CHAPTER FOUR

4.0 BIOTECHNOLOGY COMMUNICATIONS STRATEGIES AND PRACTICES IN MALAYSIA

This chapter discusses the role of the various biotechnology communicators in Malaysia, namely scientists, media, policymakers, public affairs officers at research institutes, non-research organizations, religious authorities, and teachers. The activities carried out by these groups are identified in terms of their target audience, objectives, areas covered, impact and success of the activities, challenges and constraints faced, and how these are overcome. The role religious scholars could play in communicating biotechnology is also discussed. The data obtained from the various biotechnology communicators is then compared with the communication strategies practiced in the other countries (UK, USA, Australia, Philippines and Singapore) and the data obtained from the survey conducted with the public that is discussed in the next two chapters.

4.1 MEDIA

The mass media comprise the principal arena where policy-relevant issues come to the attention of decision makers, interest groups, and the public. Not only do the media influence the attention of competing political actors and the public, but the media also powerfully shape how policy issues related to biotechnology are defined and symbolised (Nisbet and Lewenstein, 2002). Mass media are important sources for news about science and technology due to their vast ability to reach out to the public and it plays a critical role in the dissemination of scientific and health-related information (Malone et. al., 2000). According to Nelkin (1995), media is the main source for many people to obtain information on rapidly changing and advancing scientific and technical fields and on how they impact their lives. Juanillo (2003) and Metcalfe and Gascoigne (1995) stated that media has a strong influence in shaping public opinion on science and

biotechnology. It should therefore be very crucial for mass media to play a role in raising the science literacy rate among the populace.

To gauge the media involvement in communicating science, six mainstream newspapers were monitored for science news over a period of three months. This study raised pertinent questions that provided crucial information to achieve the objectives of this research.

Question 1: What has been the media attitude towards news on biotechnology?

Question 2: Which area of science receives the most attention from the media? Is this parallel to public interest?

Question 3: What was the involvement of local scientists in these news or articles and how much of interaction took place between the journalists and the scientists in producing these articles?

Thus, this study seeks to analyse if there is a discord between media coverage of biotechnology issues, and public interest, and the implications if there is any.

Table 4.0: The language, readership and existence of science desks in each of the newspaper studied in this research.

Newspaper	**Language**	**Readership***	**Science desk**
New Straits Times	English	399,195 (Daily) 513,990 (Sunday)	No
The Star	English	1,292,095 (Daily) 1,383,010 (Sunday)	Environment beat
Utusan Malaysia	Malay	789,155 (Daily) 1,845,885 (Sunday)	Yes
Berita Harian	Malay	652,805 (Daily) 1,091,030 (Sunday)	No
Tamil Nesan	Tamil	135,000 (Daily) 350,000 (Sunday)	No
Makkal Osai	Tamil	190,000 (Daily) 360,000 (Sunday)	No

*Nielsen Media Index, Jan – Dec 2010
Audit Bureau of Circulation, 2010

Table 4.1: Journalists and editors involved in the in-depth interview

Newspaper	Names	Position
New Straits Times	Theresa Manavalan Jasbeer Singh	Editor Former journalist
The Star	Natalie Heng Lim Wey Wen	Journalist Journalist
Utusan Malaysia	Khairunisa Sulaiman	Journalist
Berita Harian	Mohamad Zin Ali	Journalist
The Sun	Joseph Masilamany	Sub-editor

4.1.1 Frequency of Science News and Articles in Mainstream Newspaper

This section discusses the frequency of science news in the six newspapers that is monitored during the study, the different fields published and source of information for journalists.

Table 4.2: Number of science news in six local mainstream newspapers (Jan 2009 – March 2009)

	Total science news	Frequency (news/month)
New Strait Times	95	31.67
The Star	82	30.85
Utusan Malaysia	73	24.33
Berita Harian	52	17.33
Tamil Nesan	20	6.67
Makkal Osai	6	2.00
Total	**328**	**109.33**

Table 4.3: Number of science news by fields in six local mainstream newspapers (Jan 2009- March 2009)

	Agri	%	Biodiv	%	Biotech	%
New Strait Times	0	0	2	2.1	6	6.3
The Star	1	1.2	1	1.2	1	1.2
Utusan Malaysia	4	5.4	3	4.1	7	9.5
Berita Harian	5	6.85	2	2.74	2	2.74
Tamil Nesan	0	0	0	0	0	0
Makkal Osai	1	16.7	0	0	0	0
Total	**11**	**0.03**	**8**	**2.43**	**16**	**4.86**

Table 4.3a: Number of science news by fields in six local mainstream newspapers (Jan 2009- March 2009)

	Env	%	Health & Medical	%
New Strait Times	7	7.4	59	62.1
The Star	1	1.2	71	86.6
Utusan Malaysia	0	0	46	62.2
Berita Harian	0	0	29	39.73
Tamil Nesan	0	0	16	80.0
Makkal Osai	0	0	1	16.7
Total	**8**	**2.43**	**222**	**67.5**

Table 4.3b: Number of science news by fields in six local mainstream newspapers (Jan 2009- March 2009)

	Nutri	%	Space	%	Others	%
New Strait Times	1	1.1	8	8.4	12	12.6
The Star	4	4.9	2	2.4	1	4.9
Utusan Malaysia	0	0	4	5.4	9	12.2
Berita Harian	0	0	1	1.37	13	17.81
Tamil Nesan	0	0	3	15	1	5.0
Makkal Osai	0	0	3	50	1	16.7
Total	**5**	**1.52**	**21**	**6.38**	**37**	**11.25**

Note: The % is percentage of the field of the total science news in the individual newspaper.
Agri = agriculture, Biodiv = biodiversity, Biotech = biotechnology, Env = environment, Nutri = nutrition.

Table 4.4: Number of science news in four mainstream newspapers on days with special science pull-outs

Newspaper	Regular days	Pull-out days	Total	% on pull-out
The Straits Times	16	79	95	83.16
The Star	14	68	82	82.93
Utusan Malaysia	4	69	73	94.52
Berita Harian	10	42	52	80.77

Note: Pull out days: The Straits Times (Sunday, Tuesday); The Star (Sunday); Utusan Malaysia (Sunday, Tuesday, Wednesday, Thursday, Friday); Berita Harian (Sunday, Thursday)

Table 4.5: Holsti's Intercoder Reliability Coefficient for the different fields of news articles in six local mainstream newspaper (Jan 2009 – March 2009)

News Categories	Holsti's Intercoder Reliability Coefficient
Agriculture	0.76
Biodiversity	1.00
Biotechnology	0.81
Environment	0.85
Health & Medicine	0.74
Nutrition	0.79
Space	1.00
Others	0.87

Table 4.6: Number of articles on H1N1 in four local mainstream newspaper (May 2009 – July 2009)

Newspapers	Number of articles	Frequency (news/month)
New Straits Times	1147	382.33
The Star	776	258.67
Utusan Malaysia	948	316.00
Berita Harian	1129	376.33

The Star is Malaysia's most widely read English newspaper with a readership of 1,292,095 (daily) and 1,383,010 (Sundays). *The New Straits Times* with a readership of 399,195 (daily) and 513,990 (Sundays) is the number two English newspaper in Malaysia. Both these newspapers neither have a science desk nor journalists trained in science who are specially assigned to cover science news. Science news is covered by feature journalists on a needs basis. *Utusan Malaysia* is the top Malay newspaper with a readership of 789,155 (daily) and 1,845,855 (Sundays). Unlike the two main English dailies, *Utusan Malaysia* is the only newspaper in Malaysia with a science desk where journalists are specifically assigned to science news and they also have a basic degree in science. *Berita Harian* is the number two Malay daily with a readership of 652,805 (daily) and 1,091,030 (Sundays). Like *the News Straits Times* and *The Star*, *Berita Harian* also does not have a science desk and science news is covered by feature journalists. The significance of having a science desk is discussed later in this Chapter. *Tamil Nesan* with the readership of 135,000 (daily) and 350,000 (Sundays) do not have a science desk and this is also the case for *Makkal Osai* which has a readership of 190,000 (daily) and 360,000 (Sundays)

From Table 4.2, *the New Straits Times* and *The Star* top the list with the most number of science articles during the study period. However, compared to *Utusan Malaysia*, science news gets prominence on the days the newspapers have special sections devoted to science or health. In the case of *the New Straits Times* there are more science articles on Sundays and Tuesdays where a special section is dedicated to health and science. 83.16 per cent of the total science news for the period of three months is published in the Health sections on Sundays and Tuesdays. The other 16.84 per cent is spread on other days in the week. The frequency of science articles in *The Star* shows similar trend as in *the New Straits Times* where major peaks are observed only on the

days with special sections dedicated for science sections. Science news is published under the Fit for Life section on Sundays in *The Star* and less than 20 per cent of science news is published on other days in this newspaper.

Among all the newspapers studied, *Utusan Malaysia* has quite a steady coverage on science. Throughout the week, *Utusan Malaysia* has several sections dedicated to science. The special sections are as follows: Sundays (Health), Tuesdays (Mode), Wednesdays (Campus and Mode), Thursdays (Science, Megabait, and Focus), and Fridays (Biotechnology and Agro). These sections coupled with the presence of science desk where science journalists only cover science news result in a better spread of science articles throughout the week compared to the other newspapers, despite a lower number of science news. The quality of articles and the content will be discussed in this Chapter in the following sections based on the research questions. There are clear absence of science coverage throughout the week in *the News Straits Times*, *The Star* and *Berita Harian*, where less than 20 per cent of science news is published on days without science pull-outs. This is reflected in Table 4.4. *Berita Harian* has a health section on Sundays where major peaks on science news are observed. Science news is also covered under its Education section on Thursdays, where research work at local universities is given some prominence. Nevertheless, *Berita Harian* has the lowest news on science compared to the other three English and Malay newspapers.

However, the lowest number of science articles is in the Tamil newspapers, *Makkal Osai* and *Tamil Nesan*. Both newspapers only publish science articles on Sundays and this too very scarcely under their medical columns. The two Tamil dailies too do not have science desks and do not have special sections dedicated for science and science-related news. Besides the absence of a science desk, the other main constraint could also

be space, as the Tamil dailies have far fewer pages compared to other language newspapers. Between the two Tamil dailies, *Tamil Nesan* fared better with 20 science articles compared to only six in *Makkal Osai* during the 3-month study period.

To answer the second research question as to which area of science receives the most attention from the media, science news articles that appeared during the period of study were distinguished between several science domains. They were categorised into: agriculture, biodiversity, biotechnology, environment, health & medicine, nutrition and space. News that does not fall into any of these categories was classified as "others". Though biotechnology encompasses all the above mentioned fields, the articles that appeared did not strictly fall within the definition used for "biotechnology" in this study. For example, health & medical articles were basically explaining healthcare, nutraceuticals, diseases, diagnosis, symptoms, prevention, and drugs. Whereas, articles on agriculture were on farming; and nutrition had a focus on balanced diets. Biodiversity, space, and environment hardly dealt with biotechnology as well. As defined earlier in the Introduction, biotechnology should involve techniques that use a biological entity to produce or modify products for a specific purpose. None of the articles in the other sectors fitted this definition.

The distribution of the news articles based on science for the six newspapers is reflected in Tables 4.3, 4.3a and 4.3b. The results show a common trend among all the English and Malay newspapers, where health and medical news were given dominant emphasis. Although science news in *The Star* is also dominated by health and medical articles, the percentage is much higher compared to the other English and Malay dailies. *The Star* tops the list where health and medical accounts for 86 per cent of science news. Since health and medical news takes up the bulk of science space of this newspaper, other

science domains are not equally covered in *The Star*. Distribution of science articles in *the New Straits Times*, *Utusan Malaysia*, *and Berita Harian* were relatively similar where combined health and medical news accounted for 39 and 62 per cent of the total science articles respectively. *Utusan Malaysia* and *the New Straits Times* were the top among the three with 62 per cent of combined health and medical articles; followed by *Berita Harian* with 39 per cent.

The coverage of other science domains in these newspapers did not show any similar trends, where each newspaper gave prominence to different domains. "Other" news, which was a combination of all science articles that did not fall into any of the said domains, made up 12.6 per cent of science articles in *the New Straits Times* followed by space (8.4%), environment (7.4%), biotechnology (6.3%), biodiversity (2.1%), and nutrition (1.1%). Agriculture was not covered at all by this newspaper. Nutrition and "other" news took up 4.9 per cent of the coverage in *The Star*, followed by space (2.4%), and agriculture, biotechnology, environment, and biodiversity shared the same space with one percent each. Whereas in *Utusan Malaysia*, "other" news received the second most attention after health and medical (12.2%), followed by biotechnology (9.5%). Space and agriculture enjoyed the same prominence with 5.4 per cent. Biodiversity took up 4.1 per cent of the science coverage, whereas nutrition was not covered at all by *Utusan Malaysia*. "Other" news came second for Utusan Malaysia as a combination of various science fields.

Compared to all other newspapers, *Utusan Malaysia* gave the most attention to biotechnology news, and this explained the existence of a science desk in the newspaper with journalists trained in science, who understood the government's biotechnology policies. This is similar to what was reported by Samani et. al. (2011) where *Utusan*

Malaysia has the highest frequency of biotechnology news. *Berita Harian* gave prominence to agriculture (6.85%) and this was followed by biotechnology and biodiversity (2.74%), and space (1.37%). 'Other' news took up 17.87 per cent in *Berita Harian*.

Although *Tamil Nesan* also shares the same trend as the Malay and English newspapers with medical and health news dominating the science coverage (75%), the high percentage is due to the fact that there is a relatively a small number of science news in this newspaper. However, it is relevant to notice that the majority of the newspapers gave prominent coverage to medical and health news. Space (15%) and other news (5 %) took up the rest of science space in *Tamil Nesan*. It is interesting to note that the science articles in *Makkal Osai* were predominantly on space (30%), followed by health and medical, agriculture and 'other' domains which all took 16.7 per cent each.

A number of previous studies have been conducted on content analysis of science articles in the media based on the different domains covered. Hansen and Dickinson (1992) studied the British media where they found health/medicine news dominated science coverage (34.9% of total coverage). Bucchi and Mazzolini (2003), in their research on the influential Italian newspaper, *Il Corriere della Sera* confirmed this. They analysed scientific articles from 1946 to 1997, and found that 52.7 per cent concerned biology and medicine. Bauer (1998) also mentioned the domination of biomedical news in the British media. Hijmans et. al. (2003) studied coverage of research papers in Dutch newspapers, and reported similar observation, with medical coverage again dominating, at 32 per cent of coverage. It is clearly a global trend for print media to give more prominence to health and medical news and the Malaysian media is not an exception.

