Application of Behavioural Economics for Promotion of Environment-friendly Agricultural Practices for Food Security and Enhanced Farm Income

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Abstract

Over the years the balance between the food production and environmental sustainability is getting skewed towards adverse environmental practices. There is increasing focus on environmental sustainability. There are a number of country specific initiatives to promote environmentally sustainable cultivation practices in the form of special schemes, incentivizing best practices in the form of subsidy, premium for organic produce etc. In recent times the application of concepts of behavioural economics in policy design has received the most attention by policy makers globally, to have a positive impact of their citizen behaviour in various walks of life. This article analyzes the utility of behavioural economics concepts in the promotion of environmentally sustainable farming practices.

Key words: behavioural economics, agricultural practices, environmental sustainability

Introduction

Food security is one of the most fundamental rights of every citizen. Nearly one-third of the land on the globe is used for cultivation purposes (Wood, 2005). Food production is closely related to environmental issues due to usage of various kinds of chemicals in the form of fertilisers, pesticides etc. Fertiliser usage has been found to have increased from 100 kg/Hac to 180.75 kg/Hac from 2000 to 2011 (source: World Bank), which implies the rise in usage of chemical inputs for cultivation (FAO Statistics 2017; Max Roser and Hannah Ritchie, 2017).This large-scale usage of artificial inputs has created many environmental issues (Foley et al 2001 and Bennett et al 2001).

Over the years, the balance between food production and environmental sustainability has been disturbed and is skewed towards adverse environmental

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practices. The free rider issues on public goods, i.e. environmental sustainability, are becoming the most common area of discussions at global forums. Many country-specific initiatives have been undertaken to promote environmentally sustainable cultivation practices in the form of special schemes, incentivising the best practices in the form of frontend and backend subsidy, premium for organic produce etc. In recent times, the application of concepts of behavioural economics in policy design has received the most attention by the policymakers globally, as it emphasises the importance of the human psyche and produces long-lasting effects. This article analyses the utility of behavioural economics concepts in the promotion of environmentally sustainable farming practices.

Food security and environmentally sustainable farming

Globally, farming leads to large-scale employment. In India, more than 60 percent of aggregate employment is provided in the farming sector. On the other hand, global food security depends on the aggregate agricultural produce. Most of the Sustainable Development Goals (SDG) that will drive the nations for the next 15 years are linked with food production (FAO, 2018). Hence, there is a need for balance between the food produce and environmental protection as present agriculture practice involves huge quantities of chemical molecular involvement in the form of fertilisers, pesticides etc.

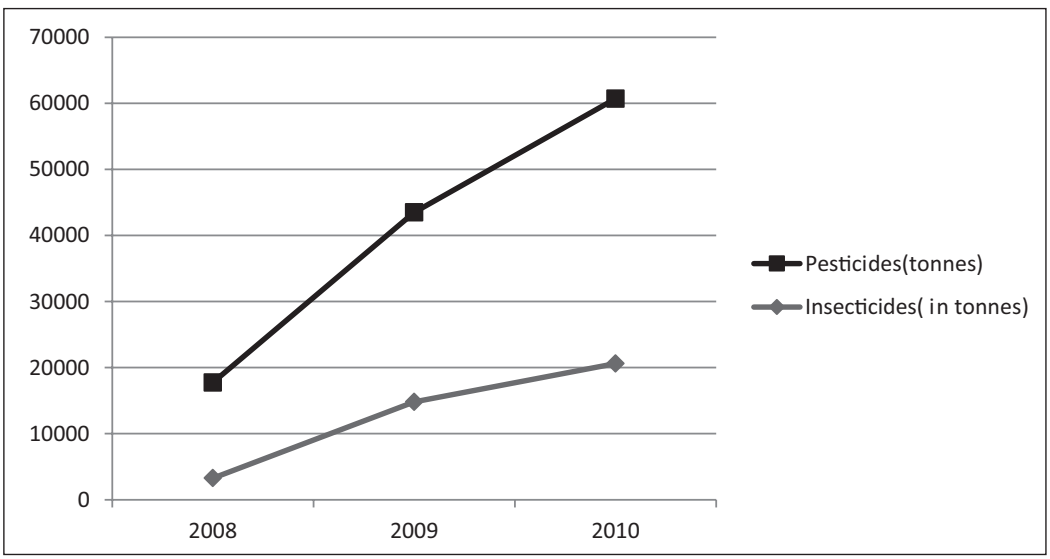


Figure 1. Consumption pattern of pesticides and insecticides in India (Source: FAO)

