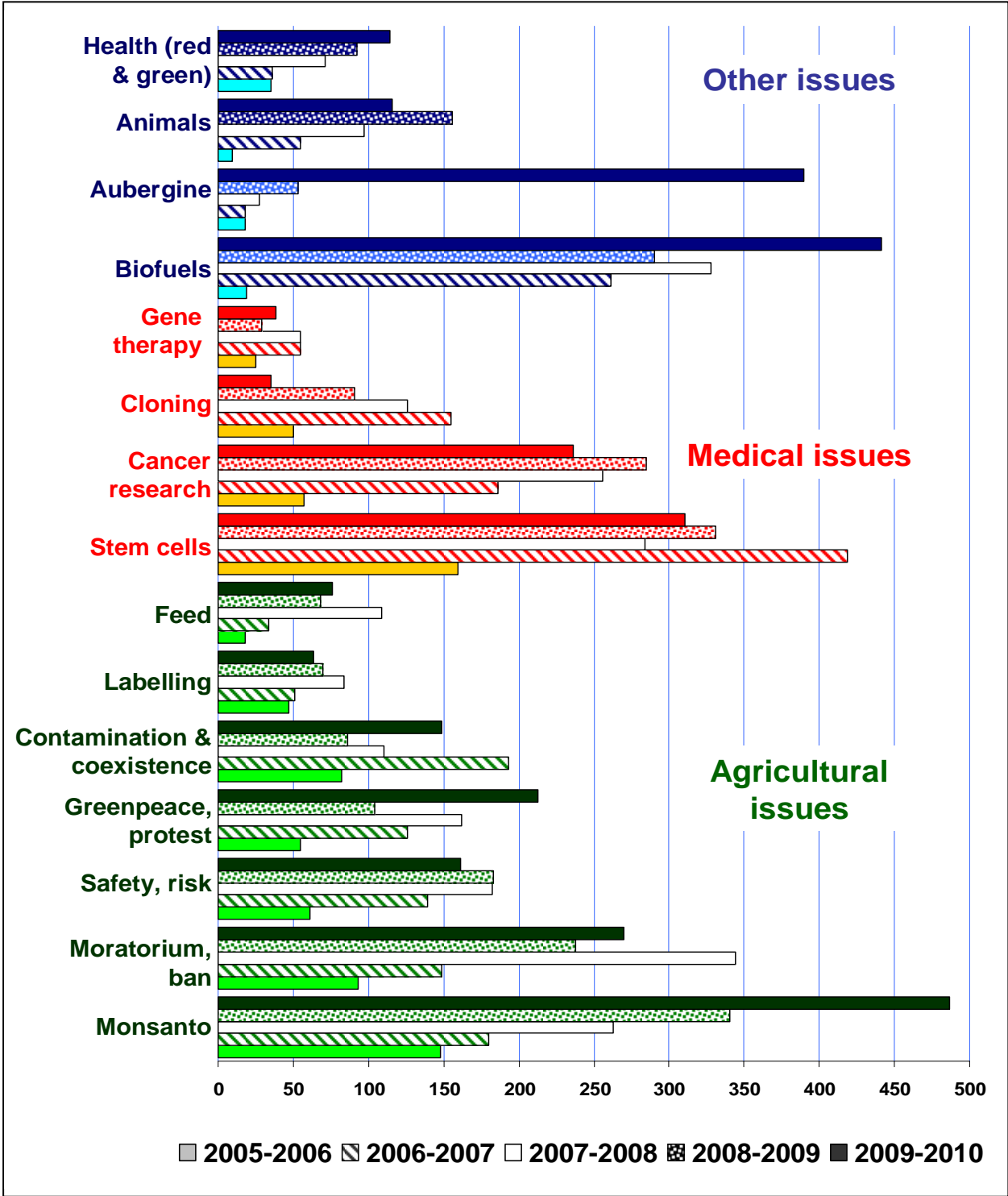
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<sup>8</sup> Latin America and Africa are not presented in the medical biotechnology graphic because of the low number of rated articles. For similar reasons split ratings for industrial biotechnology are not presented. In order to have sufficient data to present as many continents as possible the graphics in Figure 9 are based on average ratings of July 2005 – July 2008.

following list of potentially relevant issues, well divided over the three types of biotechnology – agricultural, medical and industrial- was selected (between brackets is the number of articles collected between July 2005 and July 2010):

- Agricultural biotechnology:
  - Monsanto (1, 418 articles);
  - Moratorium or ban on/of GMOs (1,094 articles);
  - Safety and risks of GMOs (726 articles);
  - Greenpeace activities and protests (660 articles).

Figure 11: Number of articles about 15 biotechnology issues (July 2005 –July 2010)



- Contamination (the presence of GMOs (traces) in non GMO commodities) and coexistence (620 articles);
- Labelling (315 articles);
- Feed (305 articles).
- Medical (and animal) biotechnology:
  - stem cell research and policy (1,505 articles);
  - cancer research (1,020 articles);
  - cloning (457 articles);
  - gene therapy (202 articles).
- Other issues:
  - Biofuels (1,339 articles);
  - Animal biotechnology (260 articles);
  - Health in agricultural and medical biotechnology (348 articles);
  - Aubergine (in India) (506 articles).

### Evolution of the issues

The way the issues evolved over time in terms of the amount of attention in the media is presented in figure 11, which demonstrates that media attention focuses in particular on three types of issues:

1. what we might call '*hypes*': Issues with a temporary character that seem to fade away after reaching a clear peak. That applies to cloning (the 'Hwang affair' in Korea reached its peak in 2007), animal biotechnology, and gene therapy, although the latter seems to regain a bit of attention in 2009/2010;
2. a few *emerging issues*: Issues that started off with little attention from the media and became a big issue as time evolved. This is clearly the case for anything that has to do with Monsanto<sup>9</sup>, biofuels and GM aubergine in India, an issue that attracted a lot of attention from the media in 2010, and, to a certain extent, for health related issues. Any of these issues may appear to be a hype at a later stage;
3. *ongoing issues*: Issues that attract a variable amount of attention in the media but that do not seem to disappear from the agenda, which seems to be the case for all selected agricultural biotechnology issues and the two major medical issues: stem cell policy and research and cancer research.

### Impact of the issues

The impact of these issues on the positioning of biotechnology has been analysed in three steps:

1. Positioning of the issues and comparison with the positioning of medical, agricultural and industrial biotechnology in general. This way we established the nature of their impact on each type of biotechnology;
2. Analysis of the significance of the issues in terms of their share in the total number of reported events in medical, agricultural and industrial biotechnology;
3. Establishing the location of the impact of the issues by means of analysis of the regional distribution of the issues.

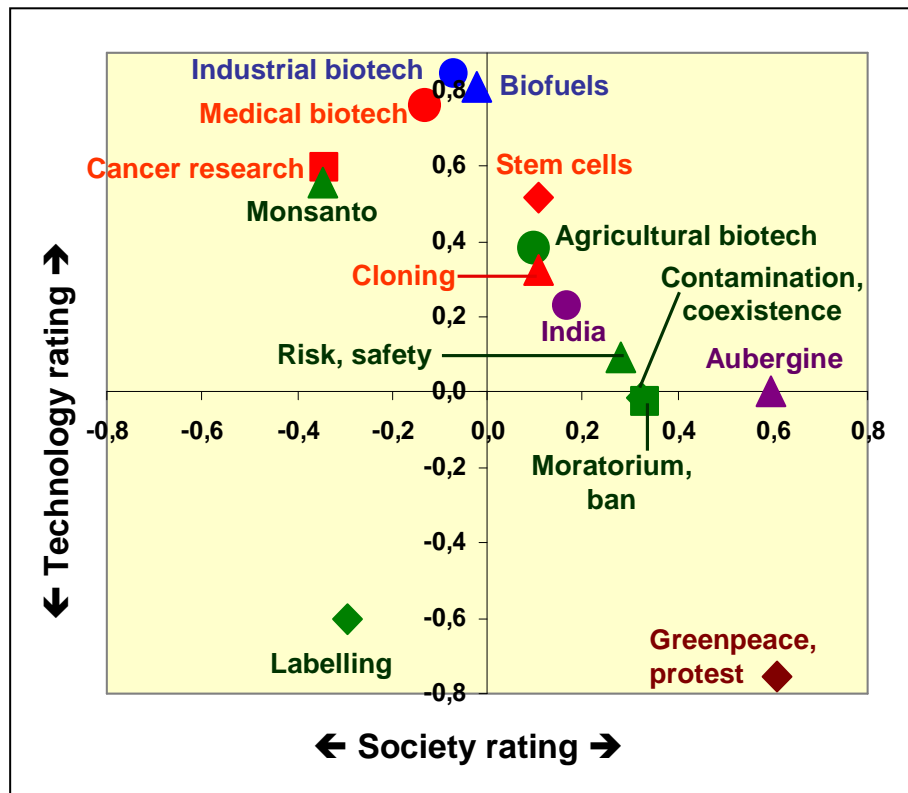
In the first step the rating of each of the issues has been calculated and compared with the total rating. The selected issues are plotted in the graphic in figure 12. The colours show how each

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<sup>9</sup> 'Monsanto' is a kind of 'trademark' or 'icon' for any kind of news about commercial activities that attract attention from the media, both in negative and positive terms. Monsanto (1,426 articles) was also chosen because the company beat competitors such as Pioneer (317), Syngenta (229), Bayer (257), BASF (275), DOW (99), KWS and Limagrain (both 9 articles) in terms of the number of articles.

issue relates to the average positioning of industrial (blue), medical (red) and agricultural (green) biotechnology.