All journalists interviewed in this study agreed that medical and health news is top priority among science news as it is the most relevant topic for the general public. Chua Yew Kay, the deputy editor of *The Star* explained that *The Star* is more focused on the development of society's mind through newspaper reading, but feels biotechnology is not an issue or topic they feel is important to be reported to the reader (Samani, et. al., 2011). Jasbeer Singh, a former journalist with *the New Straits Times*, lamented on the lack of concerted effort by the editors to develop a pool of science journalists. According to him the major challenge is to have writers with sufficient science background and training to translate scientific articles into simple language. However, journalists are not keen to attend science communication workshops. All journalists interviewed expect scientists to sharpen their skills in communicating biotechnology and their ability to interact with journalists. Tight schedules at work were pointed out as the main reason for this reluctance. Editors do not send journalists for training workshops if they do not translate into news articles the next day.

The 'issue-attention cycle', as described by Brossard and Shanahan (2007) is very true in the case of Malaysian media, where editors show more interest in science during time of crisis or when there were high-profile cases of public interest. To demonstrate this, a search was done in four newspapers; *The New Straits Times, The Star, Utusan Malaysia,* and *Berita Harian* using "H1N1" as a keyword during the height of the pandemic. This was carried out at the database libraries of the said newspapers. Table 4.6 shows the search results. Articles on H1N1 during this period (1st May 2009 – 31st July 2009) were not just confined to one section of the newspapers, but were spread from the main page to health, sports, leisure and business pages as the pandemic had an impact in all these areas. The frequency of H1N1 news peaked and was between 258 and 383 per month. This is exclusive of other science news covered during this period.

Joseph Masilamany (sub-editor, *The Sun*) said newspapers were in a competitive mode to publish the best articles in terms of information and graphics. Press conferences were organised everyday by the Ministry of Health and editors assigned more journalists to cover news related to H1N1. Scientists became an instant source of information and referral point for journalists. Various articles on virology and related subjects appeared more frequently in all newspapers. According to Theresa Manavalan (editor, *the New Straits Times*) and Joseph Masilamany, science-savvy writers are sought after by editors only when a science-related crisis becomes a national topic.

Nisbet and Lewenstein (2002) echoed the same observation made by Brossard and Shanahan (2007), saying that media attention to biotechnology is rarely distributed equally across time; instead it has been episodic and clustered around key events. They observed that several articles could appear in one edition of *the New York Times*, or several articles could appear across just a few days or a period of a few weeks. This was the case following the 1997 Dolly announcement (the first cloned sheep) where this event was high on the media's agenda in comparison to other newsworthy items. News organisations became very fascinated with the cloning of Dolly and news on this breakthrough research took up spaces within science, technology, and business sections covering the development of recombinant DNA (leading to gene-splicing and genetic engineering applications), the formation of Genentech, which is considered to be the founder of biotechnology industry, and the allocation of federal funds by the Department of Energy for the Human Genome Initiative. Articles explaining DNA, the methods of extracting it and fingerprinting, became a main focus only when there is high-profile murder cases or other criminal cases. Theresa Manavalan says science coverage in the media is issue-centric. They are editor-managed but not editor-driven. The prominence given to science depends on consumer behaviour. Readers' interest on

a current topic lasts for an average eight weeks. For example, stories on the nuclear meltdown in Fukushima after the tsunami in Japan in 2011 died off after week eight.

Using both Nisbet and Lewenstein's (2002), and Brossard and Shanahan's (2007) observation, the scarcity of science news on local media could be explained by the lack of a major science story during the study period. Theresa Manavalan of *the New Straits Times* confirmed that there were hardly any breakthrough events in the local biotechnology industry, from both the public and the private sector. According to both Mohamad Zin Ali (journalist, *Berita Harian*) and Lim Wey Wen (journalist, *The Star*), science news is also disadvantaged by the fact that many scientists are not able to relate the news worthiness of their research, and much research that is carried out by local scientists is not considered newsworthy by editors. This was echoed by Theresa Manavalan who said scientists want media coverage and support for their research but are unable to provide the salient points and relevance to the readers. Scientists expect journalists to tweak their research to fit readers' interest. Another point agreed unanimously by all journalists and editors interviewed was that a lack of understanding of technical terms by general journalists, or an ability to translate research work into laymen language.

In spite of the importance accorded to biotechnology and agriculture by the Government of Malaysia, these domains do not dominate media space compared to health, medical and even space news. A key reason for this is the news values used by media professionals who select the news. An analysis of news values explains why some domains receive more attention than others. Hansen (1994) in a study on journalistic practices in the British press showed that specialist journalists used conventional news value criteria and emphasised the importance of "relevance to the reader" criterion in

the selection of science news. This explains the domination of medical and health news in local dailies. Medical and health news are seen as more directly related to the everyday lives of the general public. All journalists and editors interviewed agreed that medical and health news is the most relevant science topic to the public. Theresa Manavalan also said that health pages attract advertisers compared to other science pages where advertisers were reluctant to place their advertisements.

Only *Utusan Malaysia* demonstrated a balance in covering science news. Though, medical and health still dominated its space, other domains receives almost equal attention. Agriculture, biotechnology, biodiversity, and 'other' domains were quite equally covered.

Nutrition was the second favourite domain in *The Star* and the 'relevance to the reader' theory could also be attributed to this. Like medical and health news, nutrition was also seen as very relevant to the readers' lives, and enjoyed a wide readership compared to news on biotechnology, space, agriculture, biodiversity and environment. The perception of media news values will be compared to the interests of the public later in Chapter 6.

The other factors that explain favourite domains covered by the media are, according to Clark and Illman (2006): interests, experience level of journalists and editors, the need to attract the "right sort" of audience, as well as events and trends within the sphere of science and technology. Although biotechnology and agriculture is accorded top priority in the National Biotechnology Policy, the media coverage does not reflect this, where medical and health news dominate science pages. Stringer and Thomson (1999) reported similar view where agricultural news is often neglected topic in the American

mass media, in spite of it being important to America's economic, environmental, and cultural growth. Various factors could be contributing to this.

4.1.2 Source of Information and Interaction between Journalists and Scientists

This section answers the third research question: What was the involvement of local scientists in these news or articles and how much of interaction took place between the journalists and the scientists in producing these articles?

Both journalists and editors are faced with the task of translating scientific information into an appealing story (Hijmans et. al. 2003) as most research reports are very detailed and replete with scientific jargon, while reporters and editors have limited time and space at their disposal (Gunter et. al. 1999; Postgate, 1995). This serves as a major constraint for journalists to repackage research news into laymen terms and make it attractive to readers. Instead, the media tends to take short cuts by just sourcing news from foreign news portals and reproducing them without the need to repackage them. With the lack of science writers and a dedicated science desk in all newspapers except for *Utusan Malaysia*, the newspapers studied did not take efforts to interview scientists or industry players. These two groups were not the main source of science news for most newspapers. This is discussed in more detail below, looking at the source of information for all the newspapers. However, since there was no past literature addressing the sources of science news for journalists, this section lacks comparisons to previous studies.

Science news articles that appeared in the six newspapers studied were categorised according to the following: foreign news (completely taken from foreign news providers); written by journalists (local journalists); and written by external contributors. Table 4.7 shows the source of news articles. Further categorisation was done on the articles written by the journalists based on the source of information or the person interviewed by the journalists for their stories. These sources were: foreign scientists, local scientists, medical personnel, NGOs, industry, farmers, and articles with no quotes (none). Table 4.8 shows the data on these categories.

Table 4.7: Sources of news article in six local mainstream newspaper (Jan 2009 – March 2009)

Newspaper	Foreign wire service	%	External contributors	%	Journalists	%
New Straits Times	67	70.5	16	16.8	12	12.6
The Star	39	47.6	30	36.6	13	15.9
Utusan Malaysia	10	13.5	22	29.7	42	56.8
Berita Harian	5	9.6	8	15.4	39	75.0
Tamil Nesan	7	35.0	8	40.0	5	25.0
Tamil Nesan	2	33.3	0	0	4	66.7

Table 4.8: Persons interviewed/quoted for news articles written by journalists

Newspaper	Foreign Scientists	Local Scientists	Medical Personnel	NGO	Industry	Farmers	None
New Straits Times	1	3	4	2	0	0	2
The Star	2	0	3	0	1	1	6
Utusan Malaysia	2	15	8	0	4	0	13
Berita Harian	1	13	18	0	6	0	1
Tamil Nesan	0	0	0	0	0	0	5
Makkal Osai	0	0	0	0	0	1	3

Although *the New Straits Times* had the highest number of science news during the period of study, 70.5 per cent of its science news was sourced from foreign news providers such as Reuters, AFP, and international journals on medicine. Only 12.6 per cent of its science news was written by its journalists. The other 16.8 per cent was written by external contributors. Medical personnel are the key source of information for *the New Straits Times* journalists, followed by local scientists and industry. This

corresponds to the fact that medical and health news appears the most in this newspaper. The lack of a science desk at *the New Straits Times* was the main reason for the low percentage of articles written by journalists, according to Theresa Manavalan. The other reasons given were the lack of interaction between journalists and local scientists, the inability of local scientists to attract journalists' and editors' attention to salient points of their research and the limited network of journalists among scientists.

The Star demonstrated the same trend as *the New Straits Times* where only 15.9 per cent of its science articles were written by its journalists. Foreign news source was the favourite source of science news for *The Star* as well, with 47.6 per cent of its science news coming from foreign sources such as AFP, HealthNewsDigest, LAT-WP and Reuters. External contributors contributed to 36.6 per cent of its science news. Unlike *the New Straits Times*, most of the articles written by *The Star* journalists were not from interviews with medical personnel. These articles were a combination of various subjects and the interviewees were not indicated. However, medical personnel are still one of the main sources of information for *The Star* as well, followed by foreign scientists, then industry and farmers. The lack of a science desk could have contributed to the low number of articles written by journalists, as was the case for *the New Straits Times*. The reason provided by Natalie Heng (journalist at *The Star),* for the high number of medical personnel as interviewees was the relevance of the topic to the public. She also pointed out that the lack of understanding of science among journalists led to more news being sourced from wire services.

Utusan Malaysia, the only local newspaper that has dedicated science writers and a science desk, has a policy of sourcing its own articles and minimising the dependence on foreign news providers, with 56.8 per cent of its science articles being written by its journalists. External contributors contribute only 29.8 per cent of its science articles, followed by foreign news providers which accounted for 10 per cent. Another significant difference was that local scientists were regularly interviewed by *the Utusan Malaysia* journalists. According to journalist Khairunisa Sulaiman, this was because of the good contacts established by their science writers and the ease of communication due to their experience working with scientists. *Utusan Malaysia* has a pool of journalists who are science-trained and with vast experience in dealing with scientists and their research and have developed their own network of scientists.

In spite of the lack of a science desk and science writers, *Berita Harian* topped the list of science coverage written by its own journalists, at 75 per cent. This was due to the existence of science related sections in *Berita Harian.* Thursdays are dedicated to science news from local universities where research by local scientists is presented. Health sections on Sunday in *Berita Harian* featured local news as well which is in contrast to *the New Straits Times* and *The Star*. External contributors contributed only 15.4 per cent of *Berita Harian's* science articles and the other 9.6 per cent came from foreign news providers. Medical personnel were the number one source of information as in *The Star* and *the New Straits Times*, followed by local scientists. According to Mohamad Zin Ali (journalist, Berita Harian), the newspaper has several journalists with science background who are often assigned to write science news.

The small number of science articles in *Tamil Nesan* and *Makkal Osai* makes it very difficult to compare them with other newspapers. The contribution of external contributors who are mainly medical doctors were the main source of science articles in *Tamil Nesan* (40%), followed by foreign news (35%). Articles compiled by journalists form 25 per cent of coverage and farmers were one of the main sources of information for *Makkal Osai's* science news.

A large number of articles for all the newspapers studied were contributed by external contributors (*New Straits Times* 16.8%; *The Star* 36.6%; *Utusan Malaysia* 29.7%; and *Berita Harian* 15.4%). These external contributors are mostly traditional medicine practitioners, representatives from health supplement companies, and medical doctors, and their columns are used to indirectly promote their products and services. Berkowitz (1992) says industry is an influential source of information to the media, and provide information and materials produced by public relations professionals and make it easier for journalists to file their story on time and effectively. Berkowitz's observations support the findings of this study, where the media gave prominence to external contributors. This was further supported by Gandy (1982), who said most stories are source-generated. Sigal (1973) and Soloski (1989) echo this with their observation saying half or more of newspaper stories are source originated. These external contributors use the agenda-setting theory to influence the public on the need of their products. For example, external contributors from health supplement companies write about the importance of nutraceuticals like Omega-3 oil, herbs, antioxidants and vitamins to create a market for their products.

The previous study by Samani et. al. (2011) had a different finding where ministers were the main source of information for journalists. The difference could be because of the difference in content analysis. Samani's team used keyword to search for biotechnology news which would mean events attended by ministers being included. Whereas, this study only focuses on news and articles which were educational in nature that could enhance public understanding of biotechnology.

All journalists and editors interviewed agreed that the media should play a role as science communicator to the public and there must be editorial will to ensure there is more science news, existence of science desks, and training on science journalism. However, they also concurred that their views are not necessarily the views of chief editors where business sense is important. For chief editors, news must be appealing to advertisers for them to buy space on that page and must be able to immediately catch the attention of the readers. Educating the public on science or biotechnology is hardly the interest of any chief editors.

4.1.3 Conclusion on Media as Biotechnology Communicator

The necessity of the media to play an effective role as science or biotechnology communicator is quite evident. However, various factors contribute to media's failure to do so. Attempts to move knowledge from the world of scientists into the public sphere presents real challenges to reporters and to newspapers that have to contend with limitations on space and reader interest (Kua et. al., 2004). Kua et. al. (2004) proposed a model in which the science reporter has three roles: to be an "intermediary", a "watchdog", and a "tool-giver." The job of the intermediary is what has traditionally been thought of as "translation". In order to handle this role, journalists have to be science-savvy. Journalists who are trained in science would fit this role in handling the

complexity of science. The "watchdog" role will see journalists as advocates and critics of science. This is important not only to generate interest, but also to create awareness and stimulate thinking about issues that are of public concern. The role as "tool-giver" would provide readers the tools with which to think and evaluate the evidence and the issues for themselves. For a field such as biotechnology, this role is of paramount importance. There is abundant misinformation on the internet about biotechnology and journalists who fit into this role could enable readers to discriminate between science and pseudoscience.

Accurate reporting depends on a strong relationship between scientists and journalists (Ruth et. al., 2005), however, except for *Utusan Malaysia* and *Berita Harian*, all other newspapers obtain majority of their science news from foreign sources. A stronger collaboration and interaction between scientists and journalists would lead to more articles sourced from local institutes and also more interviews with local scientists. Journalists who have established their network among scientists found sourcing biotechnology news from scientists is not a problem, as in the case of journalist from *Utusan Malaysia*. The frequency of biotechnology in all the six newspaper studied reflects the low priority given by editors and journalists to biotechnology despite the existence of the National Biotechnology Policy and the importance accorded to biotechnology by the government. This research echoes the findings of Samani et. al. (2011) which concludes that biotechnology is not one of media's priority areas.

