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Media representation of science: How the Philippine press defines biotechnology

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The Philippines is the first and only Asian country to approve genetically modified (GM) Bt corn for commercialization. Even prior to its approval and eventual commercialization, the print media assumed a critical role in providing information about biotechnology and in documenting the scientific process that led to its adoption by farmers. To develop an understanding of the media coverage of modern biotechnology in the Philippines, a ten-year study (2000 to 2009) was conducted to find out how the country's three major national newspapers Manila Bulletin, Philippine Daily Inquirer and Philippine Star defined biotechnology through the use of metaphors. Categorized mostly under fear- and promise domains, metaphors were dominant during the first half of the decade due to uncertainty and unfamiliarity of the technology and the absence of concrete biotech products. An analysis of metaphors showed exaggerated claims and drama initially but a shift towards straight science-based reporting citing authoritative sources was observed over time. This shows the ability of the Philippine press to define accurately and describe the technology. It was able to negotiate meanings with scientists and key stakeholders enabling it to evolve from sensational writing to clear definitions of concepts and processes.

Key words: Media representation of science, metaphor analysis, print media, agricultural biotechnology.

INTRODUCTION

The public relies on the mass media for much of what it knows about science. Hence, it is important to understand the use of newspapers as channels for information dissemination. A meta-analysis of the media's coverage of science shows that Europe and North America accounted for 94.7% of all research. In contrast, empirical studies on Asian countries are "extremely rare" (Schafer, 2010). Yet, developing countries such as the Philippines, China and India are among the mega-biotech countries in Asia or those growing 50,000 ha, or more of genetically modified (GM) or biotech crops. Those planting biotech crops from these countries are part of a record of 14 million farmers in 25 countries that are benefiting from the technology (James, 2010). Similar to

Western countries (Hornig, 2001; Nisbet and Lewinsein, 2002; Marks et al., 2007), the Philippines considers the mass media as the most frequently used source of information on biotechnology by stakeholders (Juanillo, 2003; Torres et al., 2006). An understanding of how the media "defines" biotechnology is therefore crucial. The media sets the agenda and tone for what the public deems interesting or important, and also serves as an important source of informal learning and decision making. It is unlikely that enough critical attention to any given set of issues is given to stimulate public thinking without a certain level of media activity (Hornig, 2003). How the media portrays science in general, and biotechnology in particular can have an adverse impact on public understanding and policy development. Language is a major variable in understanding how people think and act.

The media uses metaphors to communicate or transform complex ideas into what is perceived as "real"

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Table 1. Categories of metaphors used in agri-biotechnology articles.

Category	Description	Example
Potential or promise	Positive images or developments that will affect people in the future	New frontier Sunrise industry
Fear	Negative images about biotechnology and its applications in the future	As real as cancer A monster.
Ethics	Moral issues and ideas that influence values of people	Sacred or divine reality Immoral or sacrilegious
Human intervention	Creation of or transformation into something unnatural or different from its former state	Superweeds Suicide mechanism
Others	Description not among the four categories	Instruction book of life Selling tickets to the Titanic

or familiar and concrete. Metaphors are coherent conceptual systems which allow people to structure and understand abstract experiences (Holmgreen, 2008) based on physical and social experience. For example, in the Western world, the use of the metaphor “Frankenfood” gained wide popularity and became part of the language in biotech debates. It personifies the perceived fear of the unintended and uncontrollable consequences (Devos, 2007) of a technology, thus providing an emotional way to express a perspective on genetically modified foods. Through the use of the metaphor, it gave a name to an issue and provided common ground for debate to occur among stakeholders with different viewpoints. Over time, constant usage of a metaphor loses its heuristic value, and either diminishes its contextual meaning or becomes part of common language. While the analogy may not be scientifically accurate, it provides a point of discourse by both supporters and non-supporters of the technology. Conceptual or cognitive metaphor theory advances the thought that people’s conceptual system plays a central role in defining everyday realities. Linguistic evidence shows that ordinary conceptual system is metaphorical in nature. Lakoff and Johnson (1980) theorize that if our “conceptual system is largely metaphorical, then the way we think, what we experience and what we do every day is very much a matter of metaphor”. Yet while metaphors are effective tools in popularizing science by making familiar the unfamiliar, they often provide only one perspective of an issue by blocking or hiding other viewpoints. In addition, meanings can be ambiguous depending on context and the purpose of the user. As a consequence, how the media uses language to define concepts has wider social and political implications (Hellsten, 2002).