**Figure 12: Positioning of ten issues related to medical (red), agricultural (green) and industrial (blue) biotechnology (July 2006 – July 2010)**



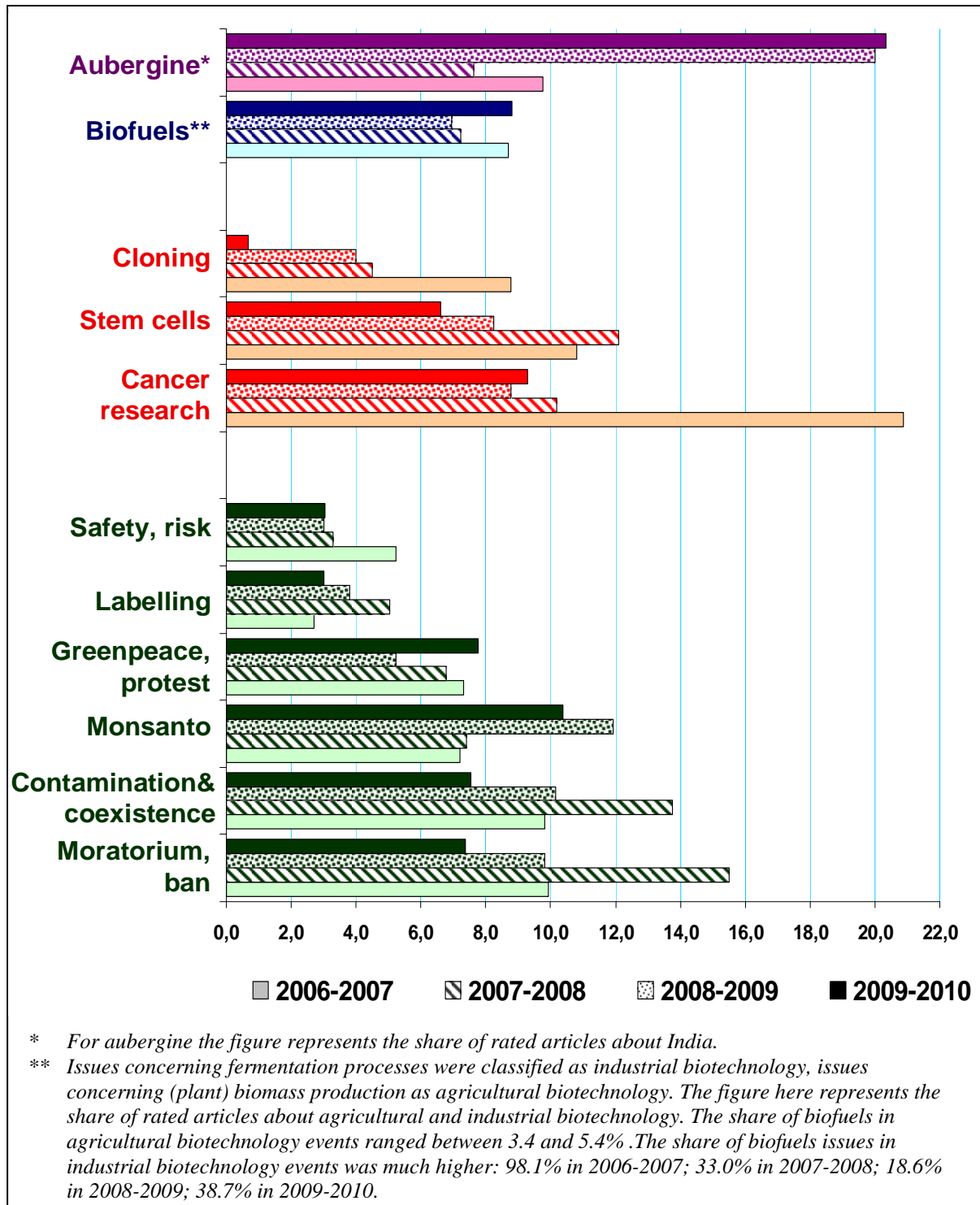
Now we can establish that:

1. The rating of the *biofuels* issue is very close to the total rating of industrial biotechnology. This is not surprising, given the high share of biofuels related events in all industrial biotechnology events: almost 40%;
2. The *stem cell* issue, and to some lesser extent the cloning issue, pulls the positioning of medical biotechnology towards collective interests, especially in North America. A closer look into the articles about stem cells tells us that this is due to the debate about the restrictive US national policy about stem cell research under the Bush administration;
3. The articles about *moratoria or bans* on GM crops, *contamination and coexistence* are often about NGO protests or lobbies, which causes a negative effect on the rating of agricultural biotechnology on the technology-axis, especially in Oceania (Australia) and Europe. Of course, events that are related to *Monsanto* (i.e. agricultural biotechnology business) tend to pull the rating of agricultural biotechnology in the direction of private/ commercial interests. It is also predictable that *labelling* events tend to pull the rating of agricultural biotechnology in the direction of citizens interests.

In the second step we determined the significance of the positioning of each of the issues the share of the rated articles in the total number of rated articles in agricultural, medical and industrial biotechnology is used as a parameter for the impact of news articles about specific issues on the total rating ( $\text{Share} = \frac{\# \text{ rated articles per issue}}{\# \text{ rated articles per type of biotechnology}}$ ). The issues concerning feed, gene therapy, animals, and health are not included in this report because their share was always lower than 5 percent. This resulted in the graphic below (Figure 13).



Figure 13: The share of ten biotechnology issues (July 2006 –July 2010)



The results show that:

1. The share of the *medical issues* in medical biotechnology events has declined significantly in all cases. In 2006/2007 stem cell issues, cloning and cancer research accounted for more than 40% of the rated articles about medical biotechnology. Their share sunk to 16.6% in 2009/2010 and was taken over by a wide range of other issues;
2. *Safety and risk* issues have become less significant in the media reporting about agricultural biotechnology. Their share decreased from a little more than 5% in 2006/2007 to a steady 3% in 2008/2010;

3. *Greenpeace* activities and other forms of *protest* seems like a permanent issue in the media reporting about agricultural biotechnology. Apart from 2008/2009, the share of *Greenpeace* activities and other types of protest in agricultural biotechnology events was more or less stable at about 7.4%;
4. What seems like a peak of *Monsanto* related events reported by the media in 2008/2009 is actually concentrated in 2009. It is not yet clear whether this company's significance in the news is on the decline or it is going to remain at a relatively high level;
5. The significance of the *other agricultural biotechnology issues* –moratorium/ban, contamination & coexistence and labelling- clearly reached a peak in 2007/2008, to become (far) less significant in 2009/2010.

In the final step, the distribution of the issues over the continents is further analysed. The results, presented in table 1, show us that:

1. North American events are dominant in the *medical issues* (stem cells, cancer research and cloning) and in events related to biofuels. Due to the restrictive stem cell policy of the Bush administration, for instance, this issue has been far more frequently discussed in the US than in Europe;

**Table 1: Distribution of nine biotechnology issues over the continents**  
(July 2006 –July 2010; in %, dominant continents in bold)

| Issues                      | Continents |             |             |               |               |             |                     | Nr. of rated articles |
|-----------------------------|------------|-------------|-------------|---------------|---------------|-------------|---------------------|-----------------------|
|                             | Africa     | Asia        | Europe      | Latin America | North America | Oceania     | Not region specific |                       |
| Stem cells                  | 0,0        | 15,4        | 23,3        | 1,4           | <b>53,1</b>   | 4,9         | 1,8                 | 493                   |
| Cancer research             | 0,0        | 10,4        | 31,0        | 0,7           | <b>51,9</b>   | 3,4         | 2,6                 | 475                   |
| Cloning                     | 0,0        | 20,8        | 19,2        | 0,0           | <b>41,5</b>   | 14,6        | 3,8                 | 388                   |
| Contamination & coexistence | 2,4        | 15,6        | <b>32,4</b> | 4,0           | <b>26,8</b>   | 14,0        | 4,8                 | 309                   |
| Moratorium, ban             | 5,1        | 17,1        | <b>28,4</b> | 2,9           | 17,3          | <b>25,3</b> | 4,0                 | 268                   |
| Labelling                   | 3,8        | 21,4        | <b>30,8</b> | 1,1           | <b>25,8</b>   | 14,3        | 2,7                 | 250                   |
| Safety, risk                | 10,0       | <b>32,5</b> | <b>23,3</b> | 3,3           | 15,0          | 8,8         | 7,1                 | 240                   |
| Greenpeace, protest         | 1,6        | <b>36,9</b> | <b>34,3</b> | 4,2           | 8,7           | 10,7        | 3,6                 | 182                   |
| Monsanto                    | 4,2        | 11,8        | 20,9        | 5,7           | <b>50,1</b>   | 5,4         | 2,0                 | 407                   |
| Biofuels                    | 2,3        | 9,0         | <b>30,2</b> | 4,1           | <b>45,1</b>   | 2,8         | 6,4                 | 130                   |

2. European events are dominant in all agricultural issues (*contamination & coexistence, labelling and moratorium*), except for safety and risk related events. Nonetheless, contamination & coexistence and labelling –both ‘typical European issues’- were also covered quite frequently in North American news articles;
3. Oceanian and European events are almost equally dominant in the *moratorium/ban* issue;
4. Surprisingly, *safety and risk* related events are reported most frequently in articles about biotechnology in Asia;

5. In more than 70% of the cases events related to the role of *Greenpeace and protest* against GM crops have been reported in Asia and Europe. Although this is most probably related to the risk and safety issues reported by the media;
6. *Monsanto* related events are in 50% of the cases taking place in the company's home-base, North America;
7. 75% of reported *biofuels* related events concern North American and European activities.

### Controversial issues

It is usually issues of controversy that attract a lot of attention in the media. This is the type of news that probably most strongly reflects and influences the public debate about biotechnology. The issues we have chosen each demonstrate how their impact on the positioning of biotechnology differs in terms of positioning on the technology on a society scale, in terms of their significance over time, and in terms of regions or countries.

From the combination of the analysis of these parameters we can draw the following conclusions:

1. Issue concerning stem cells had a significant effect on the positioning of medical biotechnology in the direction of national interests in 2006/2007, especially in North America. This effect was significantly reduced in the subsequent years. Events concerning cancer research had an equally significant but opposite effect on the positioning of medical biotechnology. Cloning issues, which had an effect similar to that of stem cell issues, more or less disappeared from the news. A wide range of other medical biotechnology issues took over;
2. The moratoria/ban and contamination & coexistence issues were quite significant in pulling the positioning of agricultural biotechnology in the direction of NGO interests in 2007/2008. Their significance decreased in the subsequent years. The moratorium issue did not only play a role in Europe but also in Oceania. The contamination and coexistence issue played in Europe and, due to trade related cases of contamination and coexistence measures, also in North America;
3. Issues concerning safety and risk had a similar effect on the positioning of agricultural biotechnology, but their significance was much lower. These issues played primarily in Asia and, to some lesser extent, in Europe;
4. The significance of labelling issues, pulling the positioning of agricultural (food) biotechnology in the direction of citizens interests, was also rather low. The issue peaked in 2007/2008 and played in Europe and, to some lesser extent, in North America;
5. Greenpeace activities and other protests were moderately significant between 2006 and 2010, pulling the agricultural biotechnology positioning slightly towards NGO interests, especially in Asia and Europe;
6. The positioning of industrial biotechnology is strongly dominated by media reporting about biofuels, and therefore the positioning of biofuels and industrial biotechnology in general are more or less equal. It is primarily a North American and European issue;
7. Events related to Monsanto are quite significant for the positioning of agricultural biotechnology, especially in North America. Their significance in pulling the agricultural biotech positioning towards company interests peaked in 2009 and seems to stay at a quite high level;
8. The authorisation of Bt aubergine was an issue that raised a lot of protest in India. This attracted a lot of attention in Indian media and had a significant impact, pulling India's agricultural biotechnology positioning strongly in the direction of public interests.

