

Attitude Towards Genetically Modified Soybean Amongst The Klang Valley Stakeholders

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ABSTRACT

Public acceptance can be understood as the combined attitude of individuals on certain political issues, such as those arising from technological innovations. Other studies have concluded that the public's attitude towards biotechnology was primarily driven by several factors such as the perceived benefits, risks, moral concerns and encouragement. Risk perception studies have identified two additional important factors named as familiarity and risk acceptance. The purpose of this paper is to study the attitude of the Malaysian public in the Klang Valley region towards genetically modified soybean. A survey was carried out on 1017 respondents from various interest groups in the Klang Valley region. Results of the survey have shown that the overall mean scores for familiarity, perceived benefits, perceived risks, moral concerns and encouragement of GM soybean were moderate. ANOVAs showed significant differences in the six dimensions of attitude across stakeholders' groups.

ABSTRAK

Penerimaan awam dapat difahamkan sebagai gabungan sikap individu terhadap sesuatu isu politik, umpamanya perkara yang muncul akibat inovasi teknologi. Kajian-kajian lain telah merumuskan bahawa sikap awam terhadap bioteknologi telah didorong oleh beberapa faktor seperti keuntungan yang dijangka, risiko, pertimbangan moral dan galakan. Kajian-kajian persepsi risiko telah mengenalpasti dua lagi faktor tambahan yang penting yang dinamakan sebagai familiariti dan penerimaan risiko. Tujuan kertas ini adalah untuk mengkaji sikap orang awam di Wilayah Lembah Klang terhadap kacang soya yang dimodifikasi secara genetik. Survei telah dilakukan ke atas 1017 orang responden daripada pelbagai kumpulan di Wilayah Lembah Klang. Hasil survei telah menunjukkan bahawa skor min keseluruhan untuk familiariti, keuntungan yang dijangka, risiko yang dijangka, pertimbangan moral dan galakan tentang kacang soya yang dimodifikasi secara genetik adalah sederhana. Hasil ANOVA

menunjukkan perbezaan signifikan dalam keenam-enam dimensi sikap di kalangan kumpulan yang berkepentingan.

INTRODUCTION

Modern biotechnology has been viewed by many as the frontier of the next revolution. It is a powerful tool that presents a range of potential environmental, social and economic benefits that demands rigorous oversight (Kamaldeen & Powell 2000). However, because the advancement in biotechnology has been so rapid in the past ten years, it has been the object of an intense and divisive debate in advanced countries. Sagar et al. (2000) suggest that a major factor in the emergence of controversies surrounding biotechnology has been the neglect of the needs, interests and concerns of the primary stakeholders – the commoners. Public perceptions, understanding and acceptance of GMOs can both promote and hamper commercial introduction and adoption of new technologies (Kamaldeen & Powell 2000).

Public acceptance can be understood as the combined attitude of individuals on certain political issues, such as those arising from technological innovations (Aerni 1999). An individual's attitude towards a new technology depends on a number of related factors such as his (or her) perception of its risks and benefits, his socially communicated values and trusts in institutions representing these technologies. With respect to public perception of biotechnology, Kelley (1995) propose that attitude to genetic engineering is determined by the worth of potential benefits offered, knowledge on genetic engineering and having a scientific world-view, minus the perceived risk (rational worries) and anxieties or fears (irrational worries) and plus/minus various minor factors such as background factors. Other studies also concluded that the public's main concerns about biotechnology are primarily driven by ethical, value and safety concerns (Einsiedel 1997). While according to Hoban (1997), the major influences on acceptance seem to be knowledge level, awareness of benefits, confidence and trust. Gaskell et al. (2000, 2003) used four dimensions of attitude: perceived use, risks, moral acceptability and encouragement to model patterns of European public response to biotechnology.

The studies of public attitude towards biotechnology have many similarities with risk perception studies. The psychometric approach suggests that the public did not perceive technological risk according to a

single dimension related to predicted injuries or fatalities akin to a risk assessor's viewpoint but interpret risk as a multidimensional concept, concerned with broader qualitative attributes (Rowe 2004). Within this approach, multi-dimensional risk perception is invoked to explain the expert-lay disagreement that is ascribed to lay ignorance in the knowledge deficit model (Hansen et al. 2003). The key variables of risk perception research are the perceived magnitude of risk or dread, risk acceptance, familiarity with the hazard and lately the factor benefit has gained much interest (Rohrmann 1999). Sjoberg (2004) has highlighted the importance of another dimension: 'interference with nature' in risk perception studies on genetic engineering.