In this study, the relationship between science and media is underscored. It also details the process of negotiating public or popular images of science. While

each system has its own language and culture, the focus on metaphors highlight the interaction necessary to come to a common agreement in meaning and context. By analyzing the use of keywords or descriptors and metaphors, the study looks at how the print media creates public representations of biotechnology in the Philippines, presents the message and popularizes complex technical information. Specifically, it investigates the semantic evolution of the concept of agricultural biotechnology in ten years (2000 to 2009) of media coverage by the top three circulated English newspapers: Manila Bulletin, Philippine Daily Inquirer, and Philippine Star.

METHODS

Articles on modern biotechnology (use of advanced techniques such as cloning, genetic engineering and molecular markers in the development of improved crops) were collected from the top three daily English newspapers: Manila Bulletin, Philippine Daily Inquirer and Philippine Star. These were obtained from three modes: online database search, microfilm file search, and manual scan of articles using the keywords “biotechnology”, “genetic modification” and “genetically engineered”. Lack of a text-based database similar to LexisNexis necessitated alternative modes of data gathering. The articles were content-analyzed in terms of keywords used in titles and text during a decade of reportage on agricultural biotechnology (2000 to 2009). Titles were analyzed separately as readers have a tendency to read only the headlines and thus, how titles present messages is crucial. Metaphors or descriptors in the text were grouped using categories that had conceptual similarities. Metaphors consist of a source domain (exemplified by a category in Table 1) and a target domain (in this study, it refers to biotechnology). Hence, in the statement “biotechnology is a new green revolution of super crops”, the source domain is both a potential or promise (referring to new green revolution) and human intervention (use of word ‘super’ while biotechnology is the target domain). Grouping the metaphors in the study led to the categories similar to those identified by Liakopoulos (2002). Categories were then grouped by key time periods to delineate crucial phases or transitions in biotechnology research and development, commercialization and debate.

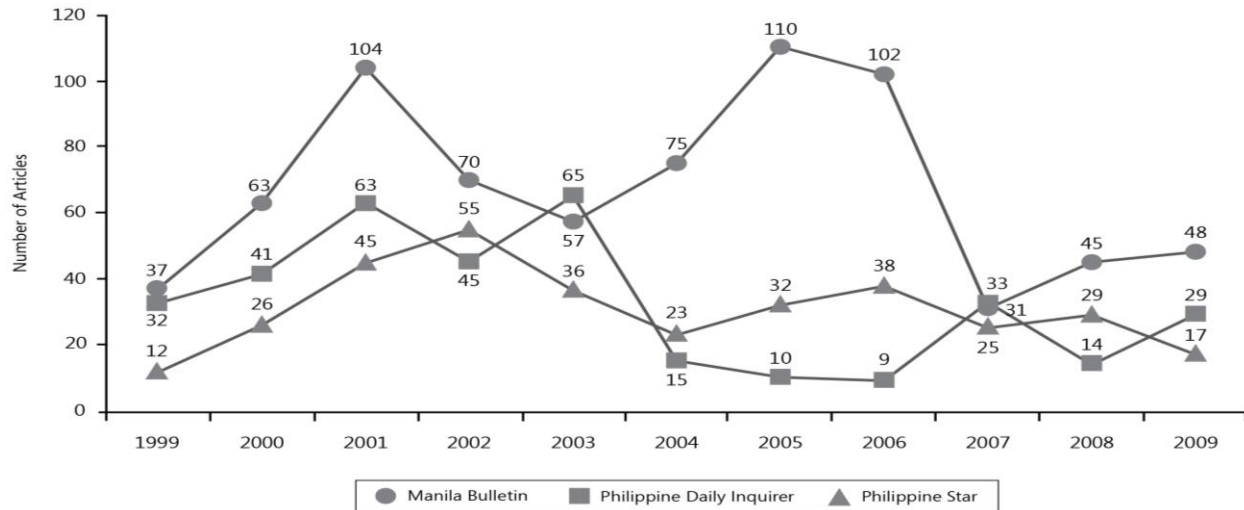


Figure 1. Comparative number of articles published yearly by the top three Philippine newspapers, 2000 to 2009.