The usage of chemical inputs such as pesticides and insecticides has been increasing across nations, and India is not an exception. The usage of insecticides in India increased from 3,278 tonnes to 20,618 tonnes from 2008 to 2010, and in the same period, the usage of pesticides also increased (FAO,UN) . This has caused a movement across the world for traditional or organic farming, which is an environmentally sustainable practice. Such practices lead to soil health protection, cost effectiveness, better yield and provide premium value for the produce in the markets.

Behavioural economics and public policies: Behavioural economics is an interdisciplinary field drawing inputs from psychology, economics, anthropology, public administration, public policy and econometrics. The field uses several experimental applications of human cognition based on the basic premise of bounded rational thinking and presents models of behaviour prediction. It is widely prescribed in public policy, and many countries across the globe have successfully applied it to patternalise the behaviour of their citizens without affecting their freedom of their choice - in other words, human behaviour is changed in the desired direction without taking away their choices (Richard Thaler 2017). The behaviour insight team in the United Kingdom and the Social and Behaviour insight team in the United States are some permanent public policy structures that have experts in this field to advise the policymakers to come up with policies congruent to human psychology, due to which a large number of successful public programmes have been implemented in various fields, such as public health, marketing and consumer behaviour, investment behaviour etc.

Farmer Psychology

Mental health is vital to all individual human beings,including cultivators. According to World Health Organization (WHO), holistic health includes psychological wellbeing besides physical and social dimensions. Mental disorders disturb the wellbeing of human beings and have serious implications on the standard of life. In a report on depression and other mental disorders - Global Health Estimates, published by WHO in 2017 - more than 300 million people have been found to be affected by depression,and among them, more than 50 per cent are said to be living in underdeveloped and developing nations. Suicide topped the list for the top 20 causes of death in these countries, implying the close relation between mental health and economic indicators. A similar prevalence of mental

health disorders has been found among Indian farmers. In a study conducted by Gyanmudra in 2010 in the Anantapur district of Andhra Pradesh, behavioural aspects were found to be the leading factor (almost 52%) for death due to suicides by farmers (Deshpande, R. S., & Arora, S, 2010). The study also found that the depression prevalence rate among farmers was quite high (26.24%). This implies that the global findings on psychological wellbeing also reflect among the farmer community, and the economic conditions of farmers contribute to their mental wellbeing.

Behaviour and environment (including economics)

Studies have proved that a disproportionate usage of inorganic matters not only affects the environment, but also human existence. There are direct effects (adverse) as well as non-obvious effects, which can have a grave impact on human lives. Such effects are dormant and not noticed in earlier stages but are felt after the threshold level is crossed. In the field of psycho- physics, it is explained in terms of Just Noticeable Difference (JND), which explains that a threshold needs to be crossed to perceive the change, until which time it is in the incubation stage. In a classic experiment in 19 villages in six states done by Greenpeace in 2004, in the cotton belt areas(where the consumption of pesticides was higher), children in the age ranges of 4-5 years and 9-13 years belonging to agricultural communities were tested with a standardized rapid assessment tool designed to measure memory skills and motor abilities (by controlling other possible variances). It was found that 86 per cent children in the younger age group (4-5 years) and 84.2 per cent in the older age group (9-13 years) performed poorly in mental and motor skills than the control group, and terotogenes (environmental factors influencing incidences such as hereditable genes) were attributed for that. This noticeable difference may be seen in later stages as poor mental and verbal skills.

Enhanced economic environment and reduced cognitive taxing

Environmental effects on human behaviour, particularly cognitive abilities, are being investigated on a large scale by experts in cognitive psychology who are prime researchers in the field of behavioural economics. In a classic field trial among sugarcane farmers in India, experts found that there was a difference of an astonishing 10 IQ levels in the intelligence levels (tested through standardised fluid intelligence test tools) before and after the harvest, which was not generally

attributed to any other plausible reason than enhanced economic conditions from the sales of their produce. Such results were also found across other cultures, though they may not be equal in strength (Mullainathan et al and Mani and others World Development Report, World Bank Group 2015).