Although it is reported that editors stubbornly prefer non-specialists for they believe that non-specialists know far better than specialists do, what questions the reader wants answered (Willems, 2001, Halberstam, 1994, and Wilkes, 1998), this is not always the case in Malaysia. *Utusan Malaysia* and *The Star* employ science graduates at the

science desk and environment beat. In Europe and USA, popularisation of science gained importance in the late twentieth century enhanced by a growing number of science journalists (Kyvik, 2005). Malaysia should move towards this direction. From the input provided by journalists, on-job training for journalists is not a viable option due to lack of interest among journalists and support from editors. Thus, recruiting science-trained journalists will solve this problem, coupled with the creation of science desk. This is the case of *Utusan Malaysia*, where all the journalists at the science desk are science graduates. These journalists interact with scientists at ease and are passionate about writing science news.

4.2 SCIENTISTS AND PUBLIC AFFAIRS OFFICERS AT RESEARCH INSTITUTES

This section discusses the role of scientists and Public Affairs Officers (PAOs) in research institutes and universities in communicating biotechnology and engaging with the public, their objectives, target audience, challenges and suggestions. The scientists interviewed are from public universities (UM, UPM, UKM and USM), research institutes (MARDI, MPOB and FRIM), private university (Monash University Sunway Campus) and industry (Sime Darby Plantation and BioSatria), whereas, the PAOs are from MARDI, FRIM and MRB. These respondents were selected due to their involvement in public understanding of biotechnology and experience in this area. Thus, while the data was obtained from a limited number of interviewees it was quite comprehensive across those involved in biotechnology communication. However, within this limitation, it is important to analyse and understand how different agencies operate in this space as they are the potential key players in a national biotechnology communications strategy, and understanding their impediments to good biotech

communications will provide key data on how to best recruit or leverage their resources to achieve the best outcomes in public understanding of biotechnology in Malaysia.

Table 4.9 lists those interviewed for this section. These scientists are selected based on their previous involvement in communicating biotechnology. The interview questions are in Appendix I.

Table 4.9: Scientists and PAOs interviewed

Organisation	**Name**	**Designation/Field of Expertise**
Malaysian Agricultural Research & Development Institute (MARDI)	i. Dr. Umi Kalsom Abu Bakar ii. Dr. Indubala Jaganath iii. Sharifah Robiaah Tengku Embong	Director, Biotechnology Research Centre (Molecular Biology) Deputy Director, Biotechnology Research Centre (Biotechnology) Former Deputy Director, Corporate Communication (Communication & Media)
Malaysian Palm Oil Board (MPOB)	Dr. Ravigadevi Sambanthamurthi	Head, Biotechnology Advanced Biotechnology and Breeding Centre (Molecular Biology)
Forest Research Institute Malaysian (FRIM)	i. Dr. Kodiswaran Kandasamy ii. Wahayu Abdul Wahab	Former Senior Researcher (Biotechnology) Information Officer (Public Affairs)
Malaysian Rubber Board (MRB)	Rabe'atun Awaluddin	Head, Corporate Unit (Public Affairs)
University Malaya (UM)	Prof. Dr. Vikineswary Sabaratnam	Professor of Microbiology (Mycology)
Universiti Sains Malaysia (USM)	i. Prof. Dr. Nazalan Najimudin ii. Assoc. Prof. Dr. Sudesh Kumar	Professor (Biotechnology) Deputy Dean, School of Biological Sciences (Biotechnology)
Universiti Putra Malaysia (UPM)	Prof. Dr. Abu Bakar Salleh	Professor (Biochemistry)
Universiti Kebangsaan Malaysia (UKM)	Prof. Dr. Wikineswari Ratnam	Professor (Forest biotechnology)
Monash University Sunway Campus	i. Dr. Song Beng Kah ii. Dr. Kan Mun Seng	Lecturer (Biotechnology) Former lecturer (Biotechnology)
Sime Darby Plantation	Dr. Harikrishna K.	Head, Quantum Leap R&D (Molecular Biology)
BioSatria Sdn Bhd	Dr Ung Eng Huan	Chief Technology Officer (Biotechnology)

4.2.1 Objectives of Scientists in Communicating Biotechnology

Universities, research institutes and industry have more than one reason to communicate biotechnology and engage with the public. Scientists may want to share the excitement of their discoveries and educators strive to improve the schooling of young people (Matterson, 2006), and these sentiments were also revealed by the scientists and academia who were interviewed.

However, a vested interest in communicating biotechnology also lies in promoting their research, or increasing public acceptance and commercialisation of the products that come from their research. Dr. Sudesh Kumar (USM), Dr. Indubala Jaganath (MARDI), Dr. Umi Kalsom (MARDI), Prof. Vikineswary (UM), Prof. Wikineswari (UKM), Dr. Ravigadevi (MPOB) and Dr. Harikrishna (Sime Darby) agreed that their intention was partly to raise public acceptance of their research, which mainly revolved around crop biotechnology, forest biotechnology, bioplastics and mycology. Some responses were:

> *"To teach; to sell my research products; to raise awareness about environmental issues related to my research."(Dr. Sudesh Kumar, USM whose expertise is on bioplastics)*

> *"To create awareness of the role of fungi in our lives - health, industry, environment , agriculture are some areas of fungal impact." (Prof. Vickineswary, UM whose expertise is on mycology)*

> *"Public awareness programmes are done during the commercialisation stage of our research." (Prof. Wikineswary, UKM, whose expertise is on forest biotechnology and rice)*

These scientists do attempt to address misinformation relating to their areas of research and address public concerns. Such motives of scientists in popularising science has been pointed out by a number of previous authors (Hilgartner, 1990; and Nelkin, 1987) who said scientists often simplify their research with an eye toward persuading their audience to support their goals, whether they seek to motivate people to follow public health recommendations, build support for research programmes, or advocate positions in science-intensive policy controversies. This was also reported by the UK Office of Science and Technology and the Wellcome Trust (2000) where the priority of many science communicators is to impart a positive attitude toward science. Thus, their activities focus on providing factual information, whether about scientific details or about the uses of science. In the case of the interviewed scientists, this seems to be the case where getting public support towards agribiotechnology seemed to be one of the prime objectives.

Another reason cited by scientists (Prof. Nazalan and Dr. Indubala) to communicate biotechnology was in order to enable students to make informed decisions on their careers. They stated that they hoped their efforts would inculcate interest among students to choose a career in biotechnology. Treise & Weigold (2002) believed scientists could play a role in enabling students to explore scientific careers. Dr. Kan Mun Seng's aim for communicating biotechnology was to bridge the different stakeholders involved in the biotechnology sector. He said this is important to develop the biotechnology industry and make them understand each other's role and needs. This was also the reason given by Dr. Ung Eng Huan, who said biotechnology stakeholders, namely policymakers and investors, need to be well-informed on the technology that will help nation building and benefit the public. Prof. Abu Bakar and Dr. Kodiswaran said that biotechnology should be brought into the public domain and scientists were in

the best position to share research excitement. This is similar to the sentiments shared by scientists surveyed by Poliakoff and Webb (2007), who found they felt they had privileged access to information that should be in the public domain. Dr. Kodiswaran, who stated he enjoys undertaking public awareness activities and has organised a few workshops for the media and teachers, aims at empowering the public with knowledge on biotechnology. This objective was shared by the majority of scientists interviewed by the Royal Society (2006), where 1,485 UK scientists' and engineers' views and experience with regard to science communication and public engagement were reported. One of the key findings from this study was that the most important reason for scientific community in general to engage the non-specialist public was to ensure the public was better informed about science and technology (35%).

4.2.2 Target Audience and Biotechnology Communication Strategies by Scientists

The target audience of the scientists varied depending on the area of their research. Dr. Umi and Dr. Indubala, for example, who are involved in crop biotechnology see entrepreneurs, farmers, students, teachers, policymakers at the Ministry of Agriculture, and the general public as their target audiences. To reach them they organise open days for school students and teachers every year where they are given a tour around their facilities, listen to talks and take part in hands-on sessions. This receives very good feedback from the schools and a lot of requests have been received by Dr. Umi and Dr. Indubala to conduct more of such sessions. Their stated strategies are to dispel misinformation on crop biotechnology and address public concerns. They believe engaging the younger generation would create a biotechnology-literate society that would be able to discriminate between science and pseudoscience and would not become victim to the scaremongering tactics employed by opponents of crop biotechnology. Farmer outreach programmes are mainly to inform them of the latest

crop and seed development at MARDI that would benefit the farmers. General public, entrepreneurs and farmers are addressed at conferences, focus group discussions and also annual exhibitions organised by MARDI. According to both these scientists, the encouraging feedback from their target audience motivates them to be involved in the engagement with the public. However, evaluation of biotechnology communication activities is not a regular practice carried out by scientists, so the impact of their initiatives are not known. There are possibilities that if scientists are made aware of the impact of their communication efforts, the positive feedback received might motivate them to be involved more actively in this area. A review of biotechnology communication activities such as that carried out in the UK among its five Scientific Research Councils (Pearson, 2001) should be included in the framework for biotechnology communication strategy. This might also create a competitive environment for all research institutes to engage in biotechnology communication activities.

MARDI's strategies are a reflection of Prof. Vikineswary's, as she too addresses key stakeholders of her research area – mushroom cultivation and production of nutraceuticals from mushrooms. Her target audiences are mushroom growers and consumers. Prof. Vikineswary organises conferences, focus group meetings and gives talks at various events to create awareness on the role of fungi in the health, environment, and agriculture sectors. Another scientist who identified her target audience to match her research area was Prof. Wikineswary. She deals with entrepreneurs to take her research from the laboratory to the market. This is done through conferences and participating in exhibitions.

Dr. Sudesh and Prof. Abu Bakar stated that their target audiences were students, academia and the general public. Students and academia are usually addressed through scientific conferences, whereas the general public is engaged during exhibitions and trade shows. Another academic, Prof. Nazalan, also pointed out that students are his main target audience, followed by parents, which is in line with his objective to help students to make informed decisions on their career path.

Since Dr. Kodiswaran's aim in communicating biotechnology is to empower the public with knowledge in this field, his target audience is broad-spectrum ranging from the general public, policymakers, students, media, teachers, farmers to agro-industry players. He enjoys media talk shows and has been a guest scientist in a number of television talk show programmes. Another passionate science communicator is Dr. Song Beng Kah who targets students and the general public with the aim to create better understanding on biotechnology and a literate science community who could influence government policies.

It is evident that scientists' target audiences are dependent on their area of research and their objectives in communicating biotechnology. Those who aimed at promoting their research work and commercialisation obviously communicated with their direct stakeholders, whereas, the general public and students become secondary target (as in the case of Prof. Wikineswary and Prof. Vikineswary). Scientists from the university tend to focus more on students and the general public (as the case of Prof. Nazalan, Dr. Sudesh and Prof. Bakar). Scientists who are passionate about biotechnology communication and public engagement (as in the case of Dr. Umi, Indubala and Kodiswaran, Song Beng Kah) are the ones who expand their target audience to cover the general public, media and students. Thus, it is important to create the interest and

passion among scientists in biotechnology communication and engaging the public. Libutti and Valente (2006) say the duty of scientists is not to educate the public, but rather to interact with it, as the public is the true driving force behind decisions with social consequences, and must be involved on an equal basis in debates about them.

4.2.3 Communication Challenges Faced by Scientists and Suggested Solutions

A large number of previous studies (Davies, 2008; Poliakoff and Webb, 2007; Reed, 2001; Weigold, 2001; Wellcome Trust, 2000) indicate the breadth of challenges faced by scientists in communicating science to the public. These challenges are common to Malaysian scientists as well. All the scientists interviewed revealed that communicating biotechnology to the public is not part of their official job requirement and all of them engage with the public on a voluntary basis out of their passion and the need to raise public awareness on their research. There are, however, a number of challenges: there is no funding allocated by universities and research institutes to communicate biotechnology to the public; there are no incentives or career advancement benefits for those involved; availability of time for this activity is limited; and there is a lack of support and encouragement from top management. Dr. Indubala from MARDI quoted lack of time and public engagement not in scientists' job scope as below:

> *"It is not emphasised in our job specification and takes too much out of our research time."(Indubala, MARDI)*

Lack of time for scientists to communicate science is one of the major issues cited by all scientists who were interviewed. In a survey conducted by the Royal Society (2006), 64 per cent of 1,485 scientists who were interviewed identified the need to spend more time on research. This leaves very little time to engage with the public on awareness programmes, which becomes a lesser priority. The Wellcome Trust (2000) survey found

that 60 per cent of scientists agreed that the day-to-day requirements of their job left them with little time to communicate about their research to others. A number of previous studies also pointed to lack of time for scientists to be involved in outreach to the public or in popularising science (Brown et. al., 2004; Kyvik, 2005; Poliakoff and Webb, 2007).

Another common challenge faced by all scientists was translating technical terms and making them simple for public understanding. Lack of communication skills among scientists is a global phenomenon as shown in the Wellcome Trust (2000) survey that reported a fifth of scientists commented that scientists lack communication skills. This was further echoed in the study done by Weigold (2001). And Malaysian scientists are no exception. All scientists, but Dr. Kodiswaran cited this as a problem that hindered them from actively pursuing public understanding of biotechnology. Some of the responses from the scientists interviewed were:

> *"Scientists are focused on the nature of job that is to be highly technical and scientific. Communicating science amongst the scientific community is not a problem for them. The real challenge begins when trying to communicate science to the general public when scientific concepts has to be explained in a very simple language. This is time consuming and hard work for many scientists." (Dr. Umi Kalsom, MARDI)*

> *"Most scientific stuff is difficult to put in layperson's terms. One needs to do much background reading to understand scientific facts and the significance of new discoveries." (Dr. Sudesh Kumar, USM)*

The Wellcome Trust (2000) and Weigold (2001) also found that scientists who felt that they have the necessary skills, or who taught as well as do research, were more likely to have participated in public engagement activities. This is evident in the case of Dr. Kodiswaran, who is a seasoned science communicator who has taken part in various biotechnology awareness programmes such as media workshops, risk communications,

and media interviews. Dr. Kodiswaran admitted that there are hardly any challenges for him in engaging with the media or other stakeholders. This supports an argument that scientists who take it upon themselves to communicate science, may pick up the communication skills. Poliakoff and Webb (2007) indicated that scientists who already participated in public engagement activities intend to continue doing so, and scientists who have not participated in public engagement events do not intend to start.

The level of biotechnology knowledge among the public was cited as a challenge which created a technical barrier between scientists and the public (Prof. Nazalan, Dr. Indubala, Prof. Abu Bakar Salleh, Dr. Umi Kalsom and Prof. Wikineswari). Similarly, this challenge has been reported by Kua (2004) where the job of science reporters is made more difficult by the lack of scientific literacy of their readers. Lack of public interest was cited by Dr. Harikrishna, Prof. Nazalan and Prof. Wikineswari as a challenge. However, the public survey conducted for this research which is discussed later in Chapter 6 shows otherwise. It clearly indicates that the scientists' understanding of the public is lacking, and their perspective towards the public needs to be changed. According to the scientists interviewed, lack of public interest on biotechnology, if any, could be due to a number of reasons: inability of scientists to develop messages that are relevant to the public that can be comprehended by them (Dr. Umi Kalsom); identifying the right audience (Prof. Vikineswary); and scientists' reluctance to engage with the public (Dr. Kodiswaran).

