Societal perception of biotech corn farmers towards the Philippine Supreme Court ban on biotech crops

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Abstract: Several studies have explored the effects of restrictive policies in different case-use instances; however, studies focusing on restrictive agricultural policies and their effects on major stakeholders are scarce. This study explored the perception of biotech corn farmers towards the 2015 Philippine Supreme Court ban on biotech crops. First, the effects of the individual decision-making stages as described in the Consumer Decision Model on farmers' perceived correctness of the ban was modelled using ordinal regression. Here, we report that while farmers' initial instinct (need recognition stage) is directly related with their ban perception, succeeding decision making stages enforce the notion of a pragmatic point of view leading to innate resistance effects towards the ban. Further, we report that influences arising from internal factors such as income and satisfaction as well as external factors involving family effects perturb their ban perception. This information can offer guidance on how future restrictive agricultural policies may be framed in order to avoid conflicting interests between policymakers and stakeholders. This also highlights the need to understand farmer perspectives and attitudes to gain critical information regarding technology adoption and development.

I. Introduction

According to the FAO 2020 report, 690 million people or 8.9 percent of the world population were undernourished prior to the COVID-19 pandemic and the figures are continuously rising. 60 million more people were affected by hunger since 2014 and if this trend continues, the number of undernourished people is estimated to exceed 840 million by 2030 (FAO, 2020). These pressing issues on food insecurity and malnutrition are further aggravated by persisting problems on climate change, booming population, urbanization, land degradation, migration, and the ongoing COVID-19 pandemic. Sustained efforts in addressing these problems involve international and multisectoral collaboration of different fields, such as agriculture, food, health, policy and development planning, among others. There is also a need to rebalance agriculture policies towards more nutrition-sensitive policy actions and focus on solutions that can cater in mitigating the lingering problems affecting global food production, distribution, and sustainability. These are imperative to be on track with the world's SDG targets, particularly in ending hunger, food insecurity, and all forms of malnutrition for the following decades to come.

Biotech crops are a prime example of agricultural modernization, which shows how the field of agriculture continues to adapt in a changing modern era, most especially in the 4th industrial revolution (4IR). Despite the persisting challenges faced by the field of agriculture, it was reported that from 1996-2018, the socio-economic benefits of biotech crops involve increasing food productivity, supporting nations' self-sufficiency in terms of arable lands, conserving biodiversity, mitigating climate change challenges, and contributing economic, health, and social improvements (ISAAA, 2019). In the Asia and Pacific region, the leading country in terms of biotech crop propagation is India with 11.9 million ha of cotton, followed by China with 3.2 million ha of cotton and papaya, Pakistan with 2.5 million ha of cotton, and the Philippines with 875,000 ha of biotech corn (ISAAA, 2019).

In December 2002, the Philippines was the first among Southeast Asian countries to adopt the application of biotechnology in agriculture, specifically biotech corn, for feed production. In the latest report of ISAAA (2019), the country ranked 12th worldwide in the list of biotech-mega countries, with 0.9 million ha allotted for biotech corn. Through the years, farmers reported sustained increase in yield and income as well as reduction of insecticide use (Yorobe and Smale, 2012; Panopio and Navarro, 2011; Yorobe and Quicoy, 2006).

The Philippines has moderate adoption of biotech cultivars, but national policies pertaining to cultivar registration are very strict. As a case in point, the Supreme Court banned the nationwide field testing of *Bt* (*Bacillus thuringiensis*) eggplant and the commercialization, propagation, and importation of genetically modified (GM) products in the Philippines on December 8, 2015. However, this ban was lifted on July 26, 2016 as a result of the appeals from the local and international scientific community (ISAAA, 2017). For 16 weeks, various media companies monitored the debates that sparked from this issue, thereby placing agricultural biotechnology in the limelight, which is in contrast with the usual low media coverage being given to science-related news (de Leon *et al*., 2019). Aside from the reversal of the Philippine Supreme Court's decision and high press attention given to this issue, it is also imperative to understand the perceptions of biotech farmers — the number one stakeholders of agricultural biotechnology who will be heavily affected if the nationwide ban persisted. In the Philippines where biotech corn is the only biotech crop approved so far for feed production, thousands of biotech corn farmers rely on this crop for their main source of livelihood. Hence, if the ban on biotech crops continued, it would equate to the loss of jobs for these farmers, which is a heavy blow in their daily lives and communities. This aspect was not covered much by the press and mass media, but analyzing this angle is equally vital for implementation of future government strategies and agricultural policies.