The objective of this paper is to assess the attitude of the Klang Valley stakeholders towards genetically modified (GM) soybean as an example of modern biotechnology product already available in the Malaysian market.

METHODOLOGY

Survey Data Collection

This is one of the first in-depth studies on attitude towards modern biotechnology in Malaysia. The people in the Klang Valley region were chosen as the targeted population as it is the centre of country's economic and social development (numerous existing universities and R&D institutions, biotechnology related industries) besides the respondents in this region meet the requirement of diverse background stated in the model.

In this study, a wider range of interest groups including producers, scientists, policy makers, NGOs, media, politicians, religious experts, university students and general public were surveyed. They were chosen using multi-stage sampling technique. The respondents (n=1017) were adult representatives (age 18 years old and above) from various interest or stakeholders groups mentioned earlier. Each stakeholders group will have a minimum target sample of 40 respondents except for the general public. Since the majority of the Klang Valley residents comprised of the general public, this group was allocated 550 respondents. The general public was further stratified according to their occupations classification by Malaysian Standard Classification of Occupations 1998 (MASCO). The ratios for different gender, races and religion of the residents in the Klang Valley were also taken into account.

Using the approach recommended by Kelley (1995) to carry out a base-line study in Malaysia, the respondents were first introduced to the

basic concepts of modern biotechnology. The questionnaires were administered face to face to the respondents.

Instrument

The multi-dimensional attitude towards biotechnology instrument used in this study was self constructed based on earlier researches (Latifah et al. 2004). The instrument incorporated six dimensions of attitude towards GM soybean (resistant to herbicide): familiarity, perceived benefits, perceived risks, risk acceptance, moral concerns and encouragement.

Familiarity ($\alpha=0.72$) comprised of four items: easy to know, easy judgement, effect known and controllability. Each item was measured on a 7-point scale, ranging from 1(not easy at all for the first two items/ strongly disagree for the remaining two items) to 7 (very easy for the first two items/ strongly agree for the other items). A higher score indicates greater familiarity.

Perceived benefit scale ($\alpha=0.87$) comprised of seven items: benefit to Malaysian society, enhance quality of product, enhance quality of life, enhance Malaysian economy, benefits exceed risks, safe to consume/use and acceptable by religion. Each item was measured on a 7-point scale, ranging from 1(not useful at all for item 1/ strongly disagree for the other items) to 7 (very useful for item 1/ strongly agree for the other items). A higher score indicates higher perceived benefit.

The measure for perceived risk ($\alpha=0.82$) was obtained by using five items: feelings of anxiety, harm to health, long term effect, catastrophic potential and overall risk magnitude. Each item was measured on a 7-point scale, ranging from 1(not worried at all for the first four items/ no harm at all for the last item) to 7 (very worried for the first four items/very harmful for the last item). A higher score indicates higher perceived risk.

Measure for risk acceptance ($\alpha=0.72$) comprised of three items: accept risk if it can boost Malaysian economy, societal risk acceptance and risk minimal in comparison with other risks. Each item was measured on a 7-point scale, ranging from 1(not willing at all for the first item/ not acceptable for the second and strongly disagree for the last item) to 7 (very willing for the first item/very acceptable for the second item and strongly agree for the last item). A higher score indicates higher risk acceptance.

Moral concern ($\alpha=0.81$) was assessed by asking the respondent three questions related to whether the application threaten natural order of things, likened as 'play God' and regarded as co modifying life. Each

item was measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). A higher score indicates higher moral concern.

Encouragement ($\alpha=0.88$) was measured by four items: more rigorous research and development, should be commercialized, should be given monetary support by government and overall encouragement. Each item was measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). A higher score indicates higher encouragement.

Statistical Analysis

Initially reliability tests and confirmatory factor analysis were carried out using SPSS version 12.0 to assess the consistency and uni-dimensionality of the constructs. ANOVAs were also carried out using the same statistical package.

RESULTS

Attitude towards GM soybean was analyzed based on six dimensions: familiarity, perceived benefits, perceived risks, risk acceptance, moral concerns and encouragement.

Familiarity

The Klang valley stakeholders perceived GM soybean as of moderate familiarity, with an overall mean score of 3.29 (Table 1). GM soybean was perceived as low in familiarity by the policy makers and three religious expert groups (Islamic, Buddhist and Christian) with the others rated it as of moderate familiarity.