Dr. Ung said one of his challenges was to communicate with NGOs that are averse to biotechnology, irrational and emotional. NGOs actively carry out scaremongering activities that strongly shape public perception of biotechnology, which further creates a problem to undo the inaccurate messages that have been spread among the public. A

survey by the Royal Society (2006) indicated that NGOs are one of the least important target audiences for scientists. MABIC refuses to communicate with NGOs as it is considered to be a futile exercise as many NGOs have fixed negative mindsets about biotechnology.

Lack of media support was also cited as a common challenge by all scientists interviewed. Various reasons were given for this: misunderstanding between scientists and journalists; the tendency of media to sensationalise and exaggerate news; lack of biotechnology understanding among journalists; fear of being misquoted; and a lack of reward for scientists to engage the media. It is clear that scientists understood their shortcomings such as an inability of scientists to simplify technical news, relate the salient points of their research (newsworthiness), and make research news relevant to the readers, but they also concluded that no efforts were taken by their institutes to train them in handling the media (or the public). Scientists had to learn from their experience when engaging the public and the media, and with no incentives for these activities, coupled with lack of time, many scientists tend to shy away and focus on their core research responsibilities.

All the scientists interviewed concurred that lack of training provided to them in communicating biotechnology was also a major hindrance. There was a consensus that with proper training they would be more willing to take part in biotechnology awareness programmes as it would help boost their confidence when facing the public and media. Prof. Abu Bakar's (from UPM) response was:

> *"It takes scientists away from their specialised field, which they are more comfortable. But if training is provided scientists would be more comfortable and confident." (Prof. Abu Bakar, UPM)*

This shows scientists can have a positive approach towards communicating biotechnology and engaging with the public, but they are not confident with their ability to do so. Literature suggests that scientists who had received communication training are more likely to participate in public engagement activities and were more confident in communicating with the media (Royal Society, 2006; Ruth et. al., 2005). This fact is further strengthened by the survey conducted by Gascoigne and Metcalfe (1997) in Australia that reported the lack of training among scientists was seen as a major obstacle to participation in communication activities.

When asked if Public Affairs Officers (PAOs) provides any support in biotechnology communication, handling the media or providing media training, all scientists responded that support from PAOs is limited. Response from Dr. Umi Kalsom was as below:

> *"Normally not for a dedicated and coordinated programs on biotechnology. Have suggested this to the Institute but the PR office or the communication unit normally has tight yearly program of their own for the Institute."(Dr. Umi Kalsom, MARDI)*

There was consensus among these scientists that PAOs could play a role especially in handling the media, repackaging scientific and research information for the use of the media, and providing media training. The scientists interviewed felt the most crucial area where they need assistance from PAOs is in getting media support and attention. However, currently PAOs dealing with the media emphasises on brand building and not to engage the public nor provide biotechnology information to the public with an aim to enhance public understanding on this subject. This is one of the challenges that all scientists felt must be addressed at the management level. Among all the scientists interviewed, only Dr. Kodiswaran expressed satisfaction with his PAO, although he said there was room for improvement where media training was concerned.

All these challenges have been discussed at length in previous studies worldwide, and these challenges which are not common to Malaysia, include: lack of incentive (Dunwoody and Ryan, 1985; Treise and Weigold, 2002); lack of support from faculties (Checkoway, 2001); lack of cooperation between scientists and media (Dunwoody, 1999; Nelkin 1995); lack of time (Gascoigne and Metcalfe, 1997); and lack of communication skills (Nelkin, 1995) are clearly issues that need to be effectively addressed.

Suggestions given by scientists in this study towards these issues, included:

1. Support from PAOs is crucial to get media attention and translating research into simple language for public consumption (suggested by all scientists). Borchelt (2001) also indicated the role information officers could play in mediating communication between scientists and the media.
2. Financial incentive is believed to encourage scientists to take up public engagement on biotechnology (Prof. Nazalan and Dr. Sudesh). Gunter, et. al. (1999) stressed that incentives are important for scientists to commit themselves to going public with their research rather than just publishing in journals read only by their professional peers.
3. Training scientists in handling the media and training the media on the basics of biotechnology would result in more biotechnology news appearing in the mass media (Dr. Kodiswaran and Prof. Abu Bakar Salleh). There was no consensus among the scientists on whether educating the scientists on media or educating the media on science would be more efficient, with one third saying educating scientists on media, one third saying educating the scientists, and another one third saying educating both. However, a study conducted by Reed (2001), suggested that educating scientists on media would be more appropriate,

because science contains complex and difficult-to-understand issues and educating the media about it could be more difficult. The need to train scientists on media relations and its positive impact on scientists' ability in communicating with the media has been discussed in a number of previous studies (Pearson, 2001; Ruth, 2005, Wellcome Trust, 2000)

4. New discoveries must be celebrated and publicised and universities and research institutes should have open days for the public where the public can understand what researchers do in the laboratory (Dr. Sudesh).
5. The use of alternative media such as the internet was suggested by Dr. Ung. He said this will reduce the dependency on mainstream media to publicise biotechnology news and the competition for space.
6. Support from institutes and relevant ministries (Ministry of Science, Technology and Innovation and Ministry of Higher Education) in terms of providing special grants for public understanding of biotechnology (Prof. Wikineswari).
7. Personal motivation and an interest to communicate biotechnology to the public have to be cultivated. Dr. Umi Kalsom and Prof. Vickineswary do not believe in financial incentives, rather being able to empower the general public with biotechnology knowledge was seen as rewarding by itself.
8. Cultivating a healthy relationship between scientists and the media would help to get media support. Organising special networking session with the media would develop a pool of supportive members of the media (Dr. Umi Kalsom).

4.2.4 Input from Public Affairs Officers (PAOs)

PAOs are potential mediators between the scientists, the media and the general public. Borchelt (2001) has said that little is known about the role that science public information officers play in brokering communication between scientists and representatives of the media and other external audiences. PAOs' role in communicating science in general and biotechnology in particular has not been studied in any previous research. Thus, this section lacks references to previous studies. All the PAOs interviewed in this study are trained in public affairs, communication and media relations, thus, they could support the scientists' efforts in engaging with the public and the media. These PAOs also represent the views of three major research institutes in Malaysia that have strong biotechnology research programmes, i.e. MARDI, MRB and FRIM. This section discusses the support PAOs currently provide to the scientists in terms of training the scientists in handling the media, repackaging scientific information for the consumption of media and the general public, institutes' target audiences, scientists-PAOs relationship, and their role in mediating information transfer between scientists and the media. Building a good rapport between scientists and the media will ensure effective information dissemination to the general public, and PAOs could play a very important role in this area.

From the interviews with PAOs and scientists at research institutes, there is a clear divide between these two groups. Although, they both work together in some cases, this is limited to events that are related to branding of institutional image, justifying their role in nation building, or the expenses spent on their institutes to the taxpayers. PAOs' tasks at research institutes did not cover creating awareness on biotechnology or communicating biotechnology to the general public. Their role is restricted to corporate communications, dealing with the government, media, and their direct stakeholders

(mostly farmers and planters). This has been reported by Corfield (2003) where media liaison officers at institutions primarily worked to establish good relations with the media so they can sell big stories and ensure public relation opportunities for their institutions, often ignoring their individual scientists. In contrast, scientists interviewed showed more social responsibility in creating public understanding of biotechnology for the benefits of the society.

This has been observed by Kyvik (2005), where institutions' managements regard popularisation of research and participation in public debate as an important effort in making the universities and their work more visible to the public and to legitimise public expenditure for the research as part of their mission and tasks in society. PAOs and scientists interviewed work in isolation with limited consultation and communication with each other on public understanding of biotechnology. PAOs do not provide communication training to scientists to assist them in simplifying scientific information, handling the media, nor developing communication strategies. All the scientists interviewed revealed that they do not receive much support from their public affairs offices. However, this does not mean that PAOs do not engage with the public. They engage primarily with their stakeholders directly related to the institute's core research area, but not the general public. All PAOs interviewed concurred that there has been much improvement in the way biotechnology is communicated to their stakeholders over the years and that their working relationship with scientists at their institutes has evolved for the better. Nevertheless, scientists still felt that they need much more support from PAOs in their institutions in terms of training, preparation of press releases, handling media interviews and taking a lead in engaging the public.

Rabe'atun Awaluddin (Malaysian Rubber Board) pointed out that her role is to reach out to planters and smallholders to provide solutions to their problems in the field and often has to work with scientists towards this. Engaging with the radio stations involves scientists, as do press conferences and press releases, which are prepared by PAOs with input from scientists. MRB engages schools in Sabah (a state in East Malaysia) on setting up nurseries and learning about bud grafting. This is also done with Academy Hevea Malaysia with the aim to encourage youths to take up entrepreneurship in the rubber plantation and industry. Rebe'atun's priority is not engaging with the general public as they are not MRB's direct stakeholder. Scientists at MRB, according to her do not engage with the general public either but she observes a change in attitude among the younger scientists who are keen in public engagements. She sums it up as:

> *"We recognise the need to engage with the public and support the scientists in doing so, but it has not been the institute's priority when it comes to public affairs duties. We are also constraint with the lack of trained personnel in science communication."(Rabe'atun, MRB)*

One of the challenges faced by Rabe'atun is getting media support and interest. Constant change of feature writers, making research newsworthy and relevant to everyday life of the society and making media understand biotechnology are some of the challenges. This, according to her is the reason for PAOs inability to assist the scientists to get media support. From her experience, she said business angles of research stand better chances in getting published. She also suggested that grooming junior scientists to be science communicators might be one solution as they are more open to engaging with the public and the media. However, PAO at MRB currently do not have communication training for scientists as this is not part of their job scope and has not been seen as a priority. Lack of trained personnel in science communication is another reason why her office does not do science communication training for scientists.

Sharifah Robiaah from MARDI stated her aim for communicating biotechnology was to sell MARDI's research to potential investors and collaborators who could take it into commercialisation and this is done primarily through the mass media. She worked with the media to achieve this objective with the support from the scientists. While scientists feel PAOs failed to provide them support in communicating biotechnology, Sharifah observed that scientists are very reluctant to handle media and appear in public events. However, she agreed that her prime aim is not to engage with the general public; this again was due to the direction set by the management where PAOs' job does not cover engaging with the public. Media and communication training is not provided to MARDI scientists due to lack of trained personnel and also lack of enthusiasm from the scientists. Funding is also not available for such training. Sharifah pointed out:

> *"There is a disconnect between scientists and PAOs. There is no coordination when it comes to public engagement. It would be best if public affairs office has dedicated staff to train and assist the scientists in communicating biotechnology. However, this will not change soon as scientists are expected to run the show out of their own interest."(Sharifah Robiaah, MARDI)*

Wahayu Abd Wahab from FRIM echoed Rabea'tun's sentiment in saying scientists are more receptive to the idea of communicating to the public compared to five years ago. Her office assists scientists in handling the media and repackaging research news into simpler language. However, just like other Public Affairs Offices at MARDI and MRB, FRIM also does not train scientists to handle media due to lack of trained personnel in this field. Wahayu observed that *Utusan Malaysia* gives FRIM the most support and this is due to the existence of a science desk at this newspaper. Like Sharifah, Wahayu also said good relationships with the media will help scientists and PAOs to get media space. She also agreed with Rabea'tun that giving the business angle to science news helps to get media attention. Lack of media understanding of biotechnology, editorial support and the tendency of media to sensationalise news were pointed out as challenges for both PAOs and scientists. Wahayu concurred with Sharifah on the

reluctance of scientists to engage the public and media, however, this trend is changing with more scientists wanting their research to be published in the public domain and slowly gaining confidence in handling the media and the public.

From the input provided by the PAOs from the three research institutes, it is clear that the priority of these institutes is not public understanding of biotechnology. Their target audience primarily are their key stakeholders who would benefit from their research. In spite of the experience PAOs have in handling the media, they do not provide training to the scientists on communicating to the media. Two main challenges are lack of trained personnel who could work with the scientists in engaging the public and the media, and the job scope of PAOs which does not require them to do biotechnology communication to the public. The former would only change if there is change in management's decision of the latter.

4.2.5 Conclusion on Scientists and PAOs

Table 4.9 summarises scientists' target audience, their objectives, challenges and solutions, which shows the combined target audience and objectives of all the scientists interviewed cover all aspects of biotechnology communication. Similar to previous academic research (DiBella et. al., 1991), the feedback received from all the scientists interviewed in this research shows that scientists agree that they have an obligation to educate the public.

While the breadth of biotechnology communication is wide, the impact of the efforts and strategies is questionable, as every effort is driven by the vested interest of the institute to promote its core research and economic efforts. Public understanding of biotechnology has taken a back seat compared to the needs to commercialise and

collaborate with the industry. The necessity to engage the public with science and to empower the scientific fraternity with public communication skills is not a priority among Malaysian universities and research institutes. There is no realisation on these needs among the policymakers and academicians. Scientists who communicate biotechnology with the public do it without institutional support and input from social scientists. Davies (2008) stated the same phenomenon in the UK and concluded that this will lead to the practice of individuals framing and shaping the communication process. Very few scientists engage with the public to empower them with knowledge on biotechnology and to address their concerns or enable them to participate in active dialogue to influence policies, and research directions and priorities. This strengthens the argument of Bensaude-Vincent (2001) that the public has never been considered as a partner of scientific enterprise and the needs, concerns and area of interest of the public are not taken into consideration when planning public engagement activities. Thus, the deficit model is still largely used in communicating biotechnology to the publics in Malaysia.

