# PUSH & PULL FACTORS BOOSTING THE DEMAND AND SUPPLY ASPECTS OF A MARKET FOR ECO-FRIENDLY PLANT NUTRIENTS, IN OPPOSITION TO SYNTHETIC CHEMICAL FERTILIZERS

***H.W.D. Shaini*[*], U.K. Jayasinghe-Mudalige[1], L.H.N. De Silva[2], A.D.K.S.S. Somarathna[1], R.S. Dharmakeerthi[3], W.S. Dandeniya[3]***

*[1]Department of Agribusiness Management, Wayamba University of Sri Lanka,*
*[2]Department of Biosystems Engineering, Wayamba University of Sri Lanka,*
*[3]Department of Soil Science, University of Peradeniya.*

## INTRODUCTION

Agriculture as a key sector in Sri Lankan economy, has immensely relied on the use of chemical fertilizers (CF) due to their high substantial and predictable provision of yield compared to organic fertilizers. On the contrary, it has been demonstrated that the presence of irrigation works and rivers that bring in 'nonpoint source' fertilizer runoff from heavily agricultural regions correlates with Sri Lanka's high incidence of chronic kidney disease of unknown aetiology (CKDU) (Dharma-Wardana *et al*., 2015). This study explicates the outcome of identifying 'Push' and 'Pull' factors that are competent to upgrading the state of Eco-Friendly Fertilizers (EFF), including 'Slow-Release Urea Fertilizer' (SRUF) and 'Biofertilizer' (BF) which were produced through a multi-stage, multi-objective research program (Eco-Friendly Technologies) as a solution to reduce CF usage.

As a matter of fact, farmers are willing to pay relatively high prices for attributes associated with Eco-Friendly Technologies (EFT) since they are more concerned about social and environmental benefits over the CF (De Silva *et al*., 2018). Also, farmers would particularly prefer EFT over CF due to its advantageous financial aspects (Silva *et al*., 2020). Subsequently, promotion of the EFF against the CF in the current fertilizer market has become an essential concern in Sri Lankan context. Therefore, the main objective of this study is to identify Push factors that stimulate the interest of end-users and Pull factors that motivate consumers' demand for EFF, further considering the 'intrinsic' (internal perspectives) and 'extrinsic' (external influences) nature of the factors (Dann, 1977).

## METHODOLOGY

### *Identification of push-pull factors*

The push-pull framework, as described by Crompton (1979), and Dann (1977) expresses sociopsychological elements that push internal needs and wants to pull on the attributes that fulfil those desires. According to Klenosky (2002), the relationship between push-pull factors has only recently been studied, although this concept has existed since 1970. Push-Pull factors were identified using 27 statements by examining extrinsic and intrinsic characters. Extrinsic factors were categorized as 'Product quality with technology adoption', 'Environmental considerations', and 'Promotional tools', while intrinsic factors were categorized as 'Intention towards a product'. Pull extrinsic factors were categorized as 'Market potential', 'Legal aspects', and 'Promotional events', while intrinsic factors were categorized as 'Intention of a consumer'.

### *Data Collection and Analysis*

A sample of ninety stakeholders including experts, producers, traders, farmers, extension officers, and media personnel were selected through the purposive sampling method. A structured questionnaire was used to conduct the survey from February to March 2022 through both modes of online and face-to-face interviews. A 10-point Likert scale ranging from 'extremely

demotivate' (-5) to 'extremely motivate' (+5) was used to evaluate predefined 15 and 12 statements on push and pull factors respectively.

To assess the internal consistency of the scale, the 'Cronbach's Alpha' was measured. By examining the unidimensionality of constructs, 'Principal Axis Factoring' was used as the extraction method. For factor retention, the Kaiser greater than 1 criterion (K1) was used, which retained factors with eigenvalues greater than 1. The factor rotation method was chosen to be Promax oblique rotation, and the rotated factors were loaded into the pattern matrix. Then using mean scores, an Aggregated Mean Attribute Score (AMAS) of the factors (Jayasinghe-Mudalige and Henson, 2006) was generated to further differentiate factors intrinsically and extrinsically (Table 1). Canonical Correlation Analysis (CCA) was carried out to identify and measure the associations between multiple independent variables (push factors) and multiple dependent variables (pull factors).