As argued earlier, the nationwide ban on biotech crops can thus be seen as a restrictive policy when applied to the case of biotech corn farmers. The implementation of restrictive policies require compliance from its target population, and based on the traditional Deterrence Theory (Vito and Maahs, 2017), it is assumed that the target population will follow the law because it is the right thing to do. The theory also assumes that people follow rules in fear of being punished, and that people rationally calculate the potential cost of penalties and sanctions. On the other hand, it is also important to understand how people think about compliance and whether they are actually being persuaded to follow. The Elaboration Likelihood Model explains that people undergo two mental routes towards attitude change (Griffin *et al*., 2019). One is the central route, a cognitive processing path where a person scrutinizes a message and carefully thinks about issue-relevant arguments contained in a persuasive communication. The other path is called the peripheral route or a mental shortcut process, where a person accepts or rejects a message based on irrelevant cues or if the persuader has high source credibility. In short, the difference between the two routes is how much cognitive effort a person is willing to give towards a certain issue that can lead to persuasion, and in this case, compliance towards a policy. These theories, which focus on explaining the concepts of compliance, thinking process, and persuasion serve as foundations in understanding the perception of biotech corn farmers towards the ban on biotech crops.

The main objective of this paper is to examine the societal perception of biotech corn farmers on the Philippine Supreme Court ban on biotech crops, in connection with their decision-making process and factors influencing their biotech corn adoption. It is important to note that this study did not measure actual behavior but focused more on the analytical perspective. Moreover, the farmers are treated as consumers/adopters in this study and the specific farming method that was analyzed is the biotech corn technology.

A paper focusing on influential factors affecting biotech corn adoption of farmers was already discussed in Gonzalvo *et al.* (2020). This paper is distinct since it would focus on mapping out the interplay between the farmers' perception of the ban and their decision-making towards their biotech corn adoption.

II. Review of literature and theoretical framework

Understanding farmers' perspectives on restrictive policies

Various papers on rural sociology and farmer decision making have tried to understand farmers' perspectives towards different agricultural policies and modelling their cognitive behavior in adopting innovations (Munguia *et al.*, 2021; Jha *et al.*, 2020; Methorst *et al.*, 2017; Bonzanigo *et al.*, 2015; Edwards-Jones, 2006). Understanding farmers' perceptions and attitudes, as well as their causes and effects, can significantly aid in the creation and implementation of future policies. Gaining knowledge about the relationship of farmers and the technologies they are adopting as well as the decision-making process they are performing individually and collectively would help in crafting better approaches towards the development of the agricultural sector.

While a lot of papers dwelled on analyzing farmer decision making towards agricultural policies, there is still a limited number of literature focusing on restrictive policies, which pertain to bans and prohibitions on certain technologies and farming methods. In a study that analyzed a farmers' perceptions towards a decade-long grazing ban policy in Northern China, it was observed that farmers are more inclined to give more importance towards short-term economic interest than ecological protection (Chen and Zhou, 2016). The study was conducted in ethnic minority areas where grassland is a main source of income; hence, the farmers are experiencing difficulty in complying with the mandatory changes of the Grazing Policy Ban (GBP). As a result, more than 70% of the farmers engaged in illegal grazing after the GBP was implemented. In Chang *et al.* (2016), farmers' attitudes towards stringent water-saving policies

were observed. The policies involve restricting household agricultural water use, closing wells, reducing farmland, increasing water prices, and allocating surface water among upper, middle, and lower beaches, which all entail negative influences towards the agricultural production of farmers. The study found that farmers' awareness of the positive consequences of the household agricultural water restriction and their perception of policy enforcement had significant relationships towards their attitudes on the stringent water-saving policies. The study recommended to strengthen open and fair policy enforcement, cautiously utilize water prices as a tool in controlling irrigation water, and enable the local farmers to be more informed about these policies. Meanwhile, Pradhan *et al*. (2017) focused on qualitative approaches to know farmers' perceptions towards the effectiveness of drought policy implementation. The study found that farmers' past experiences are directly related to their policy implementation perceptions. Moreover, it was also observed that farmers' local level adaptation is oriented towards income diversification and short-term market rewards. The study thus recommended to strengthen local level long-term adaptation strategies such as awareness raising, capacity building, watershed management, and source conservation to ensure effectiveness of policy implementation. These studies show the importance of understanding farmers' attitudes towards restrictive policies since this would reflect in their future behavior and decisions, and it can also determine the percentage of their possible compliance or non-compliance.