Table 4.10: Summary of scientists' target audience, objectives, challenges and solutions

Target audience	Objectives	Challenges	Solutions
Farmers, entrepreneurs, investors, students, parents, general public, policymakers, teachers, media,	1. To promote stakeholders' understanding on research in the institutes 2. To encourage youths to take up entrepreneurship related to the institutes' research area 3. To inform students the career opportunities in the biotechnology sector 4. To empower general public with knowledge on biotechnology 5. To dispel misinformation on biotechnology	1. Lack of media support 2. Lack of communication and collaboration between scientists and PAOs 3. Training on science communication is not provided 4. Lack of interest among the public 5. Biotechnology communication is not part of the job 5. No funding is provided for public understanding of biotechnology 6. Translating technical terms to simple language 7. Bureaucracy that prevents scientists talking directly with the media	1. Incentives to scientists who engage with the public 2. Training for the scientists and the media 3. Open days at universities and research institutes for the public 4. Use of alternative media 5. Grants from relevant ministries

Table 4.11: Summary of PAOs' target audience, objectives, challenges and solutions

Target audience	Objectives	Challenges	Solutions
Farmers, entrepreneurs, investors, policymakers, media	1. To promote stakeholders' understanding on research in the institutes 2. To encourage youths to take up entrepreneurship related to the institutes' research area 3. Branding institutional image	1. Lack of media support 2. Biotechnology communication is not part of the job 3. Lack of trained personnel on science communication 4. Public understanding of biotechnology not a priority	1. Build good rapport with media 2. Putting business angle to research news 3. Junior scientists to be trained in communicating biotechnology

The culture of science in Malaysia today does not encourage or endorse participation by scientists in activities of public outreach, including advocacy, nor does educational preparation for a professional career in the science include orientation or training towards the public context of science (Brown et. al., 2004). None of the public universities in Malaysia offers modules or programmes in science communication to

science students. Private universities are taking a lead on this with Monash University, Taylor's University and Nottingham University offering modules on science communication to their life sciences students. More scientists could be encouraged to communicate biotechnology to the publics if proper training is provided as suggested by the scientists interviewed in this research. This was the case in the UK (Royal Society, 2006) where scientists who received communication training were more likely to participate in public engagement programmes and in Australia (Gascoigne and Metcalfe, 1997), a survey indicated that a lack of training was seen as a major obstacle for scientists to participate in such programmes. It is important that institutions recognise and reward those with natural talent, and let them serve as role models to inspire others (Corfield, 2003). Incentives have been suggested by Malaysian scientists as an encouragement to be more involved in public engagement.

The other constraints in engaging the public which were raised by scientists in this study were also addressed by Kyvik in his research (2005). Kyvik acknowledged that scientists are expected to perform many tasks and roles to fulfil their obligations to their institutions. They undertake research and publish their results, teach and supervise students at various levels, participate in university administration and policy making, evaluate their researchers' work, and apply for external funding of research projects. Scientists' obligations towards the society is not compensated nor appreciated by the management of their institutes and all scientists in this study who conducted public understanding of biotechnology activities did so on a voluntary basis. Thus, some Malaysian scientists do play the role of "civic scientists" (see Clark and Illman, 2001; Greenwood and Riordan, 2001).

This could be brought to the next level, where Kalleberg (2000) distinguishes two ideal types of civic scientists: expertlike and citizenlike. The expertlike acts as specialist, disseminating knowledge and insight from the specialised research field to lay persons or academics outside the discipline. The citizenlike acts as an intellectual, contributing to public discourse and trying to place new issues on the public agenda. Judging from the communication objectives of Malaysian scientists, their role could be categorised as expertlike. Like the journalists who should be "tool-givers", scientists should also act more citizenlike when communicating biotechnology, given its controversies.

The communication and cultural divide between scientists and the media has been extensively studied (Friedman, 1986; Gascoigne and Metcalfe, 1997; Gunter et. al., 1999; Radford, 2002; Shortland and Gregory, 1991; Valenti, 1991). All scientists interviewed pointed out common frictions between them and the media. This divide was also acknowledged by the media personnel interviewed in this study. There is agreement between scientists and the media on the challenges and factors that contribute to this divide. Thus, the understanding of the problems between these two groups of communicators exists but no parties have taken the necessary measures to address the problems. From the interviews with media personnel and scientists, it is evident that scientists expect journalists to translate their research into newsworthy articles, whereas journalists expect scientists to provide them with the salient points and relevance to readers. This tug-of-war between scientists and the media need to be addressed and it could be done by having dialogues and training for both groups to enable them to work in synergy. Science communication workshops for scientists could be the most effective method as suggested by Dr. Kodiswaran and Prof. Abu Bakar in this research. Studies by the Royal Society (2006) and Gascoigne and Metcalfe (1997) lean towards this conclusion. In the case of Malaysia it would be wiser to organise

workshops for scientists, considering the interest shown by them, instead of for journalists. This is also proven from the experience of MABIC in failing to garner participation from journalists for its media workshops, as discussed in the next section. Nevertheless, for scientists and journalists who have established networks with each other, interaction between them is not seen as a challenge. However, due to the lower priority given by both parties to communicate biotechnology, not all scientists and journalists allocate time to establish contacts between them. Thus, the initial efforts should be put to educate scientists to understand the media and their culture, and to establish contacts with them. Scientists need to understand what drives the media (Khanna, 2001). Once, scientists take the first move to become media-friendly, there are possibilities that the barrier between scientists and media be broken. This has been shown by regular communicators such as Dr. Kodiswaran who deals with media with ease. This could then lead to training and workshops for media at a later stage. So, creating a pool of scientists with communication skills should be a priority.

Another solution would be for PAOs to play a more active role in mediating the interaction between scientists and the media. This has been suggested by Ruth et. al. (2005) and Corfield (2003). Scientists should know more about the conditions and restrictions of journalism, in order to better communicate to the public (Schnabel, 2003) and this is where PAOs could provide the support to scientists. PAOs are fully aware of the factors that lead to the friction and divide between scientists and media and also of the solutions to address this. Shults (2008) in his thesis indicated the unique role of public relations communicators in combining scientific accuracy with cultural relevance and in fulfilling the role of "interpreters" between scientists and target audiences of the scientific institutions. There is in agreement with the solutions provided by members of the media and PAOs and these two groups hold similar opinions about how media can

be used in popularising biotechnology. However, in spite of understanding the problems and having the knowledge to solve the problems, sufficient measures have not been taken by the public affairs offices to do this. PAOs' experience and knowledge in handling the media is untapped by scientists and their institutes. Scientists are often not aware of the presence of PAOs, their role and how they can help scientists to engage with the media or the public and lack of time, funding and trained personnel constrains research institutes from taking advantage of this. Being at the interface between scientists and the media, PAOs could play an effective role as mediators and establish links between these two groups.

Corfield (2003) suggests that media liaison officers should enhance the communication skills of scientists by explaining the process of science reporting. This would narrow the divide between scientists and the media and media support and trust could be gained. This would also solve the problem of scientists not being allowed to speak directly to the media. There is a clear divide between the PAOs and scientists who tend to work in silos when it comes to public understanding of biotechnology and their collaboration needs to be strengthened in this area. If this barrier is removed and collaboration is enhanced, it would open doors for more scientists-media interaction. Bridging the gap between scientists and journalists would lead to improved reporting and increased public understanding of science issues (Valenti, 1998, 2000; Valenti and Wilkins, 1995). And this is where PAOs have a role to play.

Based on Table 4.10 and 4.11, there are similar challenges faced by scientists and PAOs. Gaining media support and biotechnology communication not being part of their job scopes are common challenges. However, unlike scientists who undertake public engagement on a voluntary basis, PAOs concentrate only on their job scope. As

scientists' role as biotechnology communicators include the need to build institutional image and commercialise their research through publicity to their stakeholders, which is also the main tasks of PAOs, scientists and PAOs share the same target audience. Nevertheless, scientists' target audience expands to the general public and students as well. And their challenges are beyond what is experienced by PAOs since their objectives and target audience are wider. If these two groups work together on their challenges, there are possibilities that they could complement each other in engaging their stakeholders and the general public.

Institutional support and a National Policy on Science Communication would also ensure that all players worked in synergy in communicating biotechnology. This would maximise resources and the impact of the activities carried out by different institutes. The Bodmer Report (1985) which was initiated to facilitate public engagement among scientists through the establishment of Committee on Public Understanding of Science (CoPUS) saw more scientists getting involved in activities related to public understanding of science in the UK (Royal Society, 2006). This strongly demonstrates the need for Malaysia to have a National Policy on Science Communication.

4.3 NON-RESEARCH ORGANISATIONS (NROS)

This section discusses the role played by organisations that are not involved in research but carry out biotechnology public awareness activities. These organisations comprise government agencies (National Biotechnology Division at Ministry of Science, Technology and Innovation; Department of Biosafety, Ministry of Natural Resources and Environment; Malaysian Academy of Sciences; and National Science Centre); government-linked organisations (Malaysian Biotechnology Corporation, and Institute

for Islamic Understanding Malaysia); and one non-governmental organisation (Malaysian Biotechnology Information Centre). This section will compare and contrast the different objectives of all these organisations in communicating biotechnology, their objectives, strategies, target audience, availability of funds, training modules, constraints, and the impact of their activities (where the impact has been measured).

The information on NROs was obtained through in-depth interviews with Prof. Dr. Rofina Yasmin (BIOTEK), Dr. Vilasini Pillai (NRE), website and report (ASM), Phyllis Lam (NSC), Mohammad Azam Ali (BiotechCorp), Dr. Mohd Zaidi Ismail (IKIM) and author's own work at MABIC.

4.3.1 Objectives of NROs in communicating biotechnology

The objectives of each NRO depend largely on the mandate given to them by the government, except for the Malaysia Biotechnology Information Centre (MABIC) which is more independent as it is an NGO. Table 4.11 and 4.12 show the main objectives of each organisation based on their mission and vision, and also the specific objectives of biotechnology communication initiatives that each NRO conducts.

The only organisation that has a role of communicating biotechnology and biotechnology awareness as a core objective is MABIC, with all the other organisations playing various other roles, of which biotechnology communication is but one.

BIOTEK is the custodian of biotechnology research and development in Malaysia, and as such it has a larger mandate to ensure the development of biotechnology in Malaysia, which includes public awareness as one of its tasks. This is also the case for BiotechCorp, where public awareness is part of its bigger role in ensuring Malaysia

emerges as a global biotechnology player. For both BIOTEK and BiotechCorp, public awareness in biotechnology is perceived to be a prerequisite for the development of biotechnology.

Table 4.12: Main objectives of NROs

NROs	Main Objectives
BIOTEK	i. To make biotechnology the new economic engine for sustainable development ii. To drive the National Biotechnology agenda for the development of an innovation economy through research and development, international linkages, human capital development, and awareness and promotion of programmes
NRE	i. To act as one-stop centre for all activities related to biosafety
ASM	i. To pursue, encourage and enhance excellence in the fields of science, engineering and technology for the development of the nation and benefits of the mankind
NSC	i. To inculcate interest of Malaysians to science learning orientation and technology
BiotechCorp	i. To act as one-stop centre for biotechnology development ii. To nurture and accelerate growth of Malaysian biotechnology companies iii. To actively promote foreign direct investments in biotechnology iv. To create conducive environment for biotechnology development
IKIM	i. To be an excellent Institution in the planning and implementation of a strategic work agenda towards enhancing Islamic understanding
MABIC	i. To provide scientifically accurate and fact-based biotechnology information to all stakeholders ii. To provide a platform for discussion of issues on biotechnology iii. To support government's efforts in developing biotechnology as a tool for national development

BIOTEK (National Biotechnology Division, Ministry of Science, Technology and Innovation); NRE (Department of Biosafety, Ministry of Natural Resources and Environment); ASM (Academy of Science Malaysia); NSC (National Science Centre); BiotechCorp (Malaysian Biotechnology Corporation); IKIM (Institute for Islamic Understanding Malaysia); MABIC (Malaysian Biotechnology Information Centre)

NRE's core interest is on modern biotechnology as described under the Cartagena Protocol on Biosafety. Modern biotechnology is defined as, "*in vitro* nuclei acid techniques, including recombinant deoxyribonucleic acid (DNA) and direct injection of nuclei acid into cells or organelles, or fusion of cells beyond the taxonomic family (Secretariat of Convention of Biodiversity, 2000). In short, NRE deals with genetic modification and genetically modified organisms and products, and all its communication is geared towards only these topics. As Malaysia is a party to the Cartagena Protocol, the country has an obligation to promote and facilitate public

awareness, education and participation concerning the safe transfer, handling and use of living modified organisms in relation to the conservation and sustainable use of biological diversity, taking into account risks to human health. Thus, NRE's goals on public understanding of biotechnology slant towards creating awareness of the safe use of modern biotechnology, its risks and regulations.

Table 4.13: Objectives of Biotechnology Communication Initiatives of NROs

NROs	Main Objectives
BIOTEK	i. To ensure the public is well-informed on biotechnology and government's role in promoting biotechnology ii. To ensure the industry and researchers are aware of the government facilities and grants iii. To consolidate information from stakeholders and relay it to the government to facilitate policy development iv. To create awareness among students on the impact of biotechnology in their lives
NRE	i. To create public awareness on biosafety
ASM	i. To promote public awareness and understanding on science, technology and innovation
NSC	i. To create public awareness, understanding and appreciation on science, technology and innovation
BiotechCorp	i. To develop Malaysia as a significant global biotechnology player
IKIM	i. To understand the permissibility of biotechnology products in Islam ii. To bridge the knowledge divide between scientists, the public and Islamic scholars
MABIC	i. To increase public awareness on biotechnology ii. To make information on biotechnology accessible to all stakeholders iii. To inculcate interest on biotechnology among the public

ASM's objectives on biotechnology communication revolve around making policymakers and the government understand the significance of the role of biotechnology in nation building. NSC, as a science centre, promotes all sciences and biotechnology is one of the disciplines that it promotes. Biotechnology communication by IKIM is more related to Islamic perception of science, its acceptance, and the need to embrace knowledge. The topics covered by all NROs encompass the entire biotechnology spectrum, with the exception of NRE, which only covers genetic modification.

4.3.2 Target audience and biotechnology communication strategies of NROs

A one-way communication model is consistently used by all NROs. This resembles the deficit model suggested by Gross, (1994); Burns et. al., (2004); and Medlock et. al., (2007), which was commonly used in public understanding of science before the contextual approach was developed. Transmission of biotechnology information from NROs to the public does not involve public engagement and input. None of the NROs in this study has conducted surveys on the needs of the public, their concerns, interests or level of knowledge, before developing its communication strategies. This communication structure is similar to the situation in the UK as reported by Davies (2008), where there is no return flow of knowledge, but rather about simply "telling people." Communication is seen as a "packet" of scientific information of some kind where the idea of publics having a voice within the communication process is ignored and is silently constructed as being about what the science has to say (Gregory and Miller, 1998).

BIOTEK and BiotechCorp's definition of public awareness on biotechnology revolves around shaping and framing public perception of biotechnology with the aim to gain their support towards government policies and to brand Malaysia as a biotechnology player. Whereas, NRE's definition is strictly guided by Cartagena Protocol on Biosafety that encourages public participation with an aim to enable informed decision making on matters related to modern biotechnology, but its strategies heavily hinge towards the deficit model with limited public engagement. ASM, NSC, IKIM and MABIC have a broader definition of public awareness on biotechnology where public understanding is equated to awareness. Nevertheless, the deficit model is still prominent as two-way dialogue between communicators and the public is not included in their

activities. Communication is based on what the "public need to know" and not what "they want to know".

All NROs have a number of target audiences they seek to reach and this varies according to their objectives. Target audiences are a diverse group, ranging from media, students, teachers, policymakers, religious scholars, scientists, regulators and general public. Young people are also seen as priority audience by a number of NROs, and this resembles the study carried out by Pearson (2001) in the UK on its research councils (Particle Physics and Astronomy Research Council, Engineering and Physical Sciences Research Council, Natural Environmental Research Council, Medical Research Council, and Biotechnology and Biological Sciences Research Council).