Leveraging behavioural economics in nudging desirable behaviour in farming

Various principles and concepts in the field of behavioural economics have been employed by several countries for promoting desirable citizen behaviour that is beneficial to both the individual and the society. Some of those relevant to this analysis are discussed here.

Employing the endowment effect and associated loss aversion: This concept is widely prescribed by behavioural economists patternalising the environment-friendly behaviour of individuals. This principle says that the materials endowed by an individual are valued more than their market value (Kahneman, D., Knetsch, J. L., & Thaler, R. H. 1990). The individual's subjective value gets added with the objective value, which makes the material subjectively costlier and difficult to part with even when offered a similarly valued material. Hence, taking away this already endowed benefit, which may be an already existing benefit or assistance, is more intensely painful than offering a new equivalent benefit to promote desirable behaviour.

Neighbourhood farming communities that do not have enough motivation to practise environmentally sustainable farming can be encouraged to practise desired behaviour (Low, D. 2011), which can be beneficial to both them and the society. The willingness to accept - another principle closely associated with endowment - is followed by the environmental policymakers collecting compensation from the pollution makers (also known as polluter pay principle). This can also be employed as a compensatory mechanism for not following environmentally sustainable farming to reduce the utilisation of chemical fertilisers.

Such compensation needs to be out of pocket,with a strong endowment perception for long-lasting and early desired effects. In other words, asking non-followers to forgo certain already entitled and received benefits rather than asking them to pay an amount will be the best form of nudging the behaviour in desired directions, as researches have established that the loss is painful compared to equivalent gains, a concept of prospect theory (Edwards, K. D.,1996) explained as follows:

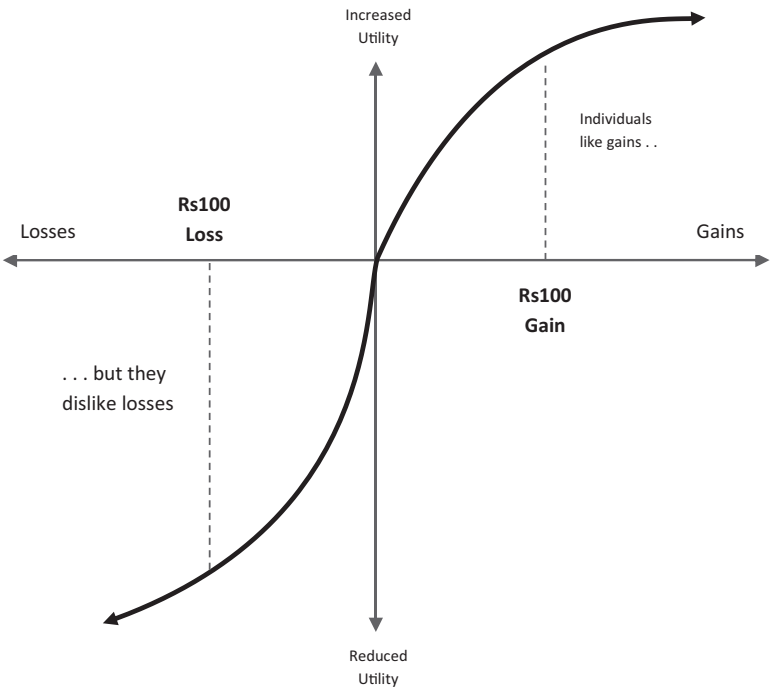


Figure 2. Differential perception of loss and gain for similar quantity

From the preceding graph, it is seen that the utility or the subjective valence for the loss is more than the equivalent gain. This differential individual utility level is attributed to the endowment effect and the human tendency of loss aversion. This loss aversion is also closely related with risk-taking behaviour in a given situation (Thaler, R, 2015). The graph also implies that the sensitivity of discomfort in the loss gets tapered for subsequent losses i.e. the first loss is more painful than the second loss. This will lead the individual, according to psychologists, to accept the risk further, and the undesirable behaviour may continue. Hence, this strategy can be combined with other nudging concepts, which are explained as follows:

Increasing knowledge endowment: Knowledge is an important endowment and can be nurtured through proper nudging principles. In the present context, cultivation is technology-driven and farmers essentially require skills and knowledge in comparison to previous years. The technology adoption facilitates better income and requires skilling of farmers, which has been found to help

the farmers come out of distress (Deshpande, R. S., & Arora, S, 2010). The educational level of farmers in India is not encouraging, and the percentage of non-literate workers engaged in agriculture is more than 50 per cent and has hovered around the same mark over the years. Hence, there is a need to reorient farmer skilling, and digital technology skilling is one of the areas that needs to be leveraged (G.K.Chadha, 2003). Skills are relatively permanent endowments in human beings. They facilitate better decision making in cultivation methods. The World Development Report, brought out in 2015 by the World Bank and titled "Mind, Society and Behaviour", says that there is a wide variation of labour productivity in farming and that the differences touch a whopping 50 per cent on a steep high compared to differences in aggregate productivity. The most likely reason for this is non-adherence of simple technologies (which aid the production of agricultural farm) by cultivators due to the existing knowledge level of farmers. The application of behavioural economics principles,such as temporal intervention, converting complex agricultural technology into simpler technology for better and easy understanding of the advantages of such technology adoption, information dissemination in accessible places by utilising digital technology tools, can be quite useful in developing skill acquisition in cultivators. It also facilitates environmentally congruent cultivation. CRRID (Centre for Research in Rural and Industrial Development) conducted a field trial from September to October 2017 in Himachal Pradesh and found that farmers who practised protected cultivation were found to have realised farm income returns of around Rs. 3-5 lakh per acre, whereas during the same period, farmers who had not practised protected cultivation werefound to have realised only around Rs. 1 lakh per acre. Hence, prompting or nudging the cultivators into practicing non-complex technology, such as protected cultivation methods, can accelerate farm income. Similarly, the adoption of simple post harvest technologies can facilitate farmer income on a large scale (Chakraverty, A., & Singh, R. P, 2016).

As knowledge enables cognitive abilities, it also facilitates farmers taking appropriate cultivation decisions in time and adoption of better technology,which has a close relation with increased farm income. Timely intervention (temporal factor), such as pre-purchase of cultivation inputs immediately after harvest (during this time, the probability of money with farmers is higher), yielded similar results, such as increase in farm productivity with state sponsored subsidy (WDR, 2015).

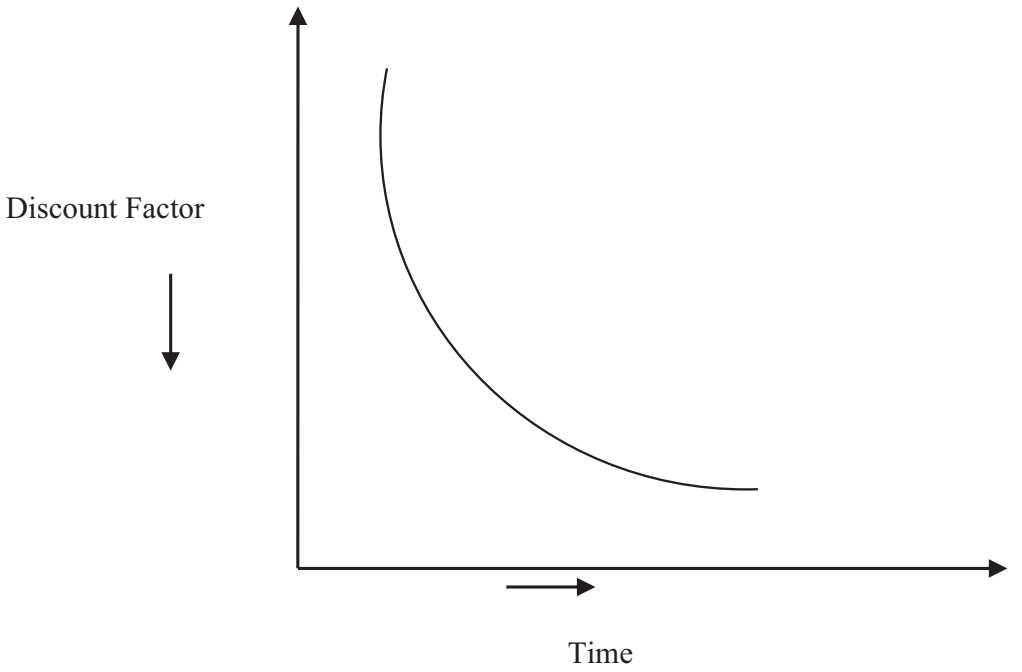
Self-enhancement through identification: This is another principle of behavioural economics for promoting desirable behaviour in individuals. In this, the individual identifies with noble causes for the society due to an enhanced self-image. Symbolic effects of having a non-polluted vehicle led individuals to feel like responsible citizens for green energy promotion, which motivated them to have such vehicles rather than other factors (Heffner 2005). This technique can be employed to promote environmentally sustainable farming by recognising the talents and works of farmers who did excellent work in practising and propagating environmentally sustainable farming. Such accreditations by the states can facilitate individuals in rethinking and identifying themselves with other behaviour that can be recognised socially.