Table 1. Familiarity of genetically modified soybean

Stakeholder	Familiarity	
	Mean score \pm std dev.	Interpretation
1. Producers	3.36 \pm 1.28	moderate
2. Biotechnologists	3.21 \pm 0.99	moderate
3. Biologists	3.19 \pm 1.26	moderate
4. Policy makers	2.95 \pm 1.10	low
5. NGOs	3.34 \pm 0.97	moderate
6. Media	3.29 \pm 1.11	moderate
7. Politicians	3.35 \pm 1.17	moderate
8. Islamic experts	2.77 \pm 1.24	low
9. Buddhist experts	2.76 \pm 0.75	low

10. Christian experts	2.49 ± 0.80	low
11. Hindu experts	3.04 ± 1.34	moderate
12. Biology students	4.04 ± 1.05	moderate
13. General public	3.36 ± 1.17	moderate
Overall	3.29 ± 1.17	moderate

ANOVA was significant for familiarity of GM soybean ($F=4.61$, $p < 0.001$), across stakeholders (Table 2). The Biology students scored the highest mean in term of familiarity with GM soybean and Post Hoc test showed that their rating differed significantly with several other stakeholders (Table 3). The students were more familiar with GM soybean compared to seven other stakeholders: biotechnologist, biologists, policy makers, Islamic, Buddhist and Hindu experts and the general public. On the other hand, the Christian experts scored the lowest mean score on the familiarity of GM soybean and differed significantly with the NGOs, politicians, general public and the Biology students.

Table 2. One way ANOVA to compare attitude towards GM soybean across stakeholders

Attitude dimension	F-value	Sig.
Familiarity	4.61	0.000***
Benefit	2.79	0.001***
Risk	1.88	0.033*
Risk acceptance	3.35	0.000***
Moral concerns	9.49	0.000***
Encouragement	3.18	0.000***

*** $p < 0.001$, * $p < 0.05$

Perceived Benefit

The overall benefit of GM soybean was in the moderate range with an overall mean score of 4.18, slightly above the mid-point of 3.5 (Table 4). All stakeholders agreed that its benefits were moderate. Comparing across stakeholders, the Biology students perceived the most benefits associated with GM soybean (mean score of 4.82) followed by the producers (mean score of 4.57) and the Buddhist experts (mean score 4.48). The lowest benefits were perceived by the Hindu experts (3.59), media (mean score 3.75 and NGOs (mean score 3.81).

Table 4. Perceived benefit of GM soybean

Stakeholder	Perceived Benefit	
	Mean score \pm std dev.	Interpretation
1. Producers	4.57 \pm 1.54	moderate
2. Biotechnologists	4.29 \pm 1.11	moderate
3. Biologists	4.29 \pm 1.41	moderate
4. Policy makers	4.26 \pm 1.14	moderate
5. NGOs	3.81 \pm 1.53	moderate
6. Media	3.75 \pm 1.22	moderate
7. Politicians	4.23 \pm 1.16	moderate
8. Islamic experts	3.96 \pm 1.48	moderate
9. Buddhist experts	4.48 \pm 0.67	moderate
10. Christian experts	3.91 \pm 0.98	moderate
11. Hindu experts	3.59 \pm 1.94	moderate
12. Biology students	4.82 \pm 1.06	moderate
13. General public	4.18 \pm 1.89	moderate
Overall	4.18 \pm 1.25	moderate

ANOVA was significant for the perceived benefits of GM soybean ($F=2.79$, $p<0.01$) across stakeholders (Table 2). Post hoc analyses of the beneficial aspects of the GM soybean highlighted the significant difference in opinion of the Biology students compared to the media, the general public, the NGOs and the Hindu experts (Table 5).

Table 5. Games-Howell Post Hoc tests to compare benefit of GM soybean between stakeholders

Stakeholder	Mean Score	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Producers	4.57													
2. Biotechnologists	4.29													
3. Biologists	4.29													
4. Policy makers	4.26													
5. NGOs	3.81													
6. Media	3.75													
7. Politicians	4.23													
8. Islamic experts	3.96													
9. Buddhist experts	4.48													
10. Christian experts	3.91													
11. Hindu experts	3.59													
12. Biology students	4.82					*	**				*			*
13. General public	4.18													

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Perceived Risk

The Klang Valley stakeholders perceived the risk aspects GM soybean as moderate with an overall mean score of 4.77, slightly above the mid-point of 3.5 (Table 6). The media subjects were the most critical compared to other stakeholders. They perceived the highest risk GM soybean (mean score of 5.46). The Islamic experts also rated GM soybean as possessing high risk (mean score of 5.08). The other stakeholders were more unanimous in their perception of risk associated with GM soybean. They viewed the risks as moderate.