Theoretical Framework

The study was theoretically guided by the Consumer Decision Model of Blackwell *et al*. (2001). This model provides a cognitive map regarding a person's decision-making stages and factors influencing those stages. Upon exposure to a stimulus and after accepting that the information is deemed relevant to a person's wants and needs, this triggers a person's *need recognition stage* where a difference between an actual and alternative state is recognized. After a need is established, the *search stage* will be activated where a person evaluates his/her

knowledge between the two states. Next, the *pre-purchase evaluation of alternatives stage* will occur where a person gauges the level of benefit derived from each state, which then leads to the *purchase stage* where likelihood to purchase or subscribe to a certain state is being evaluated. The person will now decide if he/she will continue to subscribe to the current state or go for the alternative state (*consumption/adoption stage*). Lastly, the person can choose whether he/she will recycle, dispose, or promote the chosen state (*post-consumption/adoption evaluation and divestment stage*). It is also assumed that each decision-making stage is being influenced by internal and external factors.

III. Methods

The study employed a cross-sectional survey to interview 111 biotech corn farmers in the top three biotech corn producing municipalities in the province of Pampanga (i.e., Arayat, Magalang, and Mexico), Philippines using respondent-driven sampling (Figure 1). All farmers interviewed confirmed that they were using the yellow corn hybrid with *Bt*-induced pest resistance with the most common seed type being either the Syngenta Agrisure NK8840 *Bt*/GT which have big cobs and kernels, low ear placement, and high shelling recovery (Syngenta, 2017); and DEKALB 6919S Genuity 5% RIB with *Bt* technology, Roundup Ready (Monsanto, USA) weed control technology, and high shelling recovery.

Data was collected using a standardized questionnaire, which was administered through face-to-face interviews to elicit and capture the answers and explanations of the farmers. Each of the decision-making stages, influential factors, and ban perception have a corresponding Likert scale to measure farmers' response. Accompanying explanations were requested for all the answers given.
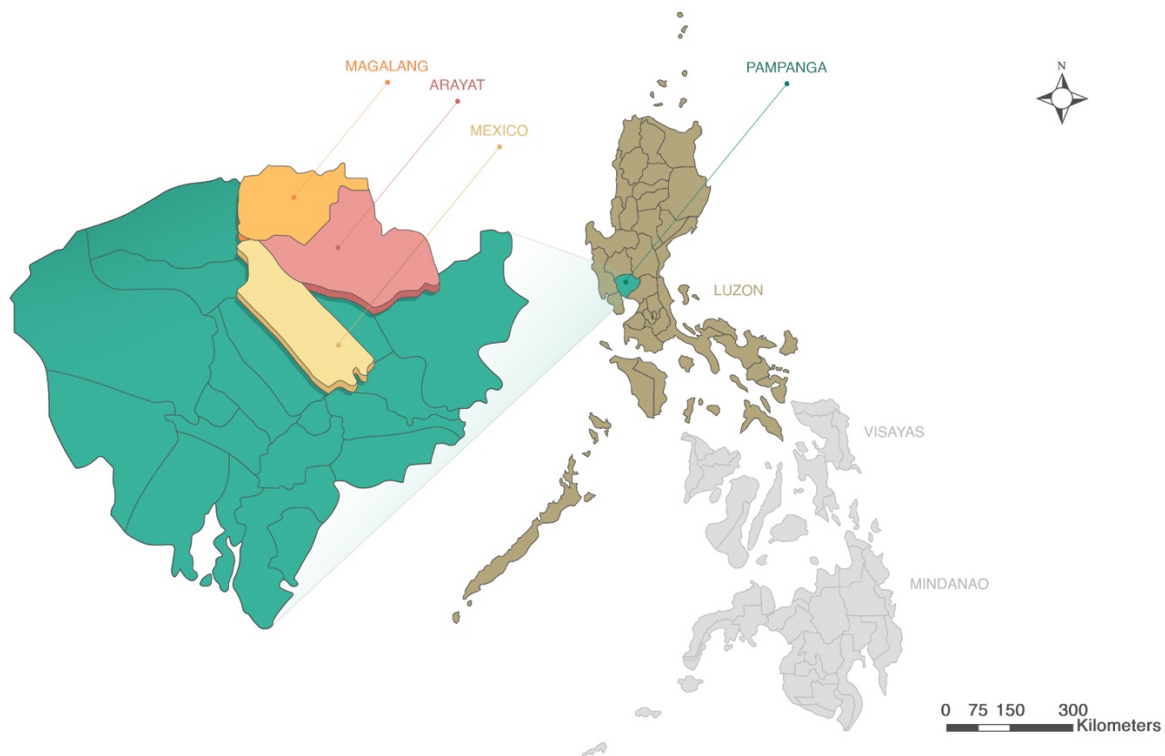
Figure 1. Sampling sites of the study showing the top three producers of biotech corn in Pampanga province, Philippines (i.e., Municipalities of Arayat, Magalang, and Mexico).