Table 4.14: Target audience of NROs

NROs	Target audience
BIOTEK	General public, students, teachers, scientists, industry
NRE	General public, scientists, regulators, policymakers, industry
ASM	Scientists, policymakers, politicians
NSC	General public, students
BiotechCorp	General public, students, teachers, scientist, policymakers, investors
IKIM	General public, scientist, policymakers, religious authorities
MABIC	General public, students, teachers, scientists, policymakers, media, religious authorities, regulators

Media

Of note, Pearson's (2001) study also identified the media as one of the main audiences as a means of influencing other key target groups through the multiplier effect, and the need to make sure that accurate and positive articles about the work carried out by these research councils were reported. A number of literatures suggest that media are a powerful tool that can influence public perception of biotechnology and that most information on science for the public comes primarily from the mass media (Valenti and Tavana, 2005; Petersen et. al., 2008; Anderson et. al., 2005; Priest, H.S., 1994;

Miller and Riechert, 2000). However, in the case of the NROs, media is not a popular target audience. This is consistent with the study by Royal Society (2006), where media was identified as the least important audience by scientists. The only NRO that engages media in its awareness programme is MABIC. Table 4.14 shows the target audience of the NROs.

BIOTEK and NRE which do not conduct any workshops or training for the media pointed out the lack of interest and cooperation among media on biotechnology as the main reason for this. MABIC which carries out media workshop also echoed BIOTEK and NRE's sentiment on the lack of media interest on biotechnology, and MABIC's efforts to engage journalists do not attract much interest among them. MABIC organised media workshops on various topics ranging from genetic engineering, tissue culture, medical biotechnology, risk communication to biotechnology communication from 2003-2009. These workshops were hosted by universities and research institutes. However, the interest from the media declined as their expectation to report breakthroughs in research at these institutes were not met. Media often attended with the intention to report exciting research work and not to engage with the scientists, learn about biotechnology nor to provide their feedback on communicating biotechnology. Thus, these workshops were judged as not very successful and came to a halt after 2009. MABIC reported that the last media workshop organised with Monash University Sunway Campus on medical biotechnology was only attended by two journalists.

In short, in spite of the realisation that media training on biotechnology is important for balanced reporting of biotechnology that will help shape public opinion, and the fact that media has the multiplier effect in disseminating information on biotechnology, engaging the media is an untapped area in public understanding of biotechnology in

Malaysia. Navarro et. al. (2011) reported how the media portrays science in general, and biotechnology in particular can have an adverse impact on public understanding and policy development. Thus, a good biotechnology communication model should include media training and engagement with the media. For example since its establishment in 1986, CoPUS has spearheaded media training workshops for scientists and has seen increased intensity in public understanding of science activities by scientists (Pearson, 2001). Not only media training, postgraduates students, especially PhD students should be encouraged to be involved in activities related to public understanding of biotechnology. Cutler (1996) reported that research councils in the UK encourage PhD students to work closely with secondary school students as a strategy with long term implications. Positive experience in public understanding of science for researchers early in their studies is believed to encourage them to do more as they continue their scientific career (Pearson, 2001).

General Public

In spite of the stated objectives to reach out to the general public, no activities undertaken by most NROs were actually geared towards this, largely due to lack of resources (funds, time and trained personnel) as stated by BIOTEK, NRE and ASM. National Science Centre is popular among the public and attracts around 1000 visitors per week, which includes general public, mainly parents who brings their children as part of their informal science education. However, interactive sessions and exhibits on biotechnology for general public are lacking.

BiotechCorp and MABIC have put in substantial amount of efforts towards reaching out to general public. Both these NROs have collaborated to organise MyBio Carnival in 2010 and 2011, with NSC and Taylor's University as the venue and host respectively.

The activities and impact of MyBio Carnival is discussed in Chapter 6 as a non-traditional approach in communicating biotechnology. NSC, MABIC and BiotechCorp identified families as their key target audience for activities, especially for MyBio Carnival. This is similar to the Engineering and Physical Sciences Research Council in the UK (Pearson, 2001).

BiotechCorp employed three different strategies in engaging the public: through national television (TV3), MyBio Carnival, and an exhibition during "Karnival Jom Heboh TV3" which is a fun fair organised by TV3. Biotechnology activities in Malaysia were featured for five minutes after primetime news, twice weekly from 30 July 2009 – 15 Feb 2011. This programme is aimed at exposing the Malaysian public to the local status and development of biotechnology. Named "BioUsahawan", it features both scientists and industry players. Research at universities and research institutes were highlighted in an easy-to-understand manner. CEOs from biotechnology companies spoke about their products and technology. According to BiotechCorp, this programme was successful in creating awareness among the public on the various biotechnology activities that is ongoing in Malaysia. BiotechCorp's participation in "Karnival Jom Heboh TV3" was undertaken to elevate the awareness and understanding of the biotechnology industry among the Malaysian public. Activities organised during "Karnival Jom Heboh TV3 included science demonstrations, interactive sessions with the public, submission of resumes by biotechnology graduates, talks on career prospects for biotechnology graduates, and showcase of biotechnology companies' commercialised products.

IKIM's public engagement on biotechnology is undertaken by its Centre for Science and Environmental Studies. Although biotechnology is a sporadic topic, IKIM uses newspapers and radio to propagate information on biotechnology. These include *Berita Harian, New Straits Times, The Star* and *New Straits Times* and its own radio station, IKIM FM.

Secondary School Students

Secondary school students were identified as one of the main target audiences by BIOTEK, NRE, NSC, BiotechCorp and MABIC. Raising science-literacy and encouraging young people to take up careers in science to build human capital in the area of science and technology have been a priority among these organisations. A recent finding by the Ministry of Education as reported by the Deputy Prime Minister, Tan Sri Muhiyiddin Yassin, who is also the Education Minister on the dwindling interest in science among Malaysian students (*Berita Harian*, 11 Feb 2012; *New Straits Times*, 3 Feb 2012; *The Borneo Post*, 11 Feb 2012; *The Star*, 2 Feb 2012; and *Utusan Malaysia*, 11 Feb 2012) has also aggravated the need to reach out to students. To reach them, several different strategies were undertaken. Road shows to secondary schools were conducted by BIOTEK throughout the country in collaboration Universiti Kebangsaan Malaysia from late 1990s to 2004 (they were then halted due to lack of funding). Activities involved talks on various fields in biotechnology, creative board games, hands-on experiments in the laboratories and exhibitions. This was later replaced by mybio@schools (with similar activities in collaboration with Malaysian Genomic Institute. Mybio@schools was similar to the earlier road shows where talks and demonstrations at secondary schools were carried out. Again, due to lack of funding, it came to a halt in 2010. Besides schools activities, BIOTEK also published a popular science magazine, *Estidotmy*, a monthly magazine that features science articles in

laymen's language, which is given out to secondary schools as part of *Utusan Malaysia*, the national Malay language newspaper. As of 2010, this magazine also ceased due to lack of funding.

NRE reaches out to schools to expose students to information on biosafety and its regulations in collaboration with Malaysian Nature Society. NSC, as a science centre, organises special exhibitions and laboratory sessions for schools. The strategies employed by NSC involve providing interactive science exhibitions, organising fun-filled science programmes and activities, to provide an environment and facilities that enable learning science in a fun manner, and to act as facilitator and advisor on informal learning of science. MABIC and BiotechCorp organised several nationwide school competitions focussed on biotechnology during MyBio Carnival as discussed in Chapter 6 as a Case Study.

Teachers

Teachers are one of the target audiences for BIOTEK, BiotechCorp and MABIC. The multiplier effect when engaging with teachers is seen to be a very effective method to disseminate information on biotechnology. BIOTEK engaged teachers during its road shows under the mybio@schools projects. Teachers were trained to handle the creative games and laboratory sessions. BiotechCorp organises MyEdu Symposium for teachers in different regions in Malaysia. Seminars and hands-on experiments are the main agenda of these symposiums. Topics ranged from agricultural, medical, environmental to industrial biotechnology and resource people, who were mainly scientists, were engaged to give lectures on these topics. Hands-on experiments on DNA extraction using household materials also is incorporated to this symposium. MyEdu Symposium engaged science teachers and career counsellors from secondary schools around the

country. The input from the participants of MyEdu Symposium was obtained to develop future programmes. Information on topics of preference, participants' expectation of the symposium, how they could contribute in organising such symposium, and their intention to participate in future symposiums were gathered by BiotechCorp.

MABIC, in collaboration with the Ministry of Education organises biotechnology workshop for teachers every year in different states of Malaysia. These workshops were organised since 2006, which started in the state of Selangor and Federal Territory of Kuala Lumpur. Later these workshops were organised in Melaka, Terengganu, Kelantan, Sarawak, Johor, Penang, and Pahang. Each workshop accommodates 20 secondary school teachers who teach biology. Workshops are held at either universities or research institutes and topics range from agricultural, medical, industrial and environmental biotechnology. Lectures are provided on the selected topic, followed by hands-on experiments on DNA extraction, PCR techniques, electrophoresis, and tissue culture techniques.

Both the MyEdu Symposium and the teachers' workshop organised by MABIC received good support from the teachers as there were no other workshops that provide hands-on experiences and that discuss various topics on biotechnology. The feedback received from teachers indicates that these workshops improve their pedagogy and enable them to gain interest among their students on biotechnology. Participants also indicated that these workshops keep them abreast of latest developments in biotechnology and its application and potential in everyday life. These, according to feedback make teaching biotechnology easier in the classrooms and improved their pedagogy.

Industry, Policymakers and Scientists

Efforts to communicate and engage industry, policymakers and scientists by all NROs are mainly done to achieve the individual objectives of the NROs. BIOTEK and BiotechCorp engage these target audiences through conferences such as BioMalaysia (an annual biotechnology conference), the National Biotechnology Conference. These target audiences implement government policies on biotechnology, thus, are seen as important target audience by BIOTEK and BiotechCorp. NRE engages the industry players, policymakers and scientists who are involved in genetically modified food products to create awareness among them on biosafety regulations. MABIC engages scientists and policymakers to empower them as biotechnology communicators through its risk and science communication workshops.

MABIC started to publish a monthly popular science newspaper with a focus on biotechnology in February 2010. This newspaper, called *The Petri Dish* is circulated to universities, ministries, research institutes, and biotechnology companies. *The Petri Dish* aims to bring biotechnology research to public domain and bridge the various biotechnology stakeholders in Malaysia. MABIC's future plans are to circulate *The Petri Dish* to secondary schools, public libraries and place it at public places such as petrol kiosks, hypermarts and eateries for general public. *The Petri Dish* is the first popular science newspaper in Malaysia. According to MABIC, the newspaper started with a circulation of 2,000 copies in February 2010 and in March 2012, the circulation went up to 6,000 copies. In June 2012, *The Petri Dish* was made available at all Starbucks outlet throughout Malaysia and this was a milestone in bringing biotechnology to the public space and engaging the general public in making them part of the biotechnology enterprise. Some of the feedbacks on *The Petri Dish* were*:*

"I think it is a really neat publication -- it is a sharp and very attractive publication. I particularly like the style of clean, attractive and bubbly writing which reveals the excitement and the dedication and commitment of the contributors."(Dr. Clive James, Chair of ISAAA Board)

"Well done! A good start to introduce biotechnology to the community. I think the newspaper need to focus on the target audience for the message to effectively reach them." (Datin Paduka Prof. Dr. Khatijah Yusoff, Deputy Secretary General, Ministry of Science, Technology and Innovation)

"The Petri Dish! How exciting to finally have a uniquely different and freely circulated newsletter.....an S&T newsletter that just focuses on the all important world of biotechnology. The inaugural issue was informative, without being boring, revealing but not dogmatic, and newsy but not gossipy or political. It captured happenings in the biotech world at home and abroad while also giving space for fun items like a crossword puzzle and brainteasers. The language, content and presentation has made it an easy-to-read paper, that offers choice pieces that would be particularly appealing to each individual reader according to the area of interest, be it in the biotech fraternity, business, research or fun areas. Looking forward to more!" (Prof. Helen Nair, Fellow Academy of Sciences Malaysia)

"The Petri Dish is a timely publication, one that addresses the need to not only reach out to, but also to bring attention to the biotechnology industry in an accessible and easy-to-read manner."(P. Kandiah, IP Lawyer)

"I am glad to subscribe The Petri Dish for my students. It makes them more interested to study science and supplements the school syllabus."(Teacher, SMK Bandar Kinrara Section 1)

ASM aims to consolidate strategies for biotechnology development for policymakers and its engagement with scientists and industry is geared towards this objective. Dialogues, consultations, and focus group discussions with scientists are held on various topics in biotechnology. Recommendations are developed from these meetings and sent to relevant ministries for development of policies and funding mechanism. IKIM's engagement with scientists is focused on Islamic matters such as bioethics and permissibility of biotechnology products.

Religious scholars

Another unique target audience is religious authorities with only IKIM and MABIC reaching out to them. Ethics and permissibility are two issues covered by IKIM. A number of dialogues were organised by IKIM for scientists and Islamic scholars until 2004. These dialogues were aimed at sharing of knowledge to enable scientists to understand Islam and Islamic scholars to understand biotechnology. Religious scholars, especially Islamic scholars are seen as an important target audience for MABIC with a focus on permissibility of genetically modified foods. International workshops have been organised by MABIC with Islamic scholars between 2009 and 2010 with an aim to develop a resolution on the permissibility of genetically modified foods and to bridge the knowledge and communication divide between scientists and Islamic scholars. The first workshop organised in July 2009 with the Centre for Dialogue and Civilisation at University of Malaya created a lot of scepticism among religious officers on biotechnology and industry players, especially the agricultural biotechnology multinationals. The issue of "trust" and "credibility" were contributing factors to this. MABIC was perceived to be an industry spokesperson with no authority to address Islamic issues related to biotechnology. "Crisis of trust" affects science policies that require a more open and transparent approach to science policy making (Petersen, 2008). Religion is a sensitive issue and addressing public values and concerns related to religion has to be carried out by highly credible parties who have public trust.

The second and third attempts by MABIC to engage Islamic scholars were successful and this was due to the collaboration with International Halal Integrity Alliance (IHIA). IHIA was seen as an authority to speak on "halal" issues, thus the messages were accepted by the religious scholars and officers. These workshops involved religious scholars from a number of countries such as Indonesia, Kuwait, Pakistan, Bangladesh,

Egypt, Iran, Saudi Arabia, and the Philippines. A resolution was adopted which stated the permissibility of genetically modified foods, the need for public awareness on biotechnology in Muslim countries, and the need to engage with Islamic scholars.