Mental accounting: This is defined as assigning different subjective values for a similar objective. For example, the money given by a mother to a child may not be a big amount but is valued heavily by the child as it was given by a person dear to them. Similarly, some savings are treated sacrosanct - for example, children's education - and kept in a low interest earning instrument, though the high cost debt can be serviced by applying the cost-benefit ratio. The human psyche can be effectively used as a tool for the promotion of environment-friendly cultivation. In this discussion, in order to prevent undesirable cultivation behaviour due to reduced negative sensitivity of subsequent losses i.e. asking the individual to forego certain endowed benefit for practising undesirable cultivation methods, programmes may be designed to utilise the accrued revenue due to the foregone endowment exclusively for the promotion of environment-friendly farming purposes, such as R&D activities for developing technologies for sustainable farming. These practices can be successful in directing the behaviour in the desirable direction. The public good charge in California, where citizens have to pay a small amount in relation to their unit usage of electricity for providing assistance to develop greener technology and energy efficiency, is one such example.

Early and better income from produce and hyperbolic discounting

Humans are found to have differential discounting factors for similar values across time. These differential factors sometimes tend to be rather high. We discount the near future a lot more than the same amount of time far in the future. When asked to choose an option among the following choices, the preferred choice for most individuals was as follows:

- Between ₹ 100 today or ₹ 105 tomorrow? = ₹105
- Between ₹ 100 in one year or ₹ 105 in 1 year + 1 day? = ₹100



Hyperbolic discounting

This is due to the human tendency of applying large discount factors between today and the near future than between two far futures. This tendency is called hyperbolic discounting, whereby the discount factor tends to taper over time. This human tendency can be effectively employed for the promotion of sustainable cultivation behaviour, which can be done by offering an immediate market value to the produce obtained through environmentally sustainable practices, which is something that comes with a smaller discount in the human psyche. Special markets, premium rates, quality certification, direct marketing for the produce obtained through environmentally sustainable cultivation are some of the means to arrive at this end. This will satisfy the human need for gratification at the earliest and motivate one to continue the practice that has assured this productivity. e-NAM (Electronic National Agricultural Market) is one such initiative of Government of India in this direction.

Framing the information: Framing, or the way information is presented,has effects on the behaviour of individuals. Several researchers have explored the profound effects of framing on the behaviour of individuals. This is also known as choice architecture. One of the framing strategies was to make the required information more salient and visible than the non-desired information. Human beings are subjected to availability bias, and information that is more salient and visible is reported and the default options serve for shaping the behaviour of individuals in the desired direction (Johnson, E. J., & Goldstein, D., 2003). In the Lakshadweep islands, there are no outlets selling fertilisers,which may also be one of the factors for coconut growers not adopting chemical-input-based cultivation practices. The non-visibility and the resultant non-available information have helped the island territory become an organic territory. Hence, framing the environment-friendly cultivation information as more salient than non-organic or non-sustainable cultivation information would help shape the behaviour of the cultivators in the desired direction. In a study by the World Bank team in 2014, it has been reported that by making available the crucial information of the relationship between the lengths of pod to the sea weed market value to Indonesian farmers, their revenue realisation has increased manifold.