The decision-making process was investigated as well as the influential factors affecting the decision making of farmers, though this paper will only focus on the societal perceptions of biotech corn farmers towards the ban. A study focusing on the effects of influential factors biotech corn farmers was already conducted in Gonzalvo *et al*. (2020). Here, the farmers' perception of the ban (the ban being correct or not) was modelled first in the context of the main decision making process which is composed of the following: needs recognition stage (willingness of the farmer to try alternative non-biotech crops), level of familiarity (farmer's degree of knowledge relative to biotech and non-biotech corn), level of benefit (degree of benefit derived from biotech corn), willingness to continue buying (degree to which farmer would continue buying biotech corn), willingness to continue planting (degree to which farmer would continue planting biotech corn), and willingness to continue selling (degree to which farmer would continue selling biotech corn). In this study, the farmers' perception of the ban was modelled against 24 putative factors affecting the decision making

of farmers. The narratives of farmers in the face-to-face interviews served as qualitative data to support the interpretation of research results.

Initial relatedness between variables was determined using Spearman's correlation (rho) in SPSS v.27. Ordinal logistic regression, correspondence analysis, and factor analysis were conducted using SPSS v.27.

IV. Results and Discussion

This study focused on exploring the various factors that may affect how farmers perceive the restrictive policy of banning biotech crops in the Philippines (2015 Supreme Court's Ban on biotech crops). Results of the initial survey indicated that among the 111 biotech corn farmers that were interviewed, roughly 46% (51/111) think that implementing the ban was an incorrect decision, and ~35% (39/111) indicated that implementing the ban was a correct decision, while the remaining ~19% (21/111) were unsure. The bifurcation of the sampled group relative to their perceived correctness of the ban may hint on the existence of possible factors that have induced different effects on individual farmers. Internal influences such as one's own decision-making process, information search, and previous and current experiences/beliefs; as well as external influences such as family, community, market situation, and local/national policy implementations may affect an individual's perception.

A common theme among farmers who said that implementing the ban is incorrect is their opinion that they have been planting biotech crops for more than a decade and they have not seen or felt any negative effects towards their health and environment; hence, they are seeking evidence from the government first before they believe and adhere to the ban. They are also saying that planting biotech corn is their number one source of income, from which they have reaped higher yields than the white corn they have been planting previously; thus, stripping this crop from them, including other rural communities in their province, would entail negative consequences to their lives. They also emphasized that planting biotech corn is less

laborious and it has significantly reduced their pesticide application. Furthermore, farmers are expressing their appeal for the government to provide alternative programs or other high-yielding crops applicable to their situation if the ban on biotech crops will persist. Lastly, since the farmers feel that they have the most direct experience in using and handling biotech corn, they strongly feel that they should be involved during the initial stages of any policy framing that involves this technology. They also felt wrongly treated for being left out when they are the number one adopters of the biotech corn technology. On the other hand, farmers who said that implementing the ban is correct expressed their desire to follow the law and their trust in the government's decision. They believe that the government has done the necessary research and legal procedures before implementing the ban. However, a lot of the farmers are still voicing out their appeal to government leaders for an alternative crop that can match the high standard set by biotech corn in their province.