Metaphors were also grouped into negative and positive categories to distinguish the different representations used by the media over time. To determine the frequency in the use of a keyword, a tag cloud was developed using the Tagxedo creator, an online application. The tag cloud is a visual representation of the frequency of keywords used in a body of text. The keyword with the highest word count has the largest font size and the least repeated word has the smallest font size (Tagxedo.com, 2010).

RESULTS AND DISCUSSION

The top three newspapers published a total of 1,355 articles on modern crop biotechnology during a 10-year period or a yearly average of 136 articles (Figure 1). Manila Bulletin (MB) published 52% of all articles, with the Philippine Daily Inquirer (PDI) accounting for 24% and Philippine Star (PS) with 24%. MB has a dedicated section for agriculture and a business feature page, PDI has a science and technology page, while PS has agriculture and science and technology sections. Most of the articles were published in these sections although 22 stories were in the front page of the newspapers or 2% of all articles. Articles that landed in the front page were stories about new biotech crops such as Golden rice, Bt corn, and drought-tolerant rice and related research breakthroughs. Other news dealt with the hunger strike against the planting of Bt corn, entry of GM rice from the U.S. and an alleged health issue against Bt corn. A total of 559 articles or 41.3% were positive while 528 articles were neutral (38.9%) in tone. Only about 268 or 19.8% were negative in stance. PS and MB had the most number of positive articles (48 and 43%, respectively). Positive articles were exemplified by stories on the benefits of the technology, farmers' experiences with growing biotech crops, and government support to biotech research and development initiatives.

Negative articles focused on perceived health and environmental problems arising from the use of the technology.

Headlines/article titles

Headlines or titles summarize the gist of a news item and provide crucial impression on whether a prospective reader will continue to read the body of the article. Generally, people tend to read headline copy more than the rest of the article. An analysis of the top three newspapers showed that the most-used keyword in headline copy was "biotechnology/biotech" (48.3%) and "genetic modification" (GM) at 35.8%. Figure 2 shows the tag cloud of the most frequently used keyword in titles. Other keywords that appeared although in insignificant numbers were the following: "Golden rice", "genetically engineered", "mutant", "gene-altered", "genetic crops", "engineered" and "super rice". The term "mutant" appeared only in 2000 and was hardly used after this period. It was only in the first period that writers coined various terms to refer to biotech crops. Terms to identify new varieties of rice for example were "Golden rice", "vitamin rich rice", "miracle rice", "genetically improved rice", "super rice" and "mutant rice". Towards the second half of the decade, writers were more specific about the biotech crops they were writing about, that is, Bt corn, pest resistant corn, herbicide tolerant corn and drought resistant corn. This can be attributed to information supplied by research and development organizations regarding local scientific initiatives that zero in on the possibility of new biotech crops in the market.

The first biotech crop, Bt corn was approved in 2003 and other research efforts were actively pursued after this period.



Figure 2. Tag clouds of frequently used key words in article titles (left) and article (right), 2000 to 2009. Key: biotech, biotechnology, engineered, gene-altered products, genetically engineered, genetically improved, genetic crops. GM, GMO, golden rice, mutant, super rice and transgenic.

Text /article body

A tag cloud was also developed for keywords commonly used in the text of articles (Figure 2). Similar to the headline, article text was dominated by the keywords “GM organism”, “biotechnology”, “genetically engineered”, “transgenic”, “genetically-altered” and “genetically improved”. Definitions of these terms were given only during the first period after which writers assumed that “biotechnology” and “GM” were already part of conventional language. After the first half of the decade, writers preferred “biotechnology” and “GMO” using them interchangeably. This finding is similar to Steiner and Bird (2008) observation that American reporters self-consciously considered word choice. Preference was for “genetic engineering” and “GMO”, the latter being perceived as neutral. Reporters used a combination of terms.