MABIC's efforts in engaging religious scholars provided two important lessons in handling highly sensitive and controversial areas such as religion. Trust is the key element to have engaged audience and effective dialogues. Sobian and Abdul Rahman (2003) stated religious scholars as a trusted source of information among the Muslims in Malaysia. It is also imperative to identify key champions who have high credibility in the community (especially among the intended target audience), as this would ensure effective transfer of messages and knowledge. Navarro and Randy (2011) listed identifying and nurturing champions who are well-informed, have high credibility in the community and are willing to advance the cause of the technology to their peers as one of the ways to address challenges in communicating biotechnology. Religious scholars and related agencies are certainly potential stakeholders that could be nurtured to become champions in communicating biotechnology among their communities. Hence, the inclusion of religious scholars in this research to evaluate their role as biotechnology communicators. This is discussed in the next Section.

4.3.3 Communication Challenges Faced by NROs and Suggested Solutions

The challenges identified by NROs:

i. **Media.** A common complaint amongst BIOTEK, NRE and MABIC is the lack of media support and interest in science and research work, and the media's inability to comprehend science, which results in science not making headlines and major stories in the newspapers. These are common challenges across the

globe and have been cited in previous studies (Treise and Weigold,2002; Gunter, 1999; Hartz and Chappel, 1997)

ii. **Scientists.** According to MABIC, Malaysian scientists do not engage themselves in advocacy work and rebut misinformation in the media. This is due to the restriction by institutes that prohibit scientists from directly dealing with the media, commenting on policies, and involving in advocacy roles. Valenti (1999) also made similar observation where government agencies put restrictions that restrain media from quoting scientists. Many scientists lack communication skills and are not able to simplify technical information. They also lack enthusiasm to engage with the public. This is due to lack of training in engaging with the public, lack of time and incentives. MABIC's observation and experience dealing with scientists were confirmed by the scientists interviewed who expressed the above shortcomings as their challenges. This has been discussed under the 'Scientists and Public Affairs Officers at Research Institutes' section.

iii. **Lack of resources.** Lack of time (cited by BIOTEK), trained personnel in science communication (BIOTEK, BiotechCorp, NSC, ASM, IKIM), and funding (all NROs) specifically for awareness programmes are some of the major challenges. Funding came as a top challenge among all NROs. It is very evident that biotechnology communication is not a priority area for allocation of fund among government agencies. All NROs linked with the government admitted that necessary funding is not allocated for communication programmes and is allocated on an ad-hoc basis.

iv. **Public interest.** Lack of interest among the public on biotechnology. This was a major complaint by all NROs, except for NSC. However, public interest based on the medium-scale survey conducted for this study shows otherwise which is

discussed in Chapter 6. This shows that the NROs perception of the public is not the real reflection of public interest in biotechnology. This also shows that communicators do not understand the public attitude, interest and needs. Although previous studies (Krieghbaum, 1967; Prewitt, 1982; and Miller, 1986) reported lack of interest among the public on science subjects, this attitude is probably changing with the rapid advances made in science.

v. **Lack of training.** All NROs, except MABIC do not have personnel trained in science communication. In-house training is also not provided for their staff. This is another main constraint voiced by all the NROs. However, there are also no initiatives among these NROs to address this problem, and funding to train staff is again an issue. Capacity building was not mentioned by any NROs as a future plan to train their staff.

Suggestions made by NROs:

i. BIOTEK and MABIC suggested training the media on biotechnology to enable them to understand biotechnology better. MABIC further suggested that newspapers should employ journalists with science background and the creation of science desks. This was further supported by BIOTEK with suggestion that collaboration with Ministry of Information and commitment from this ministry would help to promote science through the mainstream media – newspaper, radio and television.

ii. BIOTEK suggested that scientists should be trained in handling media and in communicating biotechnology. This will enable them to translate research into journalistic articles and simple language for public consumption.

iii. MABIC strongly suggested that science communication modules for science programmes in the universities will help younger generation of scientists and

science graduates to be equipped with science communication skills and also commitment to engage with the public.

iv. All biotechnology communicators should work synergistically together in an integrated and comprehensive approach to maximise the outcome and resources.

v. BiotechCorp suggested that biotechnology communicators should transform the image of biotechnology from "nerdy" to "fun". The relevance of biotechnology to everyone's live should be emphasised in communication messages. MyBio Carnival is one such initiative undertaken by MABIC and BiotechCorp, to make biotechnology relevant to the general public and by bringing biotechnology to the public sphere. The impact of this approach is evaluated in this study and suggestions are made to improve its effectiveness.

There are no data available on the impact of communication initiatives carried out by these NROs on their target audience. In-depth evaluations have not been carried out by any of the NROs as this requires resources such as manpower, funding and time. Moreover, all the public engagement activities carried out by the NROs are ad hoc and done without input from social scientists. This phenomenon has also been observed by Turney (2006) in the UK with public engagement activities funded by government. Activities are also carried out in silos that lack collaboration between scientists and media. The pressing issue faced by all NROs is lack of funding for public engagement activities. Another major complaint was lack of media cooperation, but no efforts were taken by any NROs to inculcate interest on biotechnology among the media. Government agencies such as ASM and BIOTEK should exert their political will towards engaging the media

4.3.4 Conclusion on NROs

In spite of the shortcomings in the activities carried out by NROs, this group appears to be the most active among all communicators discussed in this study. NROs reach out to almost all key target audience and cover various aspects of biotechnology, including religion and ethics. Their combined efforts are indispensable in public engagement of biotechnology in Malaysia and without NROs activities there will be a serious void in the biotechnology communication scene in Malaysia. Although the core mandate of most of the NROs with the exception of MABIC is not the communication of biotechnology, or public engagement, yet significant amount of time, effort and resources are allocated for this purpose. Nevertheless, proper policy, training and allocation of funding could further improve communication strategies, frequency of activities, and its scale.

An example could be drawn from the policies and strategies of the UK Research Councils (Pearson, 2001). The five Scientific Research Councils (Particle Physics and Astronomy Research Council, Engineering and Physical Sciences Research Council, Natural Environmental Research Council, and Biotechnology and Biological Sciences Research Council) encourage scientists to get involved in public understanding of science. Each Council has a senior executive officer responsible for public understanding of science. Advisory bodies with members drawn from academia and industry advise on the strategy that Councils might take to carry out their public understanding of science objectives. A more systematic approach is in place in the UK due to the existence of public understanding of science policy at the national level. This is a good model for Malaysia to adopt, with the Ministry of Science, Technology and Innovation (MOSTI) as the champion for the National Science Communication Policy.

In spite of the policy in the UK, limited data is available on the impact of individual public understanding of science initiatives on the public and the relative effectiveness of the different schemes that specifically involve research scientists (Pearson, 2001). This is also the case for the activities carried out by NROs in Malaysia. All NROs do not have any system in place to evaluate the effectiveness of their initiatives. Funding, human resources and time are the main constraints for this. A review such as that reported by Pearson (2001) where the success of UK Scientific Research Councils' public understanding of science initiatives were measured, is timely for Malaysian NROs. The feedback could improve current strategies and also motivate NROs to be more actively involved.

4.4 RELIGIOUS SCHOLARS

The infringement of biotechnology into ethics and religions has elevated this field beyond the realm of science and has necessitated the engagement between scientists and religious scholars and also for religious scholars to play a role as biotechnology communicator. Genetic modification, stem cell therapy, cloning, gene therapy, and xenotransplantation are some of the areas of concerns which require permissibility in most religions. Biotechnology creates moral and ethical concerns among general public which can be categorised into extrinsic and intrinsic. Extrinsic concerns refer to possible risks of biotechnology applications to human health, environment, economy and society (Gott and Monamy, 2004). These concerns need to be addressed by scientists and policymakers. Whereas, the intrinsic concerns are related to the claim that biotechnology is not natural, and that it involves changing nature and playing God. Intrinsic concerns include religious dimensions (BABAS, 1999). Study by Einsiedel (1997) also concluded that public's main concerns about biotechnology were primarily

driven by ethical, value and safety concerns. This is consistent with the survey conducted among Malaysians by Juanillo (2002) which revealed 65% of all stakeholders mentioned moral/ethical issues, while 60% have said that cultural issues have a bearing on their judgements about biotechnology. Thus, religious scholars have a big role to play to address ethical concerns of the public. These concerns could only be addressed by religious scholars and thus, their role as biotechnology communicators is of paramount importance.

However, in spite of the strong influence religions play in shaping public attitude and perception towards biotechnology, there have been no previous studies involving religious scholars on biotechnology or science communication. This group has not been seen as potential biotechnology communicators; therefore, there are no efforts to involve them in biotechnology communication strategies. Thus, this section on religious scholars lacks literature review and comparative analysis, and it is a new attempt to gauge the role religious scholars could play as biotechnology communicators and make them part of the biotechnology communication strategy in Malaysia.

Religion plays an important part in Malaysians' lifestyle and religious scholars are held high on the credibility ladder. Malaysia is a multiracial country with Islam as the official religion and a number of other major religions with a large number of followers. The total population of Malaysia stands at 26 million (citizens) according to Census 2010 (Department of Statistics, Malaysia, 2010), of which consist of the Malays (54.56%), Chinese (24.57%), Indians (7.34%), indigenous Muslims (12.8%) and other races (0.73%). Islam is the most widely professed religion in Malaysia with the proportion of 61.3 per cent. Other religions embraced are Buddhism (19.8%), Christianity (9.2%) and Hinduism (6.3%). The rest of the population are followers of

Taoism, Sikhism, or Confucianism. For this research, scholars from six major religions were selected for in-depth interview on their role as biotechnology communicators. These religions are Islam, Buddhism, Christianity, Hinduism, Taoism and Sikhism. Except for Islam, all other religions are members of Malaysian Consultative Council of Buddhism, Christianity, Hinduism, Sikhism and Taoism (MCCBCHST). Islamic affairs are under the purview of Prime Minister's Department. MCCBCHST was established in 1983 and is dedicated to the promotion of goodwill, harmony and unity amongst all Malaysians irrespective of creed, religion, race, culture or gender. The organisations representing Buddhist in MCCBCHST are Malaysian Buddhist Association (MBA), Buddhist Missionary Society Malaysia (BMSM), Sasana Abhiwurdhi Wardhana Society (SAWS); Christian member organisations are Christian Federation of Malaysia (CFM) which are inclusive of the Catholic Bioshops Conference of Malaysia (CBCM), Council of Churches Malaysia (CCM) and National Evangelical Christian Fellowship (NECF); Hindus are represented by Malaysian Hindu Sangam (MHS); Sikhs by Malaysian Gurdwaras Council (MGC), Khalsa Diwan Malaysia (KDM) and Sikh Naujawan Sabha Malaysia (SNSM); and Taos by Federation of Taoist Associations of Malaysia (FTAM). Thus, MCCBCHST is an overarching organisation that represents all faiths in Malaysia. Table 4.15 shows the list of religious scholars who were interviewed.

Table 4.15: Religious scholars interviewed for the research

Religion	Name	Designation	Affiliation
Islam	Shaikh Mohd Saifuddeen Shaikh Mohd Salleh	Former Senior Fellow	Institute for Islamic Understanding
Buddhism	Venerable Sing Kan	Vice President (MCCBCHST), President (Malaysian Buddhist Federation)	MCCBCHST & Malaysian Buddhist Federation
Christianity	Rev Dr. Thomas Philips	Vice President (MCCBCHST), President (Malaysian Christianity Federation)	MCCBCHST & Malaysian Christianity Federation
Hinduism	Dr. Bala Tharumalingam	Executive Council Member (Malaysian Hindu Sangam)	Malaysian Hindu Sangam
Sikhism	Harcharan Singh	President	Malaysian Gurdwara's Council
Taoism	Daozhang Tan Hoe Chieow	President (MCCBCHST), President (Federation of Taoist Association of Malaysia)	MCCBCHST, Federation of Taoist Association of Malaysia

The interview scope covered level of biotechnology understanding among religious scholars, relevance of biotechnology and importance its understanding to them and their followers, their role as biotechnology communicators, engagement with relevant government agencies, source of information, and challenges in communication of biotechnology and engaging with their followers. This information could identify their role in the biotechnology communication strategy. The interview questions are as in Appendix I.

4.4.1 Level of biotechnology understanding, issues related to biotechnology and religions, sources of biotechnology information, and credibility level of religious scholars

A strong understanding of biotechnology is important for religious scholars, especially among Muslim scholars as principles of *shariah* is strictly adhered to in terms of food production and medical care – the two areas that have biotechnology applications. In Malaysia, *fatwa* (or decree) is issued by the National *Fatwa* Council by Muslim scholars. The 'Muzakarah' (dialogue/forum) of the *Fatwa* Committee of the National Council for Islamic Affairs Malaysia, at its 95th sitting on 16-18 June, 2011, discussed

the Rules on the Consumption of Genetically Modified Food (National *Fatwa* Council, 2011). This is also the case for all other Muslim countries or in countries with Muslim community. For example, the National *Halal* Accreditation Board of the Philippines adopted a resolution on the *halal* status of GM foods (PNS 2067:2008) in 2008. The involvement of Christian priests in the Philippines during the field trials, approval and commercialisation of GM corn between 1999 to 2002 played an important part in both public acceptance and rejection of GM technology in this country (Panopio and Navarro, 2011).

With this background understanding on the need for biotechnology understanding among religious scholars, they were asked to self-rate their level of understanding. Two scholars, Shaikh Saifudeen (Islam) and Dr. Bala (Hindu) rated their biotechnology understanding as good. Rev. Thomas Philips (Christian) gave a rating of fair; Tan Hoe Chieow (Taoism) rated his knowledge as in between poor and fair; whereas Sing Kan (Buddhist) and Harcharan Singh (Sikh) rated their understanding as poor. As a former Senior Fellow in charge of Science and Technology matters at IKIM, Shaikh Saifudeen was involved in matters related to biotechnology and Islam, which gave him the exposure to this field. He was also involved in bioethics research. As for Dr. Bala, his formal training as a medical doctor enhanced his understanding of biotechnology. Rev. Thomas Philips' dealing with his church members exposed him to biotechnology. However, for Sing Kan, Tan Hoe Chieow and Harcharan Singh they never had many opportunities to deal with biotechnology topics, which explain their lack of understanding. All religious scholars also agreed that awareness and understanding of biotechnology is important to them and to their followers as it is a field that has huge impact on everyone's life and there are areas which impinges on ethics and religion.

They concurred that understanding biotechnology will enable their followers to make informed decision.

A previous study by Amin et. al. (2011) involved survey among religious experts (Islam, Buddhist, Christian and Hindu) on their level of knowledge and awareness on biotechnology. This survey indicated that Christian scholars have a high level of knowledge on modern biotechnology (6.03 out of total mean score of 9.0), followed by Muslim, Hindu and Buddhist scholars (5.16 out of total mean score of 9.0). Hindu scholars had the highest level of awareness (5.12 out of total mean score of 9.0), followed by Buddhist scholars (5.00 out of total mean score of 9.0), Christian scholars (4.91 out of total mean score of 9.0) and lastly Muslim scholars (3.26 out of total mean score of 9.0). However, the author failed to provide information on the affiliation of these scholars, which questions their authority as religious experts. This research differs in that the respondents are from MCCBCHST which is the national authority for all religions except Islam. These respondents are also able to use their machinery to engage the public on issues related to biotechnology and religion since they are in charge of all the churches, temples and gurdwaras (worship house of Sikhs) in Malaysia.