**Table 1. Classification of push-pull factors**

| Factor | No | Statement | MAS | AMAS |
|---|---|---|---|---|
| Push | QTA 1 | Ability to obtain a fair price for EFF | 8.4 | 41 |
| | QTA 2 | Methods for improving the qualities of EFF through research and development | 8.2 | |
| | QTA 3 | Regular public procurement and continuous supply of raw materials | 8.1 | |
| | QTA 4 | Safe fertilizer packages with eco-friendly labels | 8.2 | |
| | QTA 5 | Enhancing food safety with quality products | 8.1 | |
| | ENC 1 | Possibility of improving soil health | 8.4 | 33 |
| | ENC 2 | Reduction of releasing toxic wastes compared to CF | 8.4 | |
| | ENC 3 | Desire to conserve the environment | 7.9 | |
| | ENC 4 | Containing a proper certification process | 8.2 | |
| | PRT 1 | Possibility for point-of-sales displays | 7.4 | 22.8 |
| | PRT 2 | Attractive advertising promotional tactics | 7.5 | |
| | PRT 3 | Promotion by direct selling without intermediaries | 7.9 | |
| | INP 1 | Maintaining strong customer relations | 7.6 | 24.1 |
| | INP 2 | Intention of increasing productivity | 8.3 | |
| | INP 3 | Brand recognition when sold under new brands | 8.1 | |
| Pull | MKP 1 | Ability to obtain a guaranteed price | 8.1 | 24.1 |
| | MKP 2 | Ability for cost-cutting | 8.2 | |
| | MKP 3 | Market opportunities for the end products (using EFF) | 7.8 | |
| | PRE 1 | Use of mass media (Television, Radio) to advertise | 7.7 | 23.1 |
| | PRE 2 | Use of social media (Facebook, YouTube) to promote | 7.3 | |
| | PRE 3 | Effective training/awareness programs | 8.1 | |
| | LEA 1 | Proper implementation of regulations | 7.7 | 23.1 |
| | LEA 2 | Measures taken by National Agricultural Policy | 7.3 | |
| | LEA 3 | Possibility of establishing credit linkages | 8.1 | |
| | INC 1 | Perception on affordability and ease of access | 8.5 | 24.7 |
| | INC 2 | Desire to work with maximum self-commitment | 8.1 | |
| | INC 3 | Desire for using 'Eco-friendly' products | 8.1 | |

*No: Notation, MAS: Mean Attribute Score, AMAS: Aggregated Mean Attribute Score, QTA: Product quality with technology adoption, ENC: Environmental considerations, PRT: Promotional tools, INP: Intention towards a product, MKP: Market potential, PRE: Promotional events, LEA: Legal aspects, INC: Intention of a consumer*

## RESULTS AND DISCUSSION

### *Descriptive statistics of sample*

The majority of stakeholders of the sample were males (57.8%). Fifty-one percent of the respondents were between the age of 20 to 35 years, and the majority of them possess postgraduate qualification (60%). Nearly 86.7 percent of those surveyed were employed, and 42.2 percent had a minimum of five years of experience. Majority of respondents (63.4%) were familiar with EFF and expressed that commercialization of EFF would be most effective if both the government and private sector were involved (77.8%).

### *Outcome of Exploratory Factor Analysis for Push and Pull factors*

Mean Attribute Score values (MAS) obtained for push-pull statements were given in Figure 1. Absence of negative values depicted that all statements related to push supply side and pull demand side for EFF were accepted by respondents. As per values obtained from the AMAS, the first three highest scored statements on push factors come under the category of 'Product quality with technology adoption' (41) and 'Environmental considerations' (33). Having highest MAS on obtaining a fair price (QTA 1), considering the soil health (ENC 1), and reducing the release of toxic wastes compared to CF (ENC 2) could be considered as the most important factors when push an EFF to the consumers. As per values obtained form the AMAS, pull factors related to the 'Promotional events' and 'Legal aspects' was equally important (23.1) after the factors related to 'Market potential' (24.1) to enhance the consumers' demand for EFF. Considering the external and internal nature of the categories, 'Product quality with technology adoption' (41.0) was the most weighted extrinsic push factor while 'Market potential' (24.1) was the most weighted extrinsic pull factor. 'Intention of consumers' was the most dependent intrinsic pull factor (24.7).