## **Annex 1: Research methods**

This analysis of news articles is based on a research method that was developed in a pilot study in 2007<sup>10</sup>. The research method consists of three subsequent activities:

1. Collection of news from newspapers, magazines and electronic media;
2. Attachment of keywords and ratings to articles;
3. Analysis of the ratings and;
4. Presentation of the results.

### **A1.1 Collection of news**

During the year, several media are screened for news about biotechnology, with emphasis on genetic engineering. A wide range of sources was used, including:

- A clipping service that provides biotechnology related news from Dutch newspapers and magazines,
- A daily news service from BIO, the US Biotech Industry Association, which contains news from American and British media and other media published in English, including clippings from press agencies (Reuters, Bloomberg, Associated Press),
- The news service from GENET, a European NGO network on genetic engineering, which does not only emphasize controversies and NGO activities but also brings general biotech news from media in Africa, Asia, Latin America, Australia and New Zealand,
- SciDevNet, a news service specialized in news about developing countries,
- Checkbiotech, a service daily lists several biotechnology news items,
- Seedquest, a news service of the seed industry,
- News on the website of Agbios, a Canadian company dedicated to providing public policy, regulatory, and risk assessment expertise for products of biotechnology,
- Newswise, an electronic news service that alerts scientific news,
- Articles from a range of (popular) scientific magazines, such as New Scientist, Science, Nature, Nature Biotechnology,
- A selection of Chinese magazines, screened and translated by a Chinese student.

Between 60 and 120 articles are collected weekly, altogether more than 22,700 articles in five years (July 2005 – July 2010). All articles are converted to a PDF-format and sent to students that are trained in attaching keywords and ratings to the articles while uploading them in a database.

### **A1.2 Attachment of keywords and ratings**

Every article is put in an electronic database and provided with information about:

- a) Title, source, date and author of the article;
- b) The type of source: newspaper, journal or electronic media;
- c) The type of biotechnology the article is about or focusing on: agricultural (green), medical (red) or industrial (white) biotechnology, or biotechnology in general;
- d) The country or continent the article deals with;
- e) Keywords that reflect the content of the article, for instance a specific application, a moratorium on commercial GMO crop cultivation, authorization of a GMO product, a debate about genetic engineering and the world food supply, or biofuels;

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<sup>10</sup> Vos, Wiebe en Bastiaan Zoeteman (2007), Posities van Wereldblokken inzake Biotechnologie, COGEM, maart 2007.

f) If the article refers to a specific event or action, the type of actor that has an interest is identified: companies/industry, public authorities, citizens (consumers, patients) or NGOs. The interest is translated in a rating on two dimensions according to the table below: a technology and a society dimension.

| Interest           | Technology rating | Society rating |
|--------------------|-------------------|----------------|
| Companies/industry | +1                | -1             |
| Public authorities | +1                | +1             |
| Citizens           | -1                | -1             |
| NGOs               | -1                | +1             |

In case there is more articles referring to the same event or action, only one of the articles is rated. Appendix A.3 gives an impression of the number of collected and rated articles.

In 2005/2006 steps a) – e) were done by LIS Consult and step f) was done by a student from the University of Tilburg during a pilot study for the COGEM. In 2006/2010 only step a) was done by LIS Consult and steps b) – f) were done by students from the University of Tilburg hired by the COGEM and instructed for the job by the student who developed the methodology, LIS Consult and the supervisor.

### A1.3 Analysis of the ratings

Once the steps a) to e) have been completed for a full year (from July to July), the average ratings are calculated resulting in:

- Average ratings over 5 years, per year and per month,
- Average ratings per continent and per country (only in case of sufficient data),
- Average ratings per type of biotechnology,
- Average ratings per type of biotechnology for continents that provide sufficient data,
- The number of articles and average ratings for a selection of events or activities by selecting articles on key words.

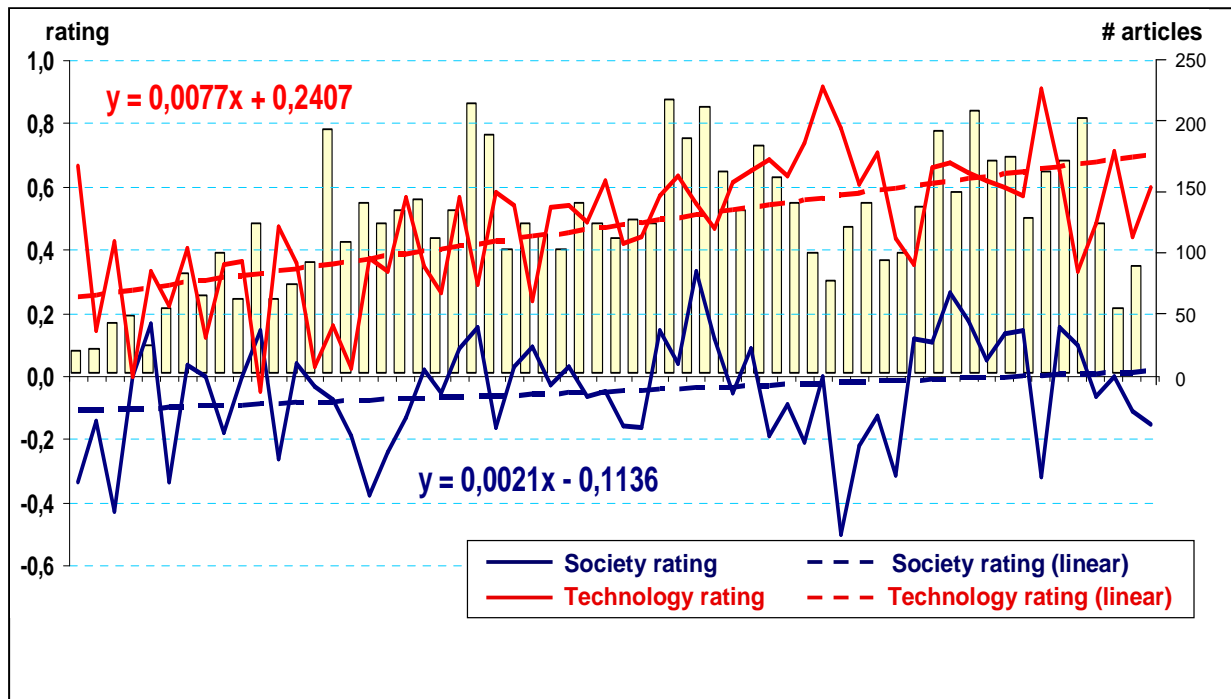
### A1.4 Presentation of the results

The monthly average ratings are presented in a graphic presentation with a horizontal time scale. Based on linear regression a linear trend is calculated (in Excel)<sup>11</sup>. Such linear trends can be calculated based on average ratings (monthly, quarterly or annual) over the total period of data collection, in this case three years, showing a ‘long’ term trend. This can be done for any type of selection from the database, such as all rated articles concerning a specific continent or country, a specific type of biotechnology or even a specific issue, as long as the selection contains sufficient data. An example of a long term trend analysis is given in the figure below.

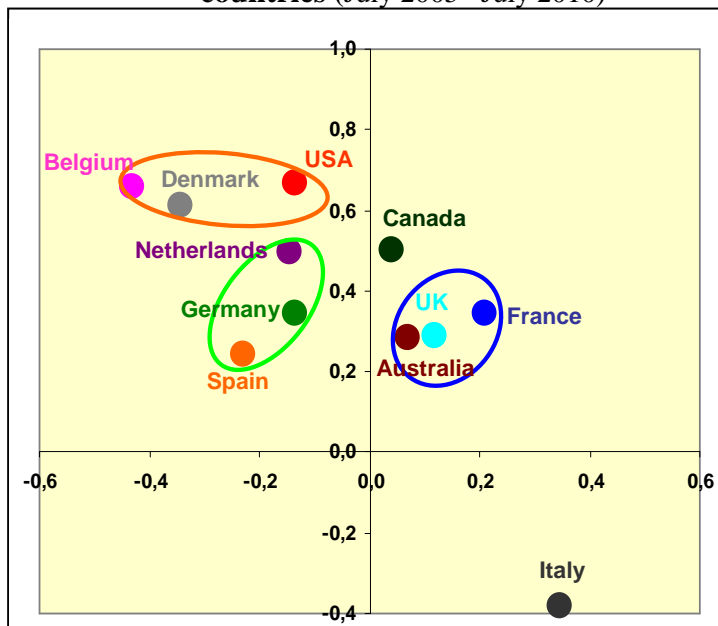
This figure also shows the number of ratings per month in a bar chart.

<sup>11</sup> A linear equation  $y = a + bx$  is constructed by calculation of least square estimates: The sum of the square of ‘errors’ or deviations from  $y = a + bx$ .

**Figure A.1.1: Development of Europe's position in biotechnology based on monthly average ratings and number of rated articles per month (July 2005 –July 2010)**



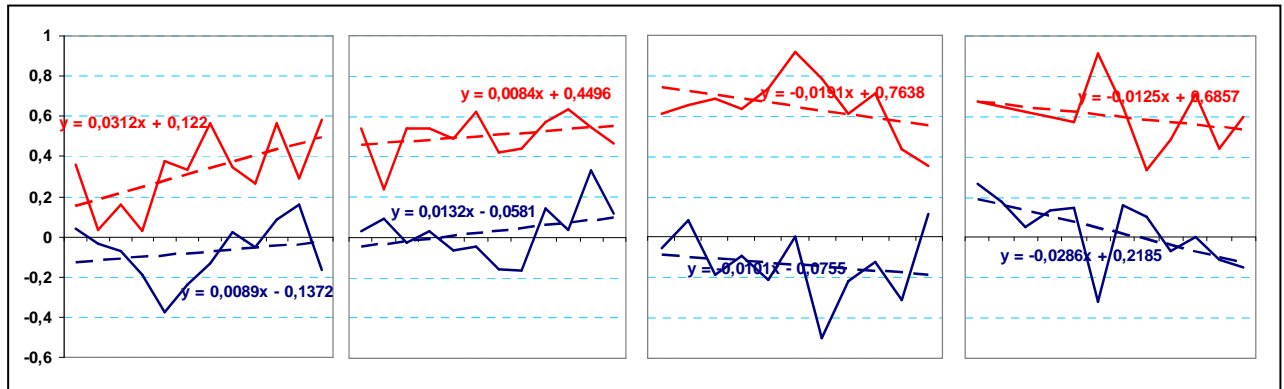
**Figure A.1.2: The average rating of industrialized countries (July 2005 –July 2010)**



In addition, a graphic presentation of the positioning of the continents, countries, types of biotechnology and issues is constructed by plotting the average ratings (annual or longer term) on two axis: a horizontal axis (-1 ⇔ 1) representing the society dimension and a vertical axis (-1 ⇔ 1) representing the technology dimension. Visualization can be further improved by zooming in on the part of the graphic that contains specific data. Clusters of similar positions can be highlighted by drawing circles. This results in graphics like the one on the left.