Exploratory factor analysis of candidate influential factors

A total of 30 variables were used in this study as predictors of farmers' perceived correctness of the ban. Of those, 6 variables comprise the decision-making stages, 16 variables represent internal factors, and 8 variables represent external factors. To determine how each of these variables relate to each other, exploratory factor analysis was carried out (Table 1).

Most variables in factor one coalesces to a common theme of outside influencers – co-farmers, family, and barangay/province – and was thus termed as *external factors*. On the other hand, variables in factor two corresponds to internal influences and was referred to as *internal factors*. Variables in factor three relate to farmer practices and gained experiences and was labeled as *farmer practices and experiences*, while factor four encompasses the *decision-making stages*, and variables in factor five as *external knowledge sources*. Farmers who have high influence from external factors (Factor 1) are more predisposed to have influence from internal factors due to the effects of their *situation after planting*, and *personal information*

regarding planting and purchasing biotech corn seeds. In addition, the decision-making stages

(Factor 4) have an inverse relationship with the first stage of decision-making (*desirability to*

plant alternative types of crops) and the farmers' *perceived correctness of the ban*.

Table 1. Exploratory factor analysis for all the variables used in the study using principal component analysis.

Variable	Eigenvalue
Factor 1: External factors	
Acceptability of biotech corn in barangay or province	0.747
Experiences of co-farmers in planting biotech corn	0.837
Personal information regarding planting and purchasing biotech corn seeds	0.412
Support of family in planting biotech corn	0.533
Perception or opinion of family regarding biotech corn	0.689
Situation of co-farmers who are planting biotech corn	0.769
Situation after planting biotech corn	0.486
Factor 2: Internal factors	
Benefits of planting biotech corn (e.g. increase in income)	0.667
Satisfaction in planting biotech corn	0.436
Personal experiences in planting biotech corn	0.439
Usage of income from biotech corn	0.686
Personal information regarding planting and purchasing biotech corn seeds	0.573
Situation of economic demand of biotech corn in the market	0.776
Situation after planting biotech corn	0.496
Factor 3: Farmer practices and experiences	
Sources of information about biotech corn	0.449
Knowledge about biotech corn	0.77
Knowledge about planting practices of biotech corn	0.702
Knowledge about the requirements needed to plant biotech corn	0.625
Attitude towards biotech corn	0.637
Factor 4: Decision-making stages	
Desirability to plant alternative types of crops	-0.744
Likelihood to buy biotech corn seeds	0.731
Likelihood to buy biotech corn seeds	0.489
Desire to continue planting biotech corn	0.604
Perceived correctness of the ban	-0.678
Factor 5: External knowledge sources	
Knowledge about news on biotech corn (e.g. TV news and newspaper reports)	0.426
Knowledge about the ban on planting biotech corn and *Bt* eggplant	0.756
Attitude towards positive effects of biotech corn on environment and health	0.456
Attitude towards the negative effects of biotech corn on the environment and health	0.805

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Relationship of decision-making stages with perceived correctness of the ban

To determine the effects of the farmers' decision-making process to their perceived

correctness of the ban, the Consumer Decision Model (Blackwell *et al.*, 2001) was translated

into a farmers' point of view, namely: desirability to plant alternative (non-biotech) crops,

familiarity and knowledge of biotech and non-biotech crops, level of benefit derived from

biotech crops, likelihood to buy biotech corn seeds, desire to continue planting biotech corn, and likelihood to sell and promote biotech corn. The effect of the farmers' ordinal response to these stages of decision-making process to their perceived correctness of the ban was then determined by Spearman correlation (Table 2).

Table 2. Relationship of each decision-making stage to farmers' perceived correctness of the Supreme Court's Ban on biotech crops using Spearman correlation.