Nudging global policy towards environmentally sustainable farming

Behavioural economics concepts are found to have a nudging effect on all individuals, including global policymakers. The green fund, carbon trade, energy efficiency rating in appliances etc are some of the policy initiatives followed across countries. Climate change, which is reported to have ramifications on food security, may also be managed through BE concepts. It requires two essential interventions (nudges):

1. Rationalisation of the cost of green technologies to nudge more R&D on green technologies for sustainable farming
2. De-risking and partially guaranteeing the returns of private investment to tap the large availability of private resources

Can the behaviour change?

Human beings' behaviour is influenced both by nature and nurture. Reinforcements in both monetary and non-monetary (such as social recognition) forms have been

found to have changed the behaviour of individuals in the desired direction, as it facilitates the individual's psychological strength, which is an area of study for behavioural scientists. Psychologists have found that a positive relationship exists between mental and material prosperity. This interconnected relationship between economic wellness (by adoption of technology in farming), cognitive resource savings and improved decision making is explained in figure 3.

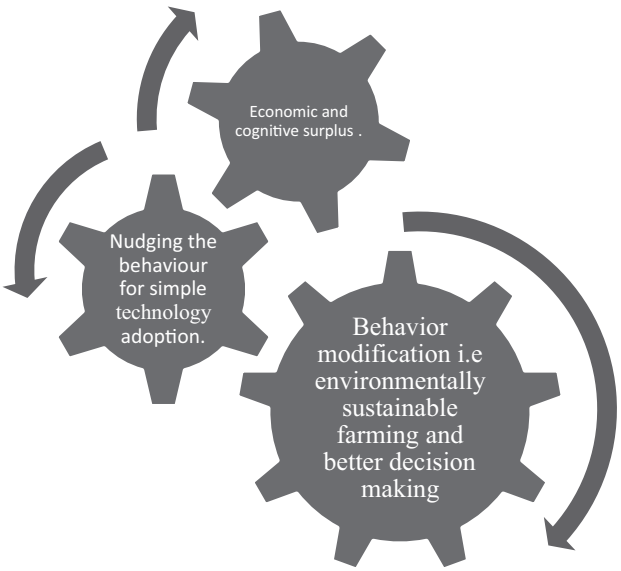


Figure 3: Interrelated process of behaviour and economic conditions

Results of experiments done by the World Bank group in the year 2015 across nations such as India, Indonesia, United States and African countries proved that economic wellness promotes savings of cognitive energy, which can be used by the individual for better decision making (Mullainathan et al 2015). Due to the adoption of simple and cost-effective technology, farmers additionally benefit with more freely available quality time. This helps in preventing the unnecessary drain of cognitive resources, which can facilitate the thinking process to arrive at better decisions for various challenges, including farming-related problems.

Though it is not possible to change an individual's entrenched behaviour in a sudden stroke, successive approximation can help with the change of behaviour in all creatures. On the other hand, the limitation of the individual thinking process (bounded rationality) propels states to alter their citizen behaviour (without

affecting their choices) in the desired direction to promote both individual and social goods. This is possible by employing various nudging methodologies for the welfare of their citizenry .

The concepts discussed here have utility not only in agriculture, but they can also be applied to other areas with suitable customisation. In the event of the absence of volunteerism, the behavioural economics concepts can be applied to cultivate useful and desirable behaviour among individuals.

Conclusion: Global policymakers are embracing the concepts in the interdisciplinary field of behavioural economics to have a positive impact on their citizen behaviour in various walks of life. Countries such as Singapore, the United Kingdom, United States of America and institutions such as the United Nations and World Bank are now focusing on the usefulness of the findings from the experiments done in this area. These strategies are cost-effective and can enhance mass scale implications without infringing on individuals' rights. Along with nudging skill enhancement in the relevant field, it is essential to sustain the modified and desired behaviour.

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