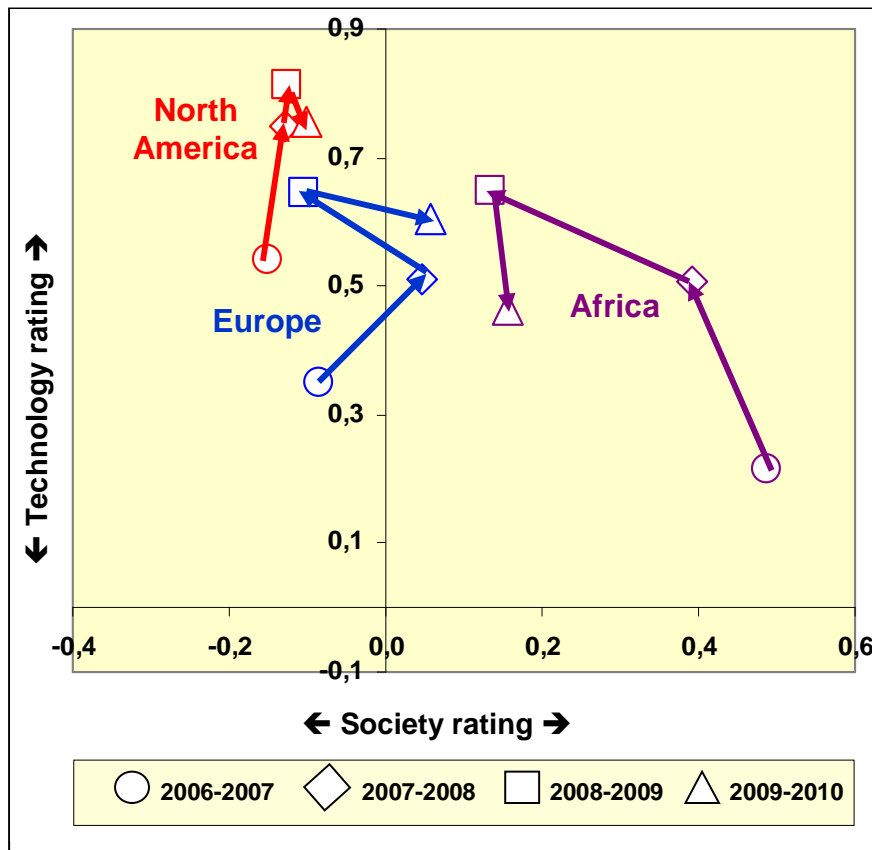
The result of the analysis presented in figure A.1.1 suggests a trend that is continuous, but in reality trends can change in another direction. Shifts in trends can be visualized by two methods. The first method calculates trends lines based on monthly average ratings for subsequent years. This method clearly shows shifts in trends. In this case, the point where a trend starts shifting is chosen quite arbitrary: end June/beginning July. The graphic below presents an example for Europe, demonstrating that subsequent trend lines do not tend to follow up quite smoothly (the Europe example).

Figure A.1.3: Trend lines based on monthly average ratings of biotechnology in Europe (July 2006 – July 2007)



The second method plots annual average ratings on the two axis with arrows indicating the direction of the shift. This results in a graphic that is visually easier to understand. It was therefore decided to apply this method as a standard for presentation of the results.

Figure A.1.4: Shifting positions of biotechnology in Europe, North America and Africa (July 2006 – July 2007)



During the pilot year 2005/2006 the data have been processed differently than during the subsequent year: a significantly smaller rate of the total number of articles was rated and standards for rating were not yet developed, so the rating was still done in an experimental way. For those reasons, it was decided not to present the data of the pilot year in the trend analysis.

The trends can be further analyzed by looking into specific issues that get a lot of attention from the media, such as moratoria/bans on GMOs and stem cell research policies. The percentage of articles on these issues is an indication for their relevance and the ratings for the direction in which they influence the position.

As we can see in this report, monthly average ratings can fluctuate strongly. Such fluctuations can usually be explained as deviations due to a low number of data. Monthly average ratings on issues could be also be used to explain strong fluctuations in monthly average ratings, but only if there is sufficient data, which is usually not the case.

### **A.1.5 Some remarks about the methodology**

The methods applied in this analysis need further improvement on at least five points.

First of all, the method for data collection results in a strong focus on Dutch and Anglo-American media, and on media that publish in English. Although there is capacity to collect and store articles in Spanish, French and German language, such articles are under represented. Hence, the results are most reliable for biotechnology developments in The Netherlands, the UK, the USA, Australia, New Zealand and India. Fortunately, articles from Dutch and Anglo-American origin cover world events quite well.

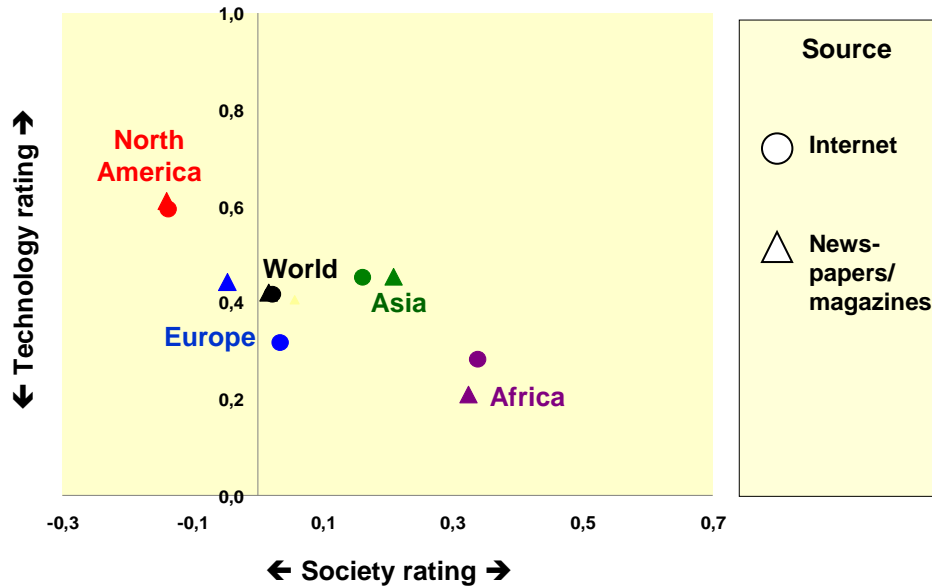
Second, splitting up data has its limits. Creation of sub categories or short term averages can result in an amount of data that is too low to make a sensible analysis. If the number of data is low, one action or event can have much impact on the average rating. For this reason, in several cases continents, countries or issues have not been included in the analysis.

As to ensure as much uniformity as possible a general guideline has been developed for the students who rate the articles and store them in the database. Nevertheless, interpretation of the articles is not fully objective, and differences in the attribution of key words and ratings to articles while storing them in the database can not be excluded. To check the influence of individual interpretation a sample taken from the articles collected and rated during the pilot project in 2005/2006 and rated again by the students who rated the articles collected during 2006/2007. This resulted in a small deviation, less than 5%, which is considered acceptable for the purpose of this analysis.

About one third of the rated articles was collected from websites. Many electronic media represent a specific interest or highlight a specific type of topics. The graphics below, showing the difference in average ratings between electronic and printed media for a number of continents and different types of biotechnology demonstrates that there is not a unidirectional effect. On average, during three years there is hardly a difference between both types of media in term of rating, but there is some difference between the continents. For North America, articles from the web rate quite similar to articles from newspapers and magazines. Articles from the web about Europe rate more in favor of NGO interests. Articles from the web about Asia tend to put a fraction less emphasis on collective interests, and articles from the web about Africa put slightly more emphasis on the possibilities of the technology.

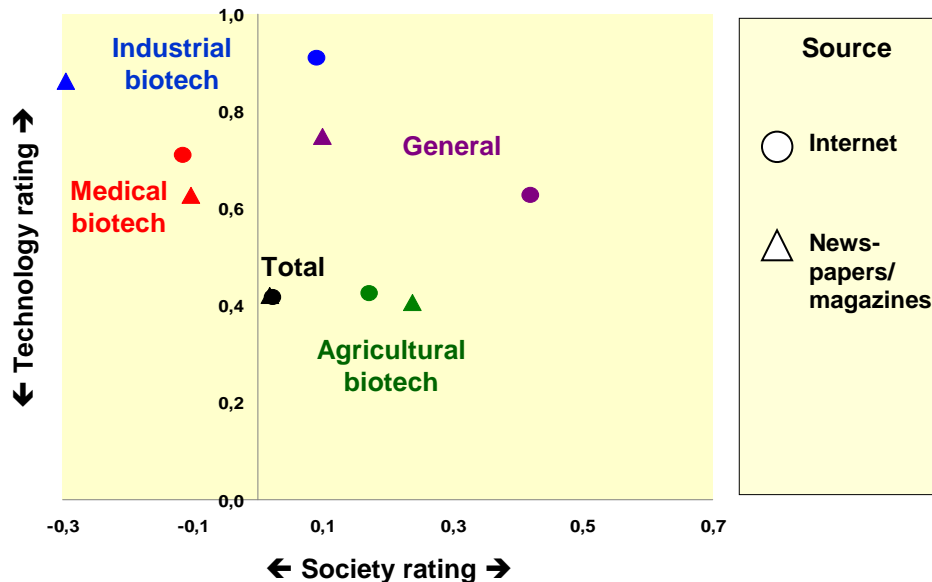


The position of biotechnology in Africa, Asia, Europe and North America based on articles from INTERNET and in NEWSPAPERS (July 2005 – July 2008)



A comparison of the rating of articles about different types of biotechnology according to their source shows only slight differences between both sources for medical and agricultural biotechnology, and a difference for industrial biotechnology. On industrial biotechnology the articles from newspapers and magazines tend to focus considerably more on private interests than articles from the web.

Rating of different types of biotechnology depending on the source of the articles (July 2005 – July 2008)



Hence, it is not possible to make a general statement about preferences of the two types of media. The reader of the report just will have to take into account that there may be a certain effect.

Of course, the extent to which the use of electronic media as a source of news affects the results depends on the share of the articles that is retrieved from the web. The table above presents the difference in ratings weighted for the share in the total of articles (= rating x percentage x 2). The difference in ratings appears to be moderate (between 0.10 and 0.20 points) to large (over 0.30 points).