Use of metaphors

Metaphor categorization

Metaphors used in the body were categorized by dominant domain used during the period. Figure 3 shows the comparative use of the metaphor domain by the three newspapers over a ten-year period. Most-used category, particularly during the first half of the decade was the fear domain. Articles that had metaphors that used negative images about biotechnology and its applications in the future accounted for 51%. These metaphors attempt to project the perceived negative side of the technology by inferring that it causes cancer, homosexuality, physical deformities and mental retardation. Examples of these metaphors are:

- i) “An infamous cancer-causing progeny of science” (MB, 2000).
- ii) “As real as cancer” (MB, 2001).
- iii) “Millions of dead bodies and sick children, physical deformities and disease cluster... can cause homosexuality and mental retardation” (MB, 2002).
- iv) “GMOs are a threat” (PDI, 2000).
- v) “Slow, silent poisoning” (PS, 2002).

Other examples of fear domain are the use of allusions to scary creatures or products as shown by the following examples:

- i) “A monster, a nightmare for everyone who eats its products...a poisoned apple that Snow White bit... a web that trapped the innocent fly into the spider’s snout” (MB, 2002).
- ii) “Monster that utilizes traits from bacteria to produce crops” (MB, 2004).
- iii) “Frankenfood” (MB, 2003; PDI, 2003; PS, 2002).
- iv) “Biological time bomb” (PDI, 2003).
- v) “Biological polluting genetic mutants” (PDI, 2007).
- vi) “Trojan horse” (PS, 2002).
- vii) “Poison bearing seeds” (PS, 2003).

In most of the examples, biotechnology is compared to a monster or mutant to drive home the point that the technology is a personification of fear and should be avoided. The fear domain was used extensively during the first period when biotechnology was a new topic at a time of uncertainty and abstractness, there was no concrete biotech product in the market and reference was made to articles from foreign media sources. Hence, associations that distort social representation of an innovation can produce a powerful negative image. It is

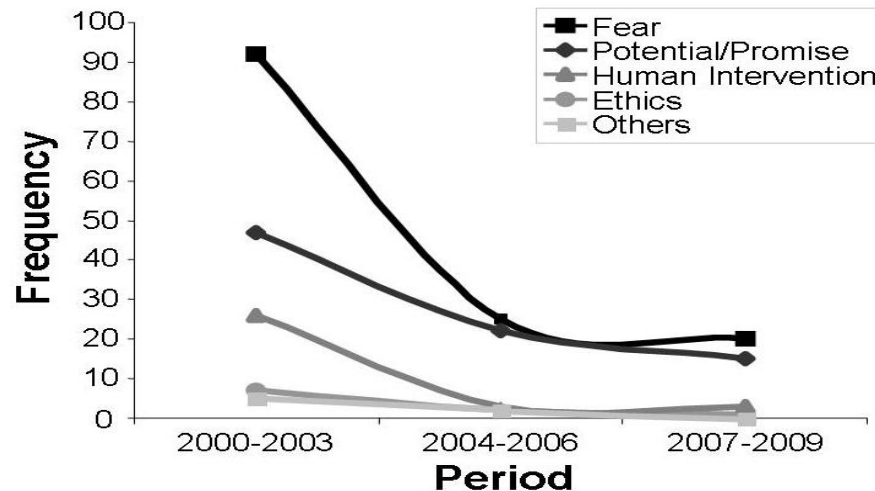


Figure 3. Comparative use of metaphor domains by the top three Philippine newspapers during specific time periods, 2000-2009.

worth noting, however, that the use of fear domain significantly decreased towards the second half of the decade, although among the categories it continues to be used more than others. Philippine media mirrored the western media in its frequent allusion to Frankenstein's creation that led to the popular use of "Frankenfood" (Figure 4). The country has indigenous mythical creatures, for example "manananggal" or vampire, but which were not used by writers to symbolize fear of the unknown. In contrast, the Frankensteinian views have been important in shaping government policy (Holmgreen, 2008). Reference to monsters, the Trojan horse, and mutants could have possibly been influenced by foreign articles that used these terms and were subsequently picked up by the local media. However, its use was not sustained over time. The second most-used category is 'potential or promise', which comprised 31%. It equates biotechnology with positive images or developments. It suggests the possibility of important changes with infinite though vague potentials.