Table 6. Perceived risk of GM soybean

Stakeholder	Perceived risks	
	Mean score \pm std dev.	Interpretation
1. Producers	4.44 \pm 1.30	Moderate
2. Biotechnologists	4.58 \pm 1.66	Moderate
3. Biologists	4.71 \pm 1.35	Moderate
4. Policy makers	4.57 \pm 1.33	Moderate
5. NGOs	4.94 \pm 1.06	Moderate
6. Media	5.46 \pm 1.33	High
7. Politicians	4.69 \pm 1.04	Moderate
8. Islamic experts	5.08 \pm 1.28	High
9. Buddhist experts	4.53 \pm 0.74	Moderate
10. Christian experts	4.71 \pm 0.99	Moderate
11. Hindu experts	4.82 \pm 1.50	Moderate
12. Biology students	4.64 \pm 1.28	Moderate
13. General public	4.77 \pm 1.13	Moderate
Overall	4.77 \pm 1.19	Moderate

ANOVA was significant for the perceived risks of GM soybean ($F=1.88$, $p<0.05$) across stakeholders (Table 2). Post Hoc test showed that only the media subjects' rating of risk significantly differed with the Buddhist experts.

Risk Acceptance

The overall mean score for risk acceptance of GM soybean (3.89) indicated that the Klang Valley stakeholders perceived the acceptance of risks associated with GM soybean as moderate (Table 7). Comparing the ten stakeholder groups, the Biology students were the most accepting of the risks associated with GM soybean (mean score of 4.48) followed by

the Buddhist experts (mean score of 4.26) and the producers (mean score of 4.24). On the other hand, the three least accepting of the risks associated with GM soybean were the media (mean score of 3.13), the Hindu experts (mean score of 3.32) and the NGOs (mean score of 3.50).

Table 7. Risk acceptance of GM soybean

Stakeholder	Risk acceptance	
	Mean score \pm std dev.	Interpretation
1. Producers	4.24 \pm 1.21	moderate
2. Biotechnologists	3.93 \pm 1.73	moderate
3. Biologists	3.81 \pm 1.68	moderate
4. Policy makers	4.05 \pm 1.52	moderate
5. NGOs	3.50 \pm 1.57	moderate
6. Media	3.13 \pm 1.43	moderate
7. Politicians	3.75 \pm 1.28	moderate
8. Islamic experts	3.77 \pm 1.46	moderate
9. Buddhist experts	4.26 \pm 0.70	moderate
10. Christian experts	3.59 \pm 1.15	moderate
11. Hindu experts	3.32 \pm 1.61	moderate
12. Biology students	4.48 \pm 1.17	moderate
13. General public	3.93 \pm 1.14	moderate
Overall	3.89 \pm 1.28	moderate

Table 8. Games-Howell Post Hoc tests to compare risk acceptance of GM soybean across stakeholders

Stakeholder	Mean Score	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Producers	4.24													
2. Biotechnologists	3.93													
3. Biologists	3.81													
4. Policy makers	4.05													
5. NGOs	3.50													
6. Media	3.13	*								**			**	
7. Politicians	3.75													
8. Islamic experts	3.77													
9. Buddhist experts	4.26													
10. Christian experts	3.59													
11. Hindu experts	3.32													
12. Biology students	4.48													
13. General public	3.93													

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

ANOVAs were significant for the risk acceptance of GM soybean ($F=3.35$, $p < 0.001$) across stakeholders (Table 2). The media subjects

were noticeably the most critical with the lowest rating for risk acceptance. Post Hoc test showed that their acceptance of risk for GM soybean (Table 8) were significantly difference from the producers, Biology students and the Buddhist experts.

Moral Concerns

The Klang Valley stakeholders regarded the moral aspects of GM soybean as moderate, with an overall mean score of 4.08 (Table 9). The Buddhist and the Christian experts considered GM soybean as having high moral concerns in contrast with the producers who regarded it as of low moral concerns (Table 9). The rest of the stakeholders perceived the moral aspects of GM soybean as moderate.