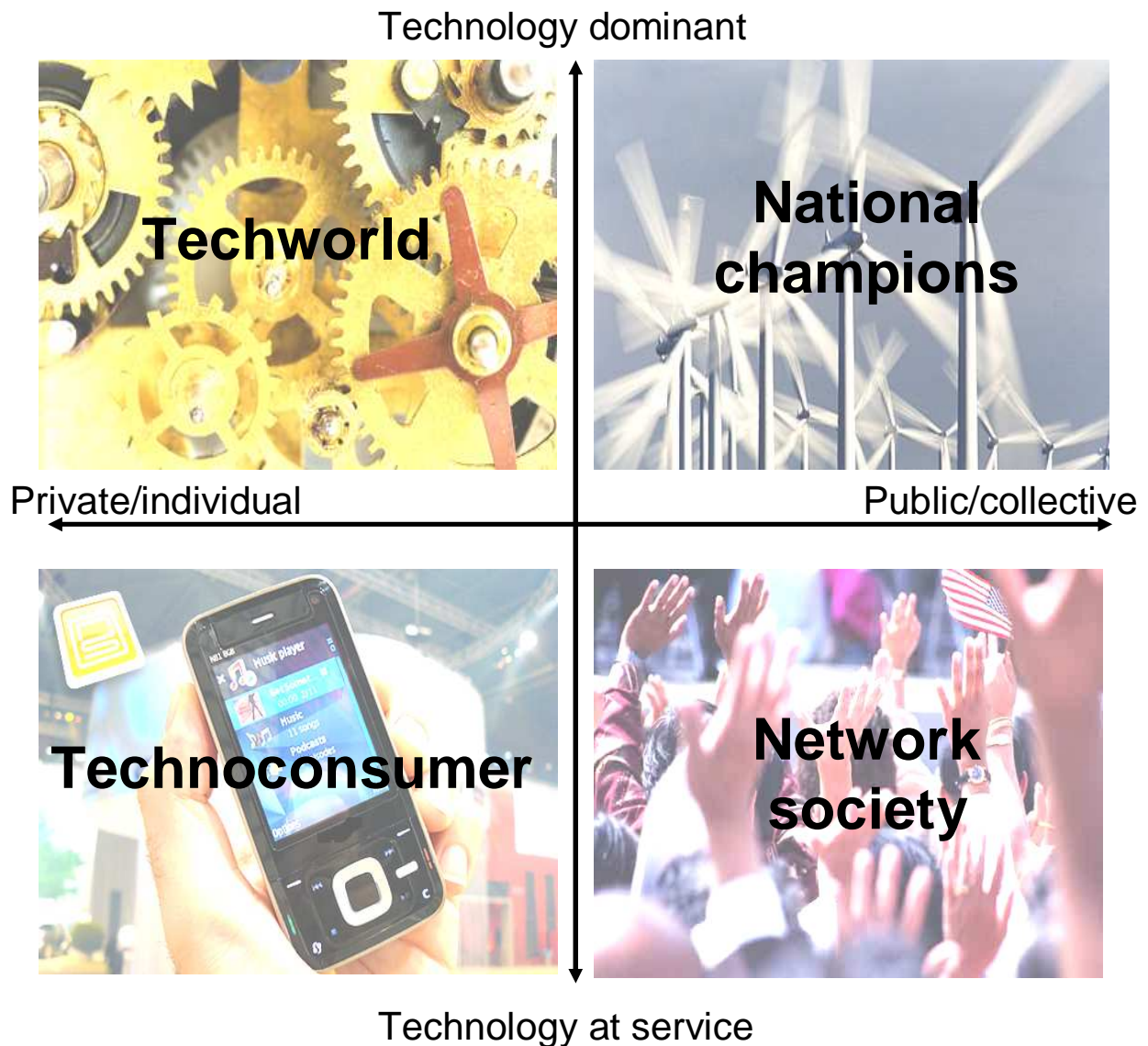
**Table 1: Weighted difference in ratings between articles from electronic and printed media (July 2005-June 2007)**

|               | Weighted difference* |              | Effect          |                      |
|---------------|----------------------|--------------|-----------------|----------------------|
|               | S-rating             | T-rating     | Extent          | Direction            |
| Africa        | 0.19                 | 0.28         | Large           | Government interests |
| Asia          | -0.11                | -0.08        | Moderate        | Citizen interests    |
| Europe        | 0.06                 | -0.35        | Large           | NGO interests        |
| Latin America | -0.10                | 0.12         | Moderate        | Company interests    |
| North America | 0.09                 | -0.30        | Large           | NGO interests        |
| Oceania       | -0.21                | -0.05        | Large           | Citizen interests    |
| <b>World</b>  | <b>0,02</b>          | <b>-0,19</b> | <b>Moderate</b> | <b>NGO interests</b> |

\* Weighted difference = (Rating<sub>electronic media</sub> x Percentage<sub>electronic media</sub> x2) – (Rating<sub>printed media</sub> x Percentage<sub>printed media</sub> x 2)

## Annex 2: The scenarios developed by TNO (2006)

In 2006, TNO Netherlands, commissioned by the COGEM, developed scenarios as a basis for exploration of future biotechnology development and its social context. The scenarios are based on two drivers: technological dominance and society's orientation. Combination of both dimensions resulted in four scenarios:



### A. *Techworld scenario* (society *private* oriented and *technology dominant*)

- + Polarised society because of power oriented companies whose principal target is creation of *shareholder value*.
- + Government authorities merely have a facilitating task, principally aimed at the protection of intellectual property of companies.
- + Technology is being *pushed* by companies.
- + Companies are represented in all forums, which is accepted by citizens and NGOs because they rely on the companies.

### B. *Technoconsumer scenario* (society *individual* oriented and *technology at service* of individual citizen).

- + Individualised society as a result of large influence of individual citizens.

- + Government authorities merely have a facilitating task, principally aimed at informing, securing and warranting of individual citizens.
- + Technology development aimed at maximisation of benefits for the end user (consumer and patient).

**C. National Champions scenario** (society regulated *publicly* and *technology dominant*)

- + Society is actively regulated by government authorities, acting as central maker and executer of policies.
- + Technology is being *pushed* by governments as to promote national interest at the economic and social level.

**D. Network society scenario** (society regulated *collectively* and *technology serving* society)

- + Society is strongly harmonised by continuous deliberation between stakeholders, in which 'civil society' represented by NGOs plays an active and binding role.
- + Government authorities merely have a facilitating task, principally aimed at promotion of interaction between stakeholders.
- + Technology development aimed at maximisation of benefits for society at large.

## Annex 3: Overall results

### A3.1 Number and distribution of rated articles

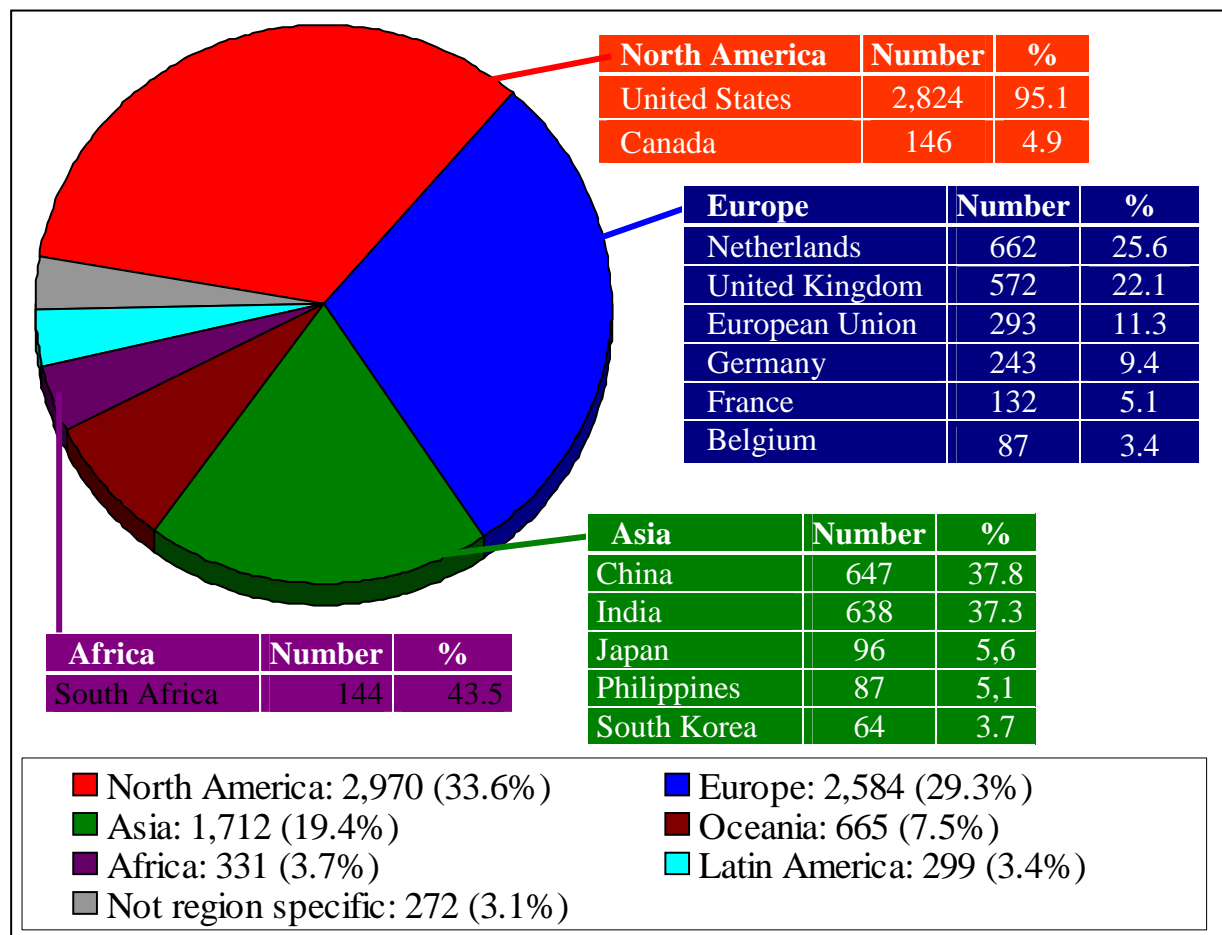
In 2005/2006, during the pilot, a limited number of 854 articles (25% of the collected articles) has been rated. During the 4 years of data collection and analysis that followed a much larger number of articles was collected and a larger percentage of the articles (35 - 45%) was rated, which resulted more than twice rated articles respectively.

**Table A3.1:** Number of collected and rated articles (July 2005 – July 2010)

|                              | 2005-2006 | 2006-2007 | 2007-2008 | 2008-2009 | 2009-2010 | 2005-2010 |
|------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Total nr. of articles        | 3,461     | 4,351     | 4,255     | 5,191     | 5,453     | 22,711    |
| Nr. of rated articles        | 858       | 1,978     | 1,908     | 1,791     | 2,212     | 8,747     |
| Rated articles in % of total | 24.67     | 45.48     | 44.84     | 34.50     | 40.56     | 38.51     |

The graphic below gives an impression of the number of rated articles between July 2005 and July 2010. Given the dominance of the United States in biotechnology development it is not a surprise that North America accounts for one-third of the articles.