Variable	Estimate	Significance
Desirability to plant alternative types of crops	0.359**	0.000
Level of familiarity and knowledge of biotech and non-biotech crops	0.015	0.873
Level of benefit derived from biotech corn	-0.211*	0.026
Likelihood to buy biotech corn seeds	-0.375**	0.000
Desire to continue planting biotech corn	-0.359**	0.000
Likelihood to sell and promote biotech corn	-0.300**	0.001

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

The first stage of decision making, needs recognition stage, compares an individual's current situation with an alternative state usually encountered from the environment. Oftentimes, this falls within the first impression type of perception which may or may not affect individuals depending on their thought process. This was termed as "automatic processing" by Jacoby (2002) since need recognition is attributed to an individual's subconscious level. Here, the farmers' current state is biotech corn farming, and the alternative state is the adoption of non-biotech farming. It was found that the biotech corn farmers' desirability to plant alternative crops is directly related with their ban perception, such that farmers who have expressed higher desire to try planting non-biotech crops perceive the ban as being a correct policy implementation, while those who expressed low levels of desire to try planting non-biotech crops perceive the ban as being an incorrect policy (Figure 2). The separation in the distribution of the farmers in terms of ban perception agrees with this result. Farmers who adhere to the law regardless of their personal satisfaction, beliefs, and experiences, and exhibit an altruistic nature towards the ban thereby conform with the moral picture described in the Deterrence Theory (Vito and Maahs, 2017). However, the presence of farmers who do not conform to this behavior and have indicated that they would still continue planting biotech corn and think that

the ban is incorrect may have influences from the Elaboration Likelihood Model (ELM) instead. Farmers who adhere with their past experiences, satisfaction, and beliefs – farmers who exhibit bottom-up thinking or *objective elaboration* which rationalize external and internal inputs (such as knowledge of the ban) – ascribe lower priority towards first impressions or suggestions from credible information sources. This population is distinct and can be clearly distinguished from another group of farmers who exhibit top-down thinking or *biased elaboration*, such that inputs from credible sources are highly valued and prioritized over other factors. This bifurcation of the population therefore leads to the formation of the dominance of extreme answers relative to their perception of the correctness of the ban, such that bottom-up thinkers are predisposed to think that the ban is incorrect whereas top-down thinkers will indicate that the ban is correct.

Figure 2. Heat diagram of each stage of the Consumer Decision Model (Blackwell *et al*., 2001) with the farmers' ban perception.

The succeeding stages of *pre-purchase evaluation* (level of benefit derived from biotech corn), *purchase* (likelihood to buy biotech corn seeds), *adoption* (desire to continue planting biotech corn), and *post-adoption evaluation and divestment* (likelihood to sell and

promote biotech corn), were found to have an inverse relationship with the farmers' ban perception. This indicates that the farmers' level of benefit and satisfaction towards biotech corn is the primary driver of their perception towards a restrictive ban that have the potential to affect their livelihood. Indeed, such dispositional behavioral factors affecting adoption of agricultural policies have been reported previously (Dessart *et al.*, 2019; Wilson and Hart, 2000). Results from this analysis has put to light the critical importance of farmer consultations in policy framing and implementation to avoid conflicts and farmer indifference. Farmer involvement in policy framing has proven to be a valuable piece of information as discussed in FAO (1997) and Darnhofer (2006).

Relationship of internal and external factors with perceived correctness of the ban

To further understand which factors affect farmers' ban perception, identified internal and external factors were used as predictors in an ordinal regression model (Table 3). Among the internal factors, *capital*, *knowledge about the requirements needed to plant biotech corn*, *attitude towards the negative effects of biotech corn on the environment and health*, *satisfaction in planting biotech corn*, and *usage of income from biotech corn* were found to have significant effects toward farmers' ban perception. Most of the variables here fall within the latent factor of internal factors in the previous exploratory factor analysis. Individual farmer profile characteristics have indeed been identified in earlier studies to affect farmer participation in agricultural policies (Karali *et al*., 2014). Meanwhile, *personal information regarding planting and purchasing biotech corn seeds*, *support of family in planting biotech corn*, and *perception or opinion of family regarding biotech corn* were external factors that have significant effects on the farmers' ban perception. These external factors (Figure 3) agree with previous studies on farmer participation towards agricultural policies (Karali, *et al.,* 2014; Dessart *et al.,* 2019). However, the alignment between the conclusions among these previous literatures are not

straightforward (Wilson and Hart, 2000; Defrancesco *et al.,* 2008). Thus, in Karali *et al.* (2014)

context-specific details is highlighted as an important factor in understanding policy support.