The end point of development is perceived to be economic in orientation with the possibility of an improved economy and growth in specific sectors such as agriculture. In another vein, the technology being the be all and end all in terms of a solution is manifested in the use of the words "salvation" and "savior". More than 56% of metaphors used this domain during the first period and gradually tapered off in the next two stages. Examples of these metaphors are:

- i) "New frontier for the wobbling Philippine economy (MB, 2004).
- ii) "Sunrise industry of the millennium" (MB, 2006; PS, 2005).
- iii) "New wave in agriculture (PDI, 2000).
- iv) "Salvation of the poor (PDI, 2000).

- v) "Savior for the starving masses" (PDI, 2000).
- vi) "Future growth engine" (PS, 2002).

The use of this metaphor category was at its peak in the first period when the technology had very little applications and was not yet being commercialized widely. Biotechnology as a profitable enterprise, source of wealth, as well as the solution to major human problems, that is food security and economic progress, were popular images portrayed in the media. However, the future-scenario perspective of this metaphor declined over time as real products were introduced in the global market. Hence, it was easier to present tangible products without resorting to metaphorical representations of objects.

The category on 'human intervention' merited 11.85%. Metaphors emphasize the intercession of the scientific process (from biotechnology) resulting in what was perceived as an unnatural product. Such metaphors are exemplified by the following:

- i) "Superweeds" (MB, 2003; PS, 2002).
- ii) "Suicide mechanism for seeds of the next generation" (MB, 2006).
- iii) "Messing with nature" (MB, 2008).
- iv) "Assault on nature" (PDI, 2000).
- v) "Quick fix or a silver bullet" (PDI, 2001; PS, 2001).
- vi) "Blasting slivers of metal into an innocent soybean plant, subjecting stalks of defenseless corn to doses of high-voltage electricity" (PDI, 2001).
- vii) "Mad scientist playing with Filipino consumers as their experimental rat" (PDI, 2001).
- viii) "Tinkering with genes" (PDI, 2003).
- ix) "Humans tinkering with its biological integrity" (PDI, 2006)
- x) "Genetic colonialism" (PS, 2005).



Figure 4. Cloud tag of negative metaphors associated with biotechnology by top three Philippine newspapers, 2000 to 2009. Key: Alien genes, bioweapon, cancer, contamination, experimental food, fools gold, Frankenfood, genetic pollution, monster, mutant food, pacman larvae, plague, poison, poisoned apple, suicide mechanism, superweeds, terminator technology, time bomb, total disaster and Trojan horse.

Science and technology as a supernatural process that goes beyond natural order was used 81% in the first period and was used with less frequency in the next two stages. Reference is made to perceived outcomes such as “superweeds” and “seeds with suicide mechanisms” as well as “mad” scientists tinkering with nature or genes. Results are similar to that of Christidou et al. (2004) where this domain was applied to genetics and biotechnology but not to natural sciences and space science and astronomy. The science of biotechnology was represented by new, mysterious and unknown territories that had to be explained by perceived technological or human interventions that allowed the extension of the frontiers of knowledge. Giving perceived special powers to science and technology fuels speculations and focuses on the unknown. Uncontrollability associated with modern technologies is also suggested by the human intervention domain. The direction for biotechnology is thus negative and suggests inherent risk, instability, and absence of regulations and safety considerations. Ethics is another metaphor category that was used but less than 9% of the time. This encompasses references to moral values and dictates what is perceived as right and wrong.

The moral acceptability of the technology of man’s interference with his natural environment has been part of the biotech debate. Examples include:

- i) “Sacred or divine reality that man must leave alone” (MB, 2005).
- ii) “Ungodly ideology” (MB, 2006).

- iii) “Immoral or sacrilegious” (PDI, 2000).