Table 9. Moral concerns of GM soybean

Stakeholder	Moral concerns	
	Mean score \pm std dev.	Interpretation
1. Producers	2.88 \pm 1.27	low
2. Biotechnologists	3.80 \pm 1.82	moderate
3. Biologists	3.77 \pm 1.79	moderate
4. Policy makers	3.68 \pm 1.49	moderate
5. NGOs	4.19 \pm 1.83	moderate
6. Media	4.61 \pm 1.47	moderate
7. Politicians	3.80 \pm 1.67	moderate
8. Islamic experts	3.83 \pm 1.37	moderate
9. Buddhist experts	5.62 \pm 1.16	high
10. Christian experts	5.76 \pm 1.25	high
11. Hindu experts	4.86 \pm 1.73	moderate
12. Biology students	3.46 \pm 1.52	moderate
13. General public	4.08 \pm 1.44	moderate
Overall	4.08 \pm 1.56	moderate

ANOVA was significant for moral concerns of GM soybean (F=9.49, $p < 0.001$) across stakeholders (Table 2). Post Hoc test confirmed the significant difference in perceived moral concerns between the Buddhist and Christian experts with majority of stakeholders except the media and Hindu experts (Table 10). Besides the three religious experts with the exception of Islam, the media subjects were next highest in rating the moral aspects of GM soybean. Post Hoc test again showed that their opinion of the moral aspects of GM soybean was significantly different from the producers and the Biology students. On the other hand,

the producers perceived low moral concerns of GM soybean compared to six other stakeholders: the NGOs, the media, the Buddhist, Christian and Hindu experts and the general public.

Encouragement

All the Klang Valley stakeholders were moderately supportive of GM soybean (with an overall mean score of 4.30) (Table 11). The most supportive group was the Biology students (mean score of 4.91) followed by the politicians (mean score of 4.80) and producers (mean score of 4.67). The three least supportive were the three religious groups, the Christian experts (mean score 3.49), the Islamic experts (mean score of 3.79) and the Buddhist experts (mean score of 3.96).

Table 11. Encouragement of GM soybean

Stakeholder	Encouragement	
	Mean score \pm std dev.	Interpretation
1. Producers	4.67 \pm 1.63	moderate
2. Biotechnologists	4.38 \pm 1.73	moderate
3. Biologists	4.32 \pm 1.59	moderate
4. Policy makers	4.42 \pm 1.46	moderate
5. NGOs	4.05 \pm 1.59	moderate
6. Media	4.21 \pm 1.17	moderate
7. Politicians	4.80 \pm 1.42	moderate
8. Islamic experts	3.79 \pm 1.58	moderate
9. Buddhist experts	3.96 \pm 0.78	moderate
10. Christian experts	3.49 \pm 1.00	moderate
11. Hindu experts	4.11 \pm 1.58	moderate
12. Biology students	4.91 \pm 1.30	moderate
13. General public	4.30 \pm 1.25	moderate
Overall	4.30 \pm 1.35	moderate

ANOVAs were significant for the encouragement of GM soybean ($F=3.18$, $p<0.001$) across stakeholders (Table 2). Post Hoc test showed significant difference in the support of the Biology students towards GM soybean compared to the three religious expert groups (the Islamic, Buddhist and Christian experts) and the general public (Table 12). While the encouragement level of the politicians and the producers were found to differ significantly from the Christian experts.

Table 12. Games-Howell Post Hoc tests to compare encouragement of GM soybean across stakeholders

Stakeholder	Mean Score	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Producers	4.67													
2. Biotechnologists	4.38													
3. Biologists	4.32													
4. Policy makers	4.42													
5. NGOs	4.05													
6. Media	4.21													
7. Politicians	4.80													
8. Islamic experts	3.79													
9. Buddhist experts	3.96													
10. Christian experts	3.49	*						**						
11. Hindu experts	4.11													
12. Biology students	4.91								*	*	***			*
13. General public	4.30													

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

CONCLUSION

Results of the survey have shown that the overall mean scores for familiarity, perceived benefits, perceived risks, moral concerns and encouragement of GM soybean were moderate. ANOVAs showed significant differences in the six dimensions of attitude across stakeholders' groups. The Biology students were the most familiar with GM soybean, perceived the highest benefit, more accepting of the risk associated with GM soybean and the most supportive of GM soybean. The media subjects were the most critical (saw the highest risks and the fourth highest moral concerns), the third lowest ranking in perceived benefit and the least accepting of the risks associated with GM soybean. The Buddhist and Christian experts were the most concern regarding the moral aspects of GM soybean. More efforts should be encouraged not only to disseminate more information to the media people, religious expert groups and general public on GM food but to hold dialogue and forum with them.

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