Table 3. Ordinal regression[a] to determine the relationship of internal and external factors to farmers' perceived correctness of the Supreme Court's Ban on biotech crops.

Variable	Estimate	Odds Ratio	Significance
Internal Factors			
Time	-0.593	180.94%	0.101
Capital	1.003	36.68%	0.008**
Sources of information about biotech corn	-0.354	142.48%	0.251
Knowledge about biotech corn	0.554	57.46%	0.163
Knowledge about planting practices of biotech corn	-0.77	215.98%	0.057
Knowledge about the requirements needed to plant biotech corn	-0.954	259.61%	0.011**
Knowledge about news on biotech corn (e.g. TV news and newspaper reports)	-0.41	150.68%	0.098
Knowledge about the ban on planting biotech corn and *Bt* eggplant	-0.104	110.96%	0.624
Attitude towards biotech corn	-0.163	117.70%	0.622
Attitude towards positive effects of biotech corn on environment and health	-0.345	141.20%	0.161
Attitude towards the negative effects of biotech corn on the environment and health	0.944	38.91%	0.005**
Benefits of planting biotech corn (e.g. increase in income)	0.499	60.71%	0.185
Satisfaction in planting biotech corn	-1.517	455.85%	0.004**
Personal experiences in planting biotech corn	-0.342	140.78%	0.325
Beliefs regarding acceptability of biotech corn	-0.149	116.07%	0.595
Usage of income from biotech corn	1.379	25.18%	0.006**
External Factors			
Acceptability of biotech corn in barangay or province	0.612	54.23%	0.103
Experiences of co-farmers in planting biotech corn	-0.04	104.08%	0.917
Personal information regarding planting and purchasing biotech corn seeds	1.232	29.17%	0.017**
Support of family in planting biotech corn	-0.775	217.06%	0.047*
Perception or opinion of family regarding biotech corn	-0.852	234.43%	0.037*
Situation of co-farmers who are planting biotech corn	-0.382	146.52%	0.212
Situation of economic demand of biotech corn in the market	-0.489	163.07%	0.075
Situation after planting biotech corn	0.224	79.93%	0.523