The use of metaphors in these examples highlights the perception that the technology is morally wrong. The combination of fear and ethical domains suggest the need to leave nature to its natural evolution. However, the use of these metaphors was not as dominant as the use of the promise and fear domains suggesting that a value-laden perspective is not a popular story angle.

Metaphor groupings

Metaphors use associative images of biotechnology or biotech-object associations. They define the field through objects that the media and the public can relate to. By clustering metaphors, two distinct categories can be deduced. One is composed of positive images exemplified by the use of the following descriptors: “new frontier”, “sunrise industry”, “new wave” that denote a positive yet vague endpoint for the technology. Use of words such as “salvation”, and “savior” as well as “revolution”, “economic evolution”, “boon to mankind” and “engine growth” suggest a drastic change or improvement due to the technology. The other category consists of negative images (Figure 4). Examples of word associations are the following: “Frankenfood,” “cancer”, “poison”, “monster”, “time bomb”, “mutant”, “bioweapon”, and word phrases include “Trojan horse”, “terminator technology”, “genetic pollution”, “agricultural asylum”, “trapped the innocent fly”. The negative images aim to

poisoned apple that Snow White bit” and “web that generate intense emotion by associating biotechnology with fear and uncertainty and resulting in harmful consequences. The use of metaphors declined through the years suggesting a shift in writing style that stressed a less sensational perspective. Media reporting of biotechnology apparently became more accurate and highlighted a scientific angle. This is consistent with the findings of Caulfield (2004) which noted accuracy over time in the media coverage of science and a strong preference for positive messages.

CONCLUSIONS/IMPLICATIONS

The literature on media coverage of science in general and biotechnology in particular is glaringly sparse in Asian countries where four of the mega-biotech countries are located. The study thus provided an insight into how the Philippine media structures and organizes information, and transforms complex ideas into understandable chunks through the use of language. It is important to note that the Asian media is expected to play a crucial role in providing valuable information that will contribute to national development (Jabbar, 2008). The use of keywords in titles and body of articles suggest media's familiarity with terminology such as biotechnology and genetic modification. After defining these terms during the first few years of media coverage, subsequent articles considered them as part of media vocabulary. Initial attempts to use related terms such as “genetically engineered”, “gene altered”, and “engineered” did not gain interest from the media. Metaphors were used in the first half of the decade at a period when there was much uncertainty and absence of tangible products and stakeholder involvement in the science. The dominant domains were fear and promise, suggesting an unclear, unfamiliar territory that needed to be explained through speculation and drama. However, there was a shift in the use of these metaphors towards the second half of the decade. The trend was towards less exaggerated claims and scenarios to articles that cited authoritative sources and straight news reporting. Philippine media was able to rise from the use of exaggerated claims, speculation and sensationalism exemplified by the use of fear and promise domains. The negativity in the first decade of news writing on biotechnology was offset by an abrupt decline suggesting writers' ability to shift modes to one based on science-based information. At this stage, writers were able to negotiate meanings with authoritative sources thus coming up with clearer discussions of scientific perspectives. Liakopoulos (2002) observes that metaphors change course over time and reflect actors' efforts at popularizing the technology. As Ryall (2008) notes, the picture of genetic technology for instance should not arise “purely as a consequence of being

bewitched though our language.” In like manner, scientists and media practitioners need to deliberately develop a shared culture by which science information is negotiated for public consumption. This scenario will enable both actors to maintain interpretative control and in constructing reality based on shared meanings. As with any metaphor, word choices are dependent on appropriateness and timeliness of their use and function. With more concise definitions and examples, certain metaphors lose their appeal but can resurface at other time periods. As shown in the study, many metaphors commonly used during the first half of the decade were no longer used in the next few years. This can be attributed to the decrease in the novelty or a growing familiarity and understanding of scientific concepts. As an example, reference to biotechnology as being a “monster” or a “mutant” has died a natural death although such representations were very popular during the initial years of biotech reporting. This observation is important in understanding the direction of the biotech debate and may contribute to understanding the future for media reporting on science in general and biotechnology in particular.

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