In spite of the varied level of biotechnology understanding among the respondents, all scholars agreed that there are a number of religious issues that influence the acceptance and permissibility of biotechnology in their religions. Three main topics that were identified by all scholars were food safety; disturbance to ecosystem; emerging advances in the medical field such as stem cell and gene therapy, and cloning. There was a consensus among all scholars that modern biotechnology is beneficial to mankind but it should not create harm to the environment.

However, when asked if biotechnology requires religious interpretation before it can be declared permissible in their respective religion, different views were given. For Islam, according to Shaikh Saifudeen, *halal* and *haram* is clearly stated in the Quran and as such everyone could make informed decisions. However, emerging technology such as gene therapy and synthetic biology need more interpretation as they are not mentioned in the Quran or Hadith. This is where dialogues between scientists and religious scholars become crucial. In Hinduism, Christianity and Sikhism, biotechnology requires interpretation as well, especially on new applications and this is done by calling experts in the fields to discuss with the scholars. However, their concern is the ethical practice of biotechnology and not at the end-user stage. According to these scholars, if the applications of biotechnology are ethically employed by scientists, there will be no concerns at the level of the public in terms of their religious principles. The Taoism and Buddhism scholars also agreed that it is more important for scientists to understand the ethical values of the different cultures and faiths. At the consumer level, Taoism and Buddhims display more liberty where the followers are provided basic religious information and they make their own decisions. This is also the same with Hinduism, Christianity and Sikhism.

The source of biotechnology information for the religious scholars in this research varied. For Shaikh Saifudeen who is very much involved in science and technology, journals, reports and magazines, seminars, working papers, internet, and informal discussion with scientists are the main sources of information. This also explains his high level of understanding of biotechnology. Internet was mentioned by all other respondents. Informal discussion with experts was mentioned by Tan Hoe Chieow and Harcharan Singh. The other sources mentioned were television (Rev. Thomas Philips) and books (Sing Kan). All scholars acknowledged that they do not look for

biotechnology information unless there are major crisis such as introduction of new technology that would impact everyone's lifestyle. Learning about biotechnology among religious scholars is an ad-hoc process. This is also the case for Malaysian Muslim scholars according to Shaikh Saifudeen.

This is also points to lack of government initiatives to engage religious scholars and provide them exposure on this subject. When asked if government has played a role in enhancing their understanding of biotechnology, all scholars unanimously agreed that there are no such initiatives in the past. All scholars also expressed their interest to learn about biotechnology to enhance their understanding should any agencies provide such outreach programmes. There was also consensus among them to engage other scholars in their organisations to ensure understanding of biotechnology is spread wider among religious scholars in Malaysia. Thus, if biotechnology communicators discussed under Scientists and NROs could develop communication modules for religious scholars and engage them actively, they could play an effective role in communicating to the general public. This would have a multiplier effect compared to the conventional methods of conducting seminars and events for only attentive public. This would also reduce the resistance among the public towards emerging biotechnology applications. However, religious scholars are not the target audience for any of the communicators discussed with the exception of MABIC and IKIM.

When asked about the credibility level of religious scholars among Malaysian publics, all scholars unanimously agreed that religious scholars are well-trusted and well-connected to the general public. Shaikh Saifudeen said when there are issues with biotechnology that is related to *halal* or *haram* matters, religious scholars are the one the public would turn to and trust. A survey on the understanding and acceptability of

biotechnology was conducted by IKIM in 2003 which indicated the religious scholars as the second most trusted sources (19.5%) after research institutions (28.5%) (Sobian and Abdul Rahman, 2003).

4.4.2 Role as biotechnology communicators, challenges and suggestions

In the Philippines, farmers and religious scholars were engaged by Social Action Center of the Archdiocese of Jaro, Iloilo to oppose the sale and propagation of all GM crops (Panopio and Navarro, 2011). At the same time proponents of GM also engaged religious scholars who recognised the benefits of biotechnology in addressing food security and agricultural problems and this contributed in reducing the fears associated with adopting biotechnology (Panopio and Navarro, 2011). When the religious scholars in this research were asked if they play a role in communicating issues related to biotechnology to their followers, there were mixed responses. Shaikh Saifudeen's response was:

> *"When it comes to religious issues, the masses will trust religious scholars more. Religious scholars are well-versed and convincing in laws (Hukum) related to matters such as usage of porcine genes compared to scientists. Religious scholars are also closer to the community and understand them better than scientists." (Shaikh Saifudeen)*

The same sentiment was also shared by Rev. Thomas Philips who said:

> *"Priests are very connected to the people and they are well-trusted. They are also able to identify issues and invite experts to address the concerns of their followers."(Rev. Thomas Philips)*

Among the Hindu community, according to Dr. Bala, it has not come to the stage for religious scholars to address biotechnology issues to their followers. However, there is a need to have dialogues with scientists to ensure technology is guided by principles of ethics and religions, and that there is no abuse of the technology. According to Dr. Bala, the need to engage religious scholars are issue-centric and religious scholars could play

a role when religious issues related to biotechnology causes a crisis. Among the followers of Taoism and Sikhism, biotechnology has not been a subject of discussion. Sermons in Gurdwaras (temple of worship for Sikhs) are given by experts from various fields and topics are of current interest to the followers. Biotechnology has not been addressed in their sermons yet. Among the Buddhists, topics on science and technology are addressed in their Dharma talks for adults and children and in Sunday Schools, however, biotechnology has not been handled yet.

In spite of the lack of involvement in communicating biotechnology to their followers, all scholars agreed that they should play a role as biotechnology is an emerging field and has a number of religious and ethical implications. Furthermore, the high credibility level of scholars makes them perfect communicators, especially in time of crisis as the case of the GM corn in the Philippines. The scholars also expressed their willingness to organise special talks for their followers if government agencies are willing to identify suitable experts and engage them with the religious organisations.

Challenges are aplenty that have been identified by these scholars in engaging them as biotechnology communicators. The most common frustration among all of them was that there has been no government agencies that engage and consult them on biotechnology matters. For the Muslim scholars, IKIM and Malaysian Institute for Islamic Training (ILIM) are the only agencies that engage and train Muslim scholars. However, these two agencies are religious-based and emerging technologies is not within its scope. Shaikh Saifudeen feels that agencies like Ministry of Science, Technology and Innovation (MOSTI), BIOTEK, BiotechCorp and Genetic Modification Advisory Committee (GMAC) should actively engage religious scholars. The other scholars shared the same frustrations where government engagement with religious

scholars on biotechnology is seriously lacking. Consultation with scholars mainly revolves around issues such as organ transplant, AIDS, and on bioethics. Biotechnology has not been the topic of discussion yet. The Dialogue and Civilisation Centre at University Malaya has played a role in engaging the scholars on bioethics and this was the only programme attended by most of the scholars or their representatives.

The other challenges are lack of knowledge on biotechnology to communicate the topics effectively to the followers. Among the Muslims, according to Shaikh Saifudeen, the priority of the congregation at the mosques is not knowledge on science or biotechnology but on Islam, Islamic history and Quranic interpretations. Talks on biotechnology have not gained popularity among Muslim congregation. Amin et. al. (2011) observed the same problem where she attributed the low level of awareness among Muslim scholars on the development of modern biotechnology to their day to day focus on existing religious issues. Shaikh Saifudeen noted that Muslim community is reactive and issues are addressed as they emerge. Getting the right speaker who could eloquently impart knowledge on biotechnology is also another challenge according to Shaikh Saifudeen as it is important to create the interest among the congregation. The situation is made even more difficult among the followers of Taoism as there is no congregation like the Muslims and Christians as most would go to temple as they please or prefer praying at home. Taoism also does not have serious issues with biotechnology unless an application is detrimental to mankind and the environment. This is also shared by Sing Kan, where Buddhism scriptures has no mention about applications of biotechnology and it is based on the basic principle that no harm should be caused to human, animals and the environment.

Another common challenge mentioned by all scholars was that government involves MCCBCHST on interfaith issues to maintain peace and harmony among the different faiths and also to address the social and economic problems of the people at the grassroots. However, biotechnology has never been a priority topic for discussion with MCCBCHST. MCCBCHST so far is only involved in bioethics issues and the scholars are consulted without being provided basic and background information on biotechnology. This provides limited scope for scholars to give their input and make well-informed decisions.

Several suggestions were provided by these scholars in addressing the above mentioned challenges. Shaikh Saifudeen said getting well-known and well-respected scholars to speak on biotechnology at the mosques during sermons would help to get public attention. Providing scholars with relevant information and exposure on biotechnology was suggested by Shaikh Saifudeen, Harcharan Singh, Sing Kan and Rev Thomas Philips. They believed knowledge would empower scholars to speak with confidence and be able to convince and influence their followers. Tan Hoe Chieow said that organising youth camps and activities on Sundays at the temples on biotechnology could attract followers to take interest on this subject. Dr. Bala said the Malaysia Hindu Sangam (MHS) is the patron to more than 3000 temples, 300 NGOs, and there are over 200 branches of MHS all over Malaysia.

> *"We (MHS) have a huge network that connects all Hindus in Malaysia and this network could be used by biotech communicators to address ethical issues (if any) or even educate the public about biotechnology. We are open to work with any agencies for this." (Dr. Bala)*

This machinery could be effectively used if government agencies and other relevant organisations engage MHS to propagate biotechnology among the Hindus in Malaysia.

MHS also has an expert database where experts could be identified and engaged to handle issues related to biotechnology.

4.4.3 Conclusion on religious scholars

Religious attachment seemed to influence the Klang Valley public towards modern biotechnology applications, with the Malays shown to be most attached to religion followed by the Indian and Chinese (Amin, et. al. 2007). The case of Malaysians' influence of religion on acceptance of biotechnology and the role played by Catholic priests in the Philippines supports the need to engage religious scholars in biotechnology communication strategies in one way or another. From this research, it is understood that biotechnology is not one of the priority areas for discussion among religious scholars and issues are discussed as they emerge, making biotechnology an issue-centric subject. They might not be effective biotechnology communicators but they could be indirectly involved in the biotechnology communication strategy. Biotechnology communicators could take advantage of religious bodies' large network and the high credibility among the general public to engage with the general public. Outreach programmes could be jointly organised with MCCBCHST and Department of Islamic Development Malaysia (JAKIM) and all their affiliations around the country.

Table 4.16: Comparisons among religious scholars of different faiths

Faiths	Issues	Credibility	Interpretation on biotechnology	Communication challenges	Suggestions	Current communication practice
Islam	Food safety, impact on ecosystem, new medical applications (stem cell, gene therapy, cloning)	High	Needed	1. Not a priority 2. Biotech related agencies do not engage scholars	1. Enhance understanding of biotechnology among scholars 2. Dialogues with scientists 3. Eloquent speakers	Issue-centric
Christianity	Same as above	High	Needed	1. Lack of knowledge	1. Enhance understanding of biotechnology among scholars	None
Hinduism	Same as above	High	Needed	1. Not a priority	1. Use the affiliations of MHS to communicate biotechnology	None
Buddhism	Same as above	High	No	1. Lack of knowledge	1. Enhance understanding of biotechnology	None
Taoism	Same as above	High	No	1. Lack of knowledge 2. No congregation	1. Use the platform of youth camps, Sunday Schools	None
Sikhism	Same as above	High	Yes	1. Lack of understanding	1. 1. Enhance understanding of biotechnology	None

Youth camps, Sunday Schools and Dharma talks are some of the avenue for talks and discussions on biotechnology.

Although there were several challenges identified by the religious scholars to enable them to engage with the public on biotechnology, these challenges could be addressed effectively if the relevant government agencies such as MOSTI, BiotechCorp and NRE take proactive measures. However, their lack of knowledge and understanding of biotechnology has to be addressed first. This could be done through MCCBCHST, JAKIM and Institute for Islamic Training Malaysia (ILIM). Basic understanding of biotechnology among religious scholars would enable them to address ethical issues that arise among their followers.

What is more important than just enhancing biotechnology understanding among religious scholars is engaging them in a dialogue adopting the contextual approach as the traditional knowledge of this scholars has to be taken into account when introducing new applications of biotechnology especially those that have ethical implications. If ethical and religious issues are handled at the level of religious scholars, there would be lesser resistance among the general public. This has been suggested by all scholars who expressed the need to have dialogue between scientists and religious scholars. Given the fact that biotechnology in not a priority topic at sermons of all faiths, it would be too ambitious to expect religious scholars to talk about biotechnology to their congregation. It would make more sense to equip them with answers when issues arise. Continuous dialogues between scientists and religious scholars would enable them to address any arising issues. Giving talks to the congregation could be handled by invited experts as it is practiced now.

A number of suggestions could be made based on the findings from this study:

i. It is too premature for religious scholars to communicate biotechnology as this topic is not a priority currently in Malaysia for all congregations. Therefore, it is more advisable to hold dialogues between scientists and religious scholars to address ethical and religious issues. Furthermore, well-informed religious scholars will be able to address any ethical and religious issues at the time of crisis. Their knowledge and understanding of biotechnology would trickle down to the general public.

ii. All the platform of the religious bodies (temples, churches, NGOs, mosques, youth camps, Sunday Schools, Dharma talks) could serve as a vehicle for biotechnology communicators where there are ready audience, especially the general public who are remote from most biotechnology communication programmes. However, messages should be crafted along the ethical and religious lines to have the connectivity and relevance to the audience.

iii. Government agencies, especially those related to biotechnology such as NRE, MOSTI, BiotechCorp and universities should engage religious scholars and provide them information on biotechnology to enable them to address issues that arise at their congregation. There is currently a serious void in this area. Furthermore, all religious scholars have expressed their desire to be engaged in dialogues with scientists and government agencies on biotechnology.

iv. There is no research on biotechnology or science communication that takes religious scholars into account as stakeholder. Hence, the serious lack of reference for this study. This has to be explored, especially in countries where religions play an important part in people's life, attitude and perception. This is the case for Malaysia.

Devos et. al. (2007) suggest a need to "move from a merely scientific evaluation and risk-based policy towards a socially more robust evaluation that takes the non-scientific concerns at stake in the genetically modified organisms debate seriously." This could be said for all other biotechnology fields where it involves the realm of ethics and religions. As science enters value-laden areas, stakeholders need to be engaged in the ethical, legal and social implications of science and technology or biotechnology in particular (Navarro, 2009). Religious leaders were identified by Asian respondents as trusted sources of information on biotechnology although their knowledge level was low (Juanillo, 2003). Torres et. al. (2006) added that religious leaders from Indonesia, a Muslim country, had a very conservative view of agricultural biotechnology. And in the Philippines, a predominately Catholic country, the biggest challenge for biotechnology as perceived by stakeholders was moral/ethical issues rather than technical soundness and utility (Navarro, 2009). Thus, any robust and effective biotechnology communication strategy should include religious scholars as one of the key stakeholders.