**Graphic A3.1:** Number of rated articles per continent (July 2005 – July 2010)



Europe is second best with almost 30% of the articles. Due to the focus on Dutch and English media, the Netherlands and the United Kingdom are over represented here. Asia comes in the third place, being dominated by articles about the two largest Asian countries, China and India. India is well represented here due to the availability of English media. About 84% of the articles about Oceania concerns actions and events in Australia, the other 16% is about New Zealand. Although South Africa is still dominating the news that has been collected about the African continent, news about other African countries such as Kenya and Uganda is rapidly increasing and South Africa's dominance is decreasing.

Looking at the distribution of the rated articles over the different types of biotechnology, the dominance of agricultural biotechnology, good for almost 60% two-third of the articles, is striking. About one-third of the articles are about medical biotechnology and only 5 % is about industrial biotechnology. Among the total number of collected articles the distribution between agricultural and medical biotechnology is more even, a relative high number of articles about medial biotechnology concerned research and could not be rated.

**Table A3.2: Number of rated articles by type of biotechnology (July 2005 – July 2010)**

| Continent          | Agricultural |             | Medical      |             | Industrial |            | General    |            |
|--------------------|--------------|-------------|--------------|-------------|------------|------------|------------|------------|
|                    | N            | in %        | N            | in %        | N          | in %       | N          | in %       |
| Africa             | 225          | 87.7        | 14           | 5.4         | 3          | 1.2        | 14         | 5.5        |
| Asia               | 1,095        | 64.8        | 418          | 24.7        | 117        | 6.9        | 61         | 3.6        |
| Europe             | 1,474        | 57.4        | 897          | 35.0        | 105        | 4.1        | 90         | 3.5        |
| Latin America      | 230          | 76.7        | 29           | 9.7         | 24         | 8.0        | 17         | 5.7        |
| North America      | 1,262        | 43.9        | 1,356        | 47.2        | 177        | 6.2        | 79         | 2.7        |
| Oceania            | 527          | 80.5        | 114          | 17.4        | 6          | 0.9        | 8          | 1.2        |
| Not region pecific | 153          | 56.5        | 87           | 32.1        | 14         | 5.2        | 18         | 6.6        |
| <b>Total</b>       | <b>4,966</b> | <b>57.6</b> | <b>2,915</b> | <b>33.8</b> | <b>446</b> | <b>5.2</b> | <b>287</b> | <b>3.3</b> |

### A3.2 Overall results by continent and country

*Table A3.3: Overall results by continent: The Society rating*

|                     | 2005-2006     |            | 2006-2007     |             | 2007-2008    |             | 2008-2009     |             | 2009-2010    |             | Average Rating |
|---------------------|---------------|------------|---------------|-------------|--------------|-------------|---------------|-------------|--------------|-------------|----------------|
|                     | Rating        | Nr         | Rating        | Nr          | Rating       | Nr          | Rating        | Nr          | Rating       | Nr          |                |
| Africa              | 0,091         | 43         | 0,486         | 74          | 0,391        | 69          | 0,135         | 74          | 0,155        | 71          | 0,266          |
| Asia                | 0,063         | 191        | 0,213         | 319         | 0,186        | 398         | 0,073         | 397         | 0,115        | 407         | 0,134          |
| Europe              | -0,053        | 267        | -0,094        | 585         | 0,046        | 581         | -0,105        | 514         | 0,058        | 637         | -0,023         |
| Latin America       | 0,104         | 66         | 0,242         | 66          | -0,067       | 45          | 0,015         | 67          | -0,345       | 55          | 0,006          |
| Oceania             | -0,045        | 88         | 0,174         | 138         | 0,202        | 178         | 0,121         | 141         | 0,017        | 120         | 0,113          |
| North America       | -0,084        | 203        | -0,151        | 747         | -0,129       | 526         | -0,125        | 576         | -0,101       | 832         | -0,123         |
| Not region specific | na            | na         | 0,429         | 49          | -0,027       | 111         | 0,273         | 22          | 0,200        | 90          | 0,154          |
| <b>Total</b>        | <b>-0,014</b> | <b>858</b> | <b>-0,001</b> | <b>1978</b> | <b>0,047</b> | <b>1908</b> | <b>-0,035</b> | <b>1791</b> | <b>0,005</b> | <b>2212</b> | <b>0,003</b>   |

*Table A3.3: Overall results by continent: The Technology rating*

|                     | 2005-2006    |            | 2006-2007    |              | 2007-2008    |              | 2008-2009    |              | 2009-2010    |              | Average Rating |
|---------------------|--------------|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------------|
|                     | Rating       | Nr         | Rating       | Nr           | Rating       | Nr           | Rating       | Nr           | Rating       | Nr           |                |
| Africa              | -0.045       | 43         | 0.243        | 74           | 0.507        | 69           | 0.649        | 74           | 0.465        | 71           | 0,399          |
| Asia                | 0.438        | 191        | 0.413        | 319          | 0.487        | 398          | 0.557        | 397          | 0.332        | 407          | 0,447          |
| Europe              | 0.227        | 267        | 0.359        | 585          | 0.511        | 581          | 0.646        | 514          | 0.604        | 637          | 0,497          |
| Latin America       | 0.373        | 66         | 0.394        | 66           | 0.600        | 45           | 0.343        | 67           | 0.673        | 55           | 0,460          |
| Oceania             | 0.205        | 88         | 0.362        | 138          | 0.236        | 178          | 0.149        | 141          | 0.183        | 120          | 0,230          |
| North America       | 0.517        | 203        | 0.539        | 747          | 0.749        | 526          | 0.813        | 576          | 0.755        | 832          | 0,693          |
| Not region specific | na           | na         | 0.469        | 49           | 0.730        | 111          | 0.727        | 22           | 0.600        | 90           | 0,640          |
| <b>Total</b>        | <b>0.338</b> | <b>858</b> | <b>0.436</b> | <b>1,978</b> | <b>0.561</b> | <b>1,908</b> | <b>0.630</b> | <b>1,791</b> | <b>0.585</b> | <b>2,212</b> | <b>0,531</b>   |

**Table A.3.4: Overall results by country: Developed countries, Society rating**

|           | 2005-2006 |     | 2006-2007 |     | 2007-2008 |     | 2008-2009 |     | 2009-2010 |     | Average rating |
|-----------|-----------|-----|-----------|-----|-----------|-----|-----------|-----|-----------|-----|----------------|
|           | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  |                |
| US        | -0,100    | 184 | -0,160    | 708 | -0,125    | 503 | -0,159    | 540 | -0,110    | 889 | -0,134         |
| Canada    | 0,050     | 19  | -0,110    | 38  | -0,182    | 22  | 0,417     | 24  | 0,070     | 43  | 0,040          |
| Australia | -0,070    | 75  | 0,140     | 114 | 0,145     | 189 | 0,068     | 103 | -0,075    | 80  | 0,070          |
| NL        | 0,211     | 38  | -0,400    | 159 | -0,242    | 161 | -0,329    | 149 | -0,161    | 155 | -0,255         |
| Germany   | 0,032     | 32  | -0,385    | 51  | -0,053    | 38  | -0,193    | 57  | -0,323    | 65  | -0,216         |
| France    | 0,200     | 16  | -0,059    | 14  | 0,490     | 51  | 0,273     | 22  | -0,034    | 29  | 0,245          |
| Spain     | -0,097    | 7   | 0,188     | 10  | 0,266     | 5   | 0,000     | 9   | 0,306     | 11  | 0,140          |
| UK        | -0,429    | 32  | -0,455    | 133 | 0,200     | 79  | -0,333    | 184 | 0,455     | 144 | -0,095         |
| Italy     | 0,143     | 7   | 0,143     | 7   | 0,750     | 8   | 1,000     | 3   | 0,111     | 9   | 0,353          |
| Denmark   | -0,200    | 5   | -0,667    | 6   | -0,429    | 7   | -0,857    | 14  | -0,200    | 15  | -0,489         |
| Belgium   | -0,200    | 5   | -0,733    | 15  | -0,100    | 20  | -0,167    | 24  | -0,304    | 23  | -0,287         |
| EU        | -0,190    | 76  | 0,326     | 89  | 0,220     | 0   | 0,273     | 44  | 0,381     | 84  | 0,200          |

**Table A.3.5: Overall results by country: Developed countries, Technology rating**

|           | 2005-2006 |     | 2006-2007 |     | 2007-2008 |     | 2008-2009 |     | 2009-2010 |     | Average rating |
|-----------|-----------|-----|-----------|-----|-----------|-----|-----------|-----|-----------|-----|----------------|
|           | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  |                |
| US        | 0,530     | 184 | 0,540     | 708 | 0,769     | 503 | 0,621     | 540 | 0,764     | 889 | 0,666          |
| Canada    | 0,370     | 19  | 0,580     | 38  | 0,364     | 22  | 0,469     | 24  | 0,581     | 43  | 0,502          |
| Australia | 0,250     | 75  | 0,370     | 114 | 0,276     | 189 | 0,299     | 103 | 0,175     | 80  | 0,282          |
| NL        | 0,320     | 38  | 0,475     | 159 | 0,689     | 161 | 0,745     | 149 | 0,819     | 155 | 0,660          |
| Germany   | 0,355     | 32  | 0,308     | 51  | 0,368     | 38  | 0,544     | 57  | 0,538     | 65  | 0,441          |
| France    | 0,600     | 16  | 0,176     | 14  | 0,255     | 51  | -0,091    | 22  | 0,724     | 29  | 0,334          |
| Spain     | 0,290     | 7   | 0,263     | 10  | 0,316     | 5   | 0,619     | 9   | 0,764     | 11  | 0,481          |
| UK        | -0,143    | 32  | 0,273     | 133 | 0,600     | 79  | 0,556     | 184 | 0,091     | 144 | 0,340          |
| Italy     | -0,714    | 7   | -0,429    | 7   | 0,000     | 8   | 0,333     | 3   | 0,111     | 9   | -0,176         |
| Denmark   | 0,600     | 5   | 0,667     | 6   | 0,714     | 7   | 1,000     | 14  | 1,000     | 15  | 0,872          |
| Belgium   | 0,200     | 5   | 0,739     | 15  | 0,900     | 20  | 0,583     | 24  | 0,913     | 23  | 0,748          |
| EU        | 0,215     | 76  | 0,438     | 89  | 0,660     | 0   | 0,727     | 44  | 0,452     | 84  | 0,428          |