* Estimate is significant at the 0.05 level (2-tailed).
** Estimate is significant at the 0.01 level (2-tailed).
[a]Link function: Cauchit: $\tan(\pi(F_k(x_i)-0.5))$
Psuedo R-squared: Cox & Snell: 0.316; Nagerlike: 0.361; McFadden: 0.183
Test of parallel lines: Chi-square=8.876, df=24, sig=0.998
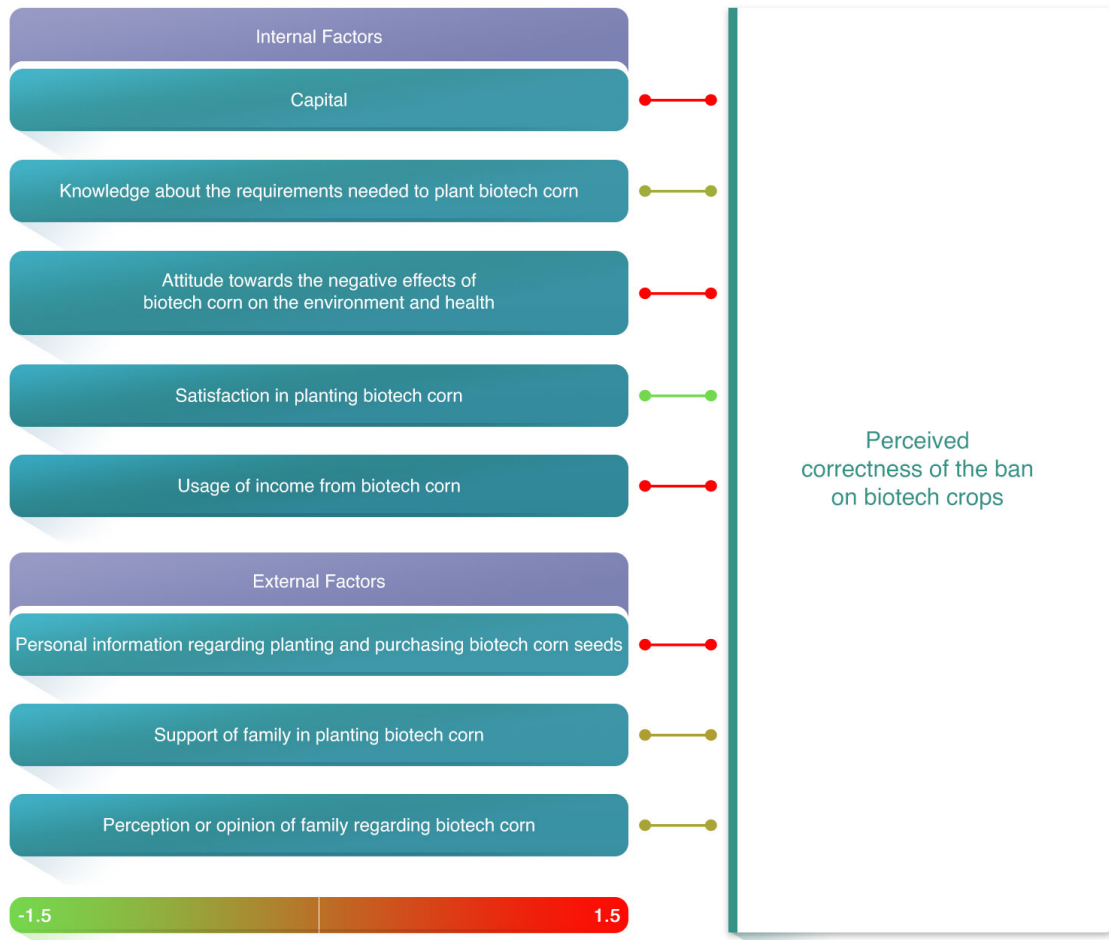Model fit: Chi-square=42.191, df=24, sig=0.012

Figure 3. Heat diagram of significant internal and external factors with the farmers' ban perception.

Taken together, it is shown that within the context of the 2015 Philippine Supreme Court's ban on biotech crops, biotech corn farmers thus have significant influences from their decision-making process, internal factors of income and product satisfaction, and external factors of family (Figure 4). The dilemma of choosing either policy support or product satisfaction is clearly evident in the results from this study which deviates from the Deterrence Theory school of thought. While such observations may differ from those in other countries, results from this study could prove to be a pivotal source of information for farmer-informed data regarding agricultural policy support and product adoption.

Figure 4. Integrated interaction map of significant internal and external factors (left), and decision-making factors (right) affecting farmers' ban perception.

Conclusion

As the prime stakeholders for the agribiotech industry, farmers' perspectives remain to be a viable source of information regarding policy changes and strategies, market situation, and societal impacts. Had the 2015 Philippine Supreme Court ban on biotech crops persisted, severe impacts on farmers' quality of life and income is anticipated and thereby prompts research initiatives targeting key interactions among factors affecting farmer perspectives and decision making.

This study first sets out to determine the relationship between the biotech corn farmers' decision-making stages and perceived correctness of the ban. Almost all of the stages had a significant relationship with the farmers' perception of the ban, except the information stage. The observed direct relationship between the need recognition stage and the perceived correctness of the ban appears to conform with the assumptions of the Elaboration Likelihood Model (ELM), such that the clear bifurcation of the population regarding how they perceive the ban directly agrees with the central (bottom-up thinking) and peripheral (peripheral

thinking) routes in this model. While farmers' perspectives at the initial stage of decision-making (need recognition stage) appears to separate the farmers into two distinct groups, the succeeding decision-making stages show otherwise. This hints at the resistive behavior among biotech corn farmers towards restrictive policies, more specifically towards the Supreme Court's ban on biotech crops. This therefore confirms the pragmatic nature of farmers as previously described in Gonzalvo *et al.* (2020). This therefore prompts immediate attention from policymakers and local government units who develop and improve on agricultural policies regarding biotech crops since the observed behavior among farmers may incite disagreements between stakeholders. Hence, better consultation and communication between farmers and policymakers should be carried out in future policy framing and implementation regarding biotech crops.

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