**Table A.3.6: Overall results by country: Developing countries, Society rating**

|             | 2005-2006 |     | 2006-2007 |     | 2007-2008 |     | 2008-2009 |     | 2009-2010 |     | Average rating |
|-------------|-----------|-----|-----------|-----|-----------|-----|-----------|-----|-----------|-----|----------------|
|             | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  |                |
| China       | 0.020     | 47  | 0.419     | 62  | 0.192     | 154 | 0.004     | 233 | 0.106     | 151 | 0.114          |
| Japan       | 0.090     | 11  | 0.100     | 20  | 0.053     | 19  | -0.250    | 16  | 0.067     | 30  | 0.021          |
| India       | 0.080     | 130 | 0.158     | 133 | 0.203     | 118 | 0.224     | 85  | 0.198     | 172 | 0.170          |
| Philippines | 0.000     | 0   | 0.385     | 26  | 0.462     | 26  | 0.571     | 14  | -0.333    | 21  | 0.264          |
| S-Korea     | 0.330     | 3   | 0.250     | 16  | 0.333     | 21  | 0.176     | 17  | -0.143    | 7   | 0.219          |
| Brasil      | 0.110     | 36  | -0.060    | 32  | -0.200    | 68  | -1.000    | 28  | -0.515    | 33  | -0.287         |
| S. Africa   | 0.000     | 18  | 0.290     | 31  | 0.263     | 49  | 0.000     | 22  | 0.083     | 24  | 0.166          |

**Table A.3.7: Overall results by country: Developing countries, Technology rating**

|             | 2005-2006 |     | 2006-2007 |     | 2007-2008 |     | 2008-2009 |     | 2009-2010 |     | Average rating |
|-------------|-----------|-----|-----------|-----|-----------|-----|-----------|-----|-----------|-----|----------------|
|             | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  | Rating    | Nr  |                |
| China       | 0.740     | 47  | 0.774     | 62  | 0.675     | 154 | 0.682     | 233 | 0.759     | 151 | 0.712          |
| Japan       | 0.090     | 11  | 0.400     | 20  | 0.579     | 19  | 0.875     | 16  | 0.400     | 30  | 0.479          |
| India       | 0.340     | 130 | 0.429     | 133 | 0.407     | 118 | 0.294     | 85  | -0.163    | 172 | 0.229          |
| Philippines | 0.000     | 0   | 0.154     | 26  | 0.000     | 26  | -0.143    | 14  | 0.905     | 21  | 0.241          |
| S-Korea     | 1.000     | 3   | 0.500     | 16  | 0.619     | 21  | 0.412     | 17  | 0.714     | 7   | 0.563          |
| Brasil      | 0.220     | 36  | 0.440     | 32  | 0.520     | 68  | 1.000     | 28  | 0.818     | 33  | 0.570          |
| S. Africa   | -0.220    | 18  | 0.100     | 31  | 0.368     | 49  | 0.727     | 22  | 0.500     | 24  | 0.314          |

### A3.3 Overall results by type of biotechnology

*Table A.3.8: Overall results by type of biotechnology, Society rating*

|              | 2005-2006     |            | 2006-2007     |              | 2007-2008    |              | 2008-2009     |              | 2009-2010    |              | Average      |
|--------------|---------------|------------|---------------|--------------|--------------|--------------|---------------|--------------|--------------|--------------|--------------|
|              | Rating        | Nr         | Rating        | Nr           | Rating       | Nr           | Rating        | Nr           | Rating       | Nr           | Rating       |
| Agricultural | -0.068        | 619        | 0.090         | 1,057        | 0.188        | 1,148        | 0.085         | 896          | 0.038        | 1,148        | 0.108        |
| Medical      | 0.061         | 147        | -0.133        | 690          | -0.231       | 580          | -0.170        | 752          | -0.026       | 580          | -0.155       |
| Industrial   | -0.095        | 42         | -0.280        | 101          | -0.072       | 97           | -0.150        | 113          | -0.148       | 97           | -0.067       |
| General      | n.a.          | 48         | 0.136         | 125          | 0.220        | 82           | 0.200         | 30           | 0.286        | 82           | 0.173        |
| <b>Total</b> | <b>-0.014</b> | <b>856</b> | <b>-0.001</b> | <b>1,973</b> | <b>0.047</b> | <b>1,908</b> | <b>-0.035</b> | <b>1,791</b> | <b>0.005</b> | <b>2,212</b> | <b>0.003</b> |

*Table A.3.9: Overall results by type of biotechnology, Technology rating*

|              | 2005-2006    |            | 2006-2007    |             | 2007-2008    |              | 2008-2009    |              | 2009-2010    |              | Average      |
|--------------|--------------|------------|--------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|              | Rating       | Nr         | Rating       | Nr          | Rating       | Nr           | Rating       | Nr           | Rating       | Nr           | Rating       |
| Agricultural | 0.200        | 619        | 0.330        | 1,057       | 0.330        | 1,148        | 0.408        | 896          | 0.370        | 1,148        | 0.297        |
| Medical      | 0.687        | 147        | 0.499        | 690         | 0.499        | 580          | 0.846        | 752          | 0.887        | 580          | 0.615        |
| Industrial   | 0.905        | 42         | 0.842        | 101         | 0.842        | 97           | 0.876        | 113          | 0.923        | 97           | 0.843        |
| General      | n.a.         | 48         | 0.648        | 125         | 0.648        | 82           | 0.867        | 30           | 0.857        | 82           | 0.692        |
| <b>Total</b> | <b>0.338</b> | <b>856</b> | <b>0.436</b> | <b>1973</b> | <b>0.436</b> | <b>1,907</b> | <b>0.436</b> | <b>1,791</b> | <b>0.585</b> | <b>2,212</b> | <b>0.531</b> |

Table A.3.10 Overall results by type of biotechnology 2005-2006

|               | General     |             |           |            | Agricultural |             |            |             | Medical     |             |            |             | Industrial  |             |           |            |
|---------------|-------------|-------------|-----------|------------|--------------|-------------|------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|-----------|------------|
|               | Rating      |             | Nr        |            | Rating       |             | Nr         |             | Rating      |             | Nr         |             | Rating      |             | Nr        |            |
|               | S-axis      | T-axis      | N         | in %       | S-axis       | T-axis      | N          | in %        | S-axis      | T-axis      | N          | in %        | S-axis      | T-axis      | N         | in %       |
| Africa        | 0.56        | 0.11        | 9         | 20.9       | 0.67         | 0.47        | 32         | 74.4        | 1.00        | 1.00        | 2          | 4.7         | 0.00        | 0.00        | 0         | 0.0        |
| Asia          | 0.64        | 1.00        | 13        | 6.8        | 0.48         | 0.54        | 160        | 83.3        | 0.38        | 0.88        | 17         | 8.9         | 0.00        | 0.00        | 2         | 1.0        |
| Europe        | 1.00        | 0.69        | 13        | 4.9        | 0.51         | 0.50        | 185        | 70.1        | 0.52        | 0.83        | 48         | 18.2        | 1.00        | 0.33        | 18        | 6.8        |
| Latin America | 1.00        | 0.33        | 3         | 4.5        | 0.39         | 0.71        | 58         | 87.9        | 1.00        | 1.00        | 2          | 3.0         | 1.00        | 0.33        | 3         | 4.5        |
| North America | 0.11        | 0.56        | 9         | 4.4        | 0.25         | 0.54        | 115        | 56.7        | 0.46        | 0.86        | 62         | 30.5        | 1.00        | 0.06        | 17        | 8.4        |
| Oceania       | -1.00       | 1.00        | 1         | 1.1        | 0.46         | 0.52        | 69         | 78.4        | 0.38        | 1.00        | 16         | 18.2        | 1.00        | 0.00        | 2         | 2.3        |
| <b>World</b>  | <b>0.61</b> | <b>0.63</b> | <b>48</b> | <b>5.6</b> | <b>0.45</b>  | <b>0.54</b> | <b>619</b> | <b>72.3</b> | <b>0.48</b> | <b>0.87</b> | <b>147</b> | <b>17.2</b> | <b>0.95</b> | <b>0.29</b> | <b>42</b> | <b>4.9</b> |

Table A.3.11 Overall results by type of biotechnology 2006-2007

|                     | General     |             |            |            | Agricultural |             |              |             | Medical      |             |            |             | Industrial   |             |           |            |
|---------------------|-------------|-------------|------------|------------|--------------|-------------|--------------|-------------|--------------|-------------|------------|-------------|--------------|-------------|-----------|------------|
|                     | Rating      |             | Nr         |            | Rating       |             | Nr           |             | Rating       |             | Nr         |             | Rating       |             | Nr        |            |
|                     | S-axis      | T-axis      | N          | in %       | S-axis       | T-axis      | N            | in %        | S-axis       | T-axis      | N          | in %        | S-axis       | T-axis      | N         | in %       |
| Africa              | 0.82        | 0.64        | 11         | 8.1        | 0.42         | 0.13        | 124          | 91.2        | 1.00         | 1.00        | 1          | 0.7         | 0.00         | 0.00        | 0         | 0.0        |
| Asia                | 0.65        | 0.74        | 23         | 7.2        | 0.21         | 0.34        | 229          | 71.8        | 0.10         | 0.63        | 60         | 18.8        | -0.14        | 1.00        | 7         | 2.2        |
| Europe              | -0.33       | 0.54        | 39         | 6.7        | 0.14         | 0.19        | 314          | 53.7        | -0.32        | 0.50        | 215        | 36.8        | -0.65        | 1.00        | 17        | 2.9        |
| Latin America       | 0.75        | 1.00        | 8          | 11.6       | 0.08         | 0.38        | 48           | 69.6        | 0.40         | 0.00        | 12         | 17.4        | 1.00         | 1.00        | 1         | 1.4        |
| North America       | 0.02        | 0.61        | 40         | 5.4        | -0.18        | 0.55        | 330          | 44.2        | -0.13        | 0.50        | 351        | 47.1        | -0.44        | 0.84        | 25        | 3.4        |
| Oceania             | 0.33        | 1.00        | 3          | 2.2        | 0.15         | 0.36        | 94           | 0.0         | 0.25         | 0.35        | 40         | 29.2        | 0.00         | 0.00        | 0         | 0.0        |
| Not region specific |             |             | 2          | 4.1        | 0.64         | 0.33        | 33           | 67.3        | 0.08         | 0.69        | 13         | 26.5        | -1.00        | 1.00        | 1         | 2.0        |
| <b>World</b>        | <b>0.15</b> | <b>0.65</b> | <b>127</b> | <b>6.1</b> | <b>0.09</b>  | <b>0.35</b> | <b>1,110</b> | <b>53.5</b> | <b>-0.11</b> | <b>0.53</b> | <b>786</b> | <b>37.9</b> | <b>-0.46</b> | <b>0.88</b> | <b>52</b> | <b>2.5</b> |

**Table A.3.12 Overall results by type of biotechnology 2007-2008**

|                     | General     |             |           |            | Agricultural |             |              |             | Medical      |             |            |            | Industrial   |             |           |            |
|---------------------|-------------|-------------|-----------|------------|--------------|-------------|--------------|-------------|--------------|-------------|------------|------------|--------------|-------------|-----------|------------|
|                     | Rating      |             | Nr        |            | Rating       |             | Nr           |             | Rating       |             | Nr         |            | Rating       |             | Nr        |            |
|                     | S-axis      | T-axis      | N         | in %       | S-axis       | T-axis      | N            | in %        | S-axis       | T-axis      | N          | in %       | S-axis       | T-axis      | N         | in %       |
| Africa              | 0.60        | 0.60        | 5         | 7.2        | 0.39         | 0.49        | 59           | 85.5        | 0.00         | 0.50        | 4          | 5.8        | -1.00        | 1.00        | 1         | 1.4        |
| Asia                | 0.28        | 0.85        | 15        | 3.8        | 0.28         | 0.36        | 257          | 64.7        | -0.07        | 0.64        | 98         | 24.7       | 0.11         | 0.85        | 27        | 6.8        |
| Europe              | 0.44        | 0.76        | 25        | 4.3        | 0.26         | 0.33        | 349          | 59.8        | -0.39        | 0.77        | 186        | 31.8       | -0.14        | 0.90        | 21        | 3.6        |
| Latin America       | -0.20       | 0.60        | 5         | 11.1       | -0.06        | 0.50        | 32           | 71.1        | 0.60         | 1.00        | 5          | 11.1       | -1.00        | 1.00        | 3         | 6.7        |
| North America       | -0.22       | 1.00        | 18        | 3.4        | -0.08        | 0.64        | 227          | 43.2        | -0.19        | 0.82        | 247        | 47.0       | 0.06         | 0.82        | 34        | 6.5        |
| Oceania             | -0.33       | -0.33       | 3         | 1.7        | 0.26         | 0.20        | 164          | 92.1        | -0.33        | 1.00        | 9          | 5.1        | -1.00        | 1.00        | 2         | 1.1        |
| Not region specific | 0.45        | 0.64        | 11        | 9.9        | 0.08         | 0.64        | 61           | 55.0        | -0.27        | 0.87        | 30         | 27.0       | -0.56        | 1.00        | 9         | 8.1        |
| <b>World</b>        | <b>0.21</b> | <b>0.75</b> | <b>82</b> | <b>4.3</b> | <b>0.19</b>  | <b>0.41</b> | <b>1,149</b> | <b>60.3</b> | <b>-0.23</b> | <b>0.78</b> | <b>579</b> | <b>0.0</b> | <b>-0.09</b> | <b>0.88</b> | <b>97</b> | <b>5.1</b> |

**Table A.3.13 Overall results by type of biotechnology 2008-2009**

|                     | General     |             |           |            | Agricultural |             |            |             | Medical      |             |            |             | Industrial   |             |            |            |
|---------------------|-------------|-------------|-----------|------------|--------------|-------------|------------|-------------|--------------|-------------|------------|-------------|--------------|-------------|------------|------------|
|                     |             |             | Nr        |            | Rating       |             | Nr         |             | Rating       |             | Nr         |             | Rating       |             | Nr         |            |
|                     | S-axis      | T-axis      | N         | in %       | S-axis       | T-axis      | N          | in %        | S-axis       | T-axis      | N          | in %        | S-axis       | T-axis      | N          | in %       |
| Africa              |             |             | 0         | 0.0        | 0.11         | 0.63        | 70         | 94.6        | 0.33         | 1.00        | 3          | 4.1         | 1.00         | 1.00        | 1          | 1.4        |
| Asia                | 0.45        | 1.00        | 11        | 2.8        | 0.20         | 0.35        | 185        | 46.6        | -0.09        | 0.67        | 150        | 37.8        | 0.02         | 0.88        | 51         | 12.8       |
| Europe              | 0.50        | 0.75        | 8         | 1.6        | 0.15         | 0.41        | 262        | 51.0        | -0.38        | 0.88        | 224        | 43.6        | -0.70        | 1.00        | 20         | 3.9        |
| Latin America       | 1.00        | 1.00        | 1         | 1.5        | 0.12         | 0.15        | 52         | 77.6        | 0.33         | 1.00        | 6          | 9.0         | -1.00        | 1.00        | 8          | 11.9       |
| North America       | -0.14       | 1.00        | 7         | 1.2        | -0.11        | 0.61        | 210        | 36.5        | -0.14        | 0.93        | 329        | 57.1        | 0.00         | 0.93        | 30         | 5.2        |
| Oceania             |             |             | 0         | 0.0        | 0.04         | 0.04        | 110        | 78.0        | 0.40         | 0.53        | 30         | 21.3        | 1.00         | 1.00        | 1          | 0.7        |
| Not region specific | -1.00       | 0.33        | 3         | 13.6       | 0.71         | 0.71        | 7          | 31.8        | 0.20         | 0.80        | 10         | 45.5        | 1.00         | 1.00        | 2          | 9.1        |
| <b>World</b>        | <b>0.20</b> | <b>0.87</b> | <b>30</b> | <b>1.7</b> | <b>0.08</b>  | <b>0.40</b> | <b>896</b> | <b>50.0</b> | <b>-0.17</b> | <b>0.85</b> | <b>752</b> | <b>42.0</b> | <b>-0.15</b> | <b>0.93</b> | <b>113</b> | <b>6.3</b> |

Table A.3.14 Overall results by type of biotechnology 2009-2010

|                     | General     |             |           |            | Agricultural |             |              |             | Medical      |             |            |             | Industrial   |             |            |            |
|---------------------|-------------|-------------|-----------|------------|--------------|-------------|--------------|-------------|--------------|-------------|------------|-------------|--------------|-------------|------------|------------|
|                     |             |             | Nr        |            | Rating       |             | Nr           |             | Rating       |             | Nr         |             | Rating       |             | Nr         |            |
|                     | S-axis      | T-axis      | N         | in %       | S-axis       | T-axis      | N            | in %        | S-axis       | T-axis      | N          | in %        | S-axis       | T-axis      | N          | in %       |
| Africa              |             |             | 0         | 1.4        | 0.18         | 0.42        | 66           | 91.7        | 0.00         | 1.00        | 4          | 5.6         | -1.00        | 1.00        | 1          | 1.4        |
| Asia                | 1.00        | 1.00        | 1         | 1.2        | 0.18         | 0.09        | 282          | 68.6        | 0.00         | 0.87        | 94         | 22.9        | -0.13        | 0.87        | 30         | 7.3        |
| Europe              | -0.20       | 0.60        | 5         | 0.0        | 0.23         | 0.39        | 377          | 59.7        | -0.18        | 0.92        | 226        | 35.8        | -0.24        | 0.93        | 29         | 4.6        |
| Latin America       |             |             | 0         | 8.3        | -0.33        | 0.57        | 42           | 70.0        | -0.50        | 1.00        | 4          | 8.3         | -0.33        | 1.00        | 9          | 13.3       |
| North America       | 0.60        | 1.00        | 5         | 0.1        | -0.25        | 0.59        | 386          | 46.6        | 0.04         | 0.89        | 370        | 44.7        | -0.07        | 0.94        | 71         | 8.6        |
| Oceania             | -1.00       | 1.00        | 1         | 1.7        | 0.04         | 0.04        | 96           | 79.3        | 0.00         | 0.73        | 22         | 18.2        | -1.00        | 1.00        | 1          | 0.8        |
| Not region specific | 1.00        | 1.00        | 2         | 0.0        | 0.15         | 0.46        | 52           | 59.1        | 0.24         | 0.82        | 34         | 38.6        | 0.00         | 0.00        | 2          | 2.3        |
| <b>World</b>        | <b>0.29</b> | <b>0.86</b> | <b>14</b> | <b>0.6</b> | <b>0.04</b>  | <b>0.37</b> | <b>1,301</b> | <b>58.8</b> | <b>-0.03</b> | <b>0.89</b> | <b>755</b> | <b>34.1</b> | <b>-0.15</b> | <b>0.92</b> | <b>142</b> | <b>6.4</b> |

Table A.3.15 Overall results by type of biotechnology 2005-2010

|                     | General     |             |            |            | Agricultural |             |              |             | Medical      |             |              |             | Industrial   |             |            |            |
|---------------------|-------------|-------------|------------|------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|------------|------------|
|                     |             |             | Nr         |            | Rating       |             | Nr           |             | Rating       |             | Nr           |             | Rating       |             | Nr         |            |
|                     | S-axis      | T-axis      | N          | in %       | S-axis       | T-axis      | N            | in %        | S-axis       | T-axis      | N            | in %        | S-axis       | T-axis      | N          | in %       |
| Africa              | 0.69        | 0.41        | 26         | 7.9        | 0.32         | 0.43        | 288          | 87.0        | 0.29         | 0.86        | 14           | 4.2         | -0.33        | 1.00        | 3          | 0.9        |
| Asia                | 0.53        | 0.87        | 63         | 3.7        | 0.25         | 0.31        | 1,113        | 65.0        | -0.02        | 0.71        | 419          | 24.5        | -0.01        | 0.86        | 117        | 6.8        |
| Europe              | 0.16        | 0.64        | 90         | 3.5        | 0.24         | 0.35        | 1,487        | 57.6        | -0.27        | 0.77        | 899          | 34.8        | -0.16        | 0.85        | 105        | 4.1        |
| Latin America       | 0.53        | 0.76        | 17         | 5.6        | 0.07         | 0.46        | 232          | 76.8        | 0.34         | 0.59        | 29           | 9.6         | -0.42        | 0.92        | 24         | 7.9        |
| North America       | 0.00        | 0.75        | 79         | 2.7        | -0.13        | 0.59        | 1,268        | 44.0        | -0.07        | 0.78        | 1,359        | 47.1        | 0.02         | 0.82        | 177        | 6.1        |
| Oceania             | -0.25       | 0.50        | 8          | 1.2        | 0.18         | 0.21        | 533          | 80.3        | 0.21         | 0.61        | 117          | 17.6        | 0.00         | 0.67        | 6          | 0.9        |
| Not region specific | 0.50        | 0.61        | 66         | 5.9        | 0.38         | 0.51        | 772          | 68.4        | 0.30         | 0.84        | 234          | 20.7        | 0.64         | 0.43        | 56         | 5.0        |
| <b>World</b>        | <b>0.18</b> | <b>0.72</b> | <b>253</b> | <b>2.6</b> | <b>0.10</b>  | <b>0.38</b> | <b>4,455</b> | <b>46.4</b> | <b>-0.13</b> | <b>0.76</b> | <b>2,872</b> | <b>29.9</b> | <b>-0.18</b> | <b>0.91</b> | <b>404</b> | <b>4.2</b> |