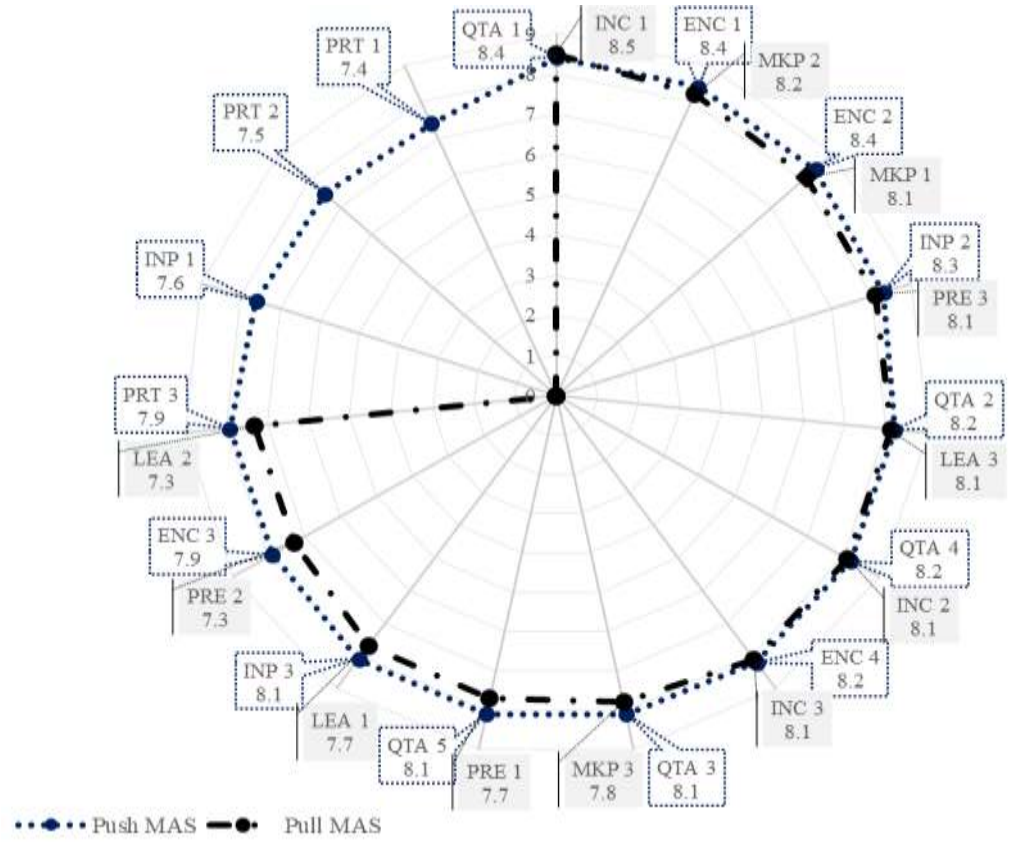


**Figure 1. Outcome of highest to lowest MAS for the push-pull factors given in Table 1**

### *Outcome of the Canonical Correlation Analysis*

A weighted sum of variables (Canonical variates) was used to assess the strength of the

correlation between push-pull factors. Five significant variates ($p<0.005$) out of 12 canonical variates were identified. The proportion of variance explained from the push items was 60 percent, while the proportion of variance explained from pull items was 70 percent. Push item variance that could be explained by pull items was 40 percent, while 30 percent of pull item variance could be explained by push items (Table 2). As obtained from the canonical loadings for the push factors, the highest values resulted from the statements of 'Regular public procurement and continuous supply of raw materials' (-0.80); 'Methods for improving the qualities of EFF through research and development' (-0.77); and 'Enhancing food safety with quality products' (-0.74). Considering pull factors, the highest values resulted from 'Ability for cost-cutting' (-0.81); 'Proper implementation of regulations' (-0.79); 'Desire for using 'Eco-friendly' products' (-0.72); and 'Perception on affordability and ease of access' (-0.69).

**Table 2. Proportion of variance explained**

| CV | CR | EV | Set 1 By Self (Push) | Set 1 By Set 2 | Set 2 By Self (Pull) | Set 2 By Set 1 |
|---|---|---|---|---|---|---|
| 1 | 0.9 | 2.6 | 0.4 | 0.3 | 0.4 | 0.3 |
| 2 | 0.8 | 1.6 | 0.1 | 0.1 | 0.2 | 0.0 |
| 3 | 0.7 | 1.0 | 0.1 | 0.0 | 0.1 | 0.0 |
| 4 | 0.7 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 0.6 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | | | 0.6 | 0.4 | 0.7 | 0.3 |

*CV: Canonical variate, CR: Correlation, EV: Eigenvalue, Set 1 by Set 2: Push items explained by pull items, Set 2 by Set 1: Pull items explained by push items*

## CONCLUSIONS/RECOMMENDATIONS

This study implies that the supply section of eco-friendly fertilizers can be boosted by improving the product quality with technology adoption, environmental considerations, and promotional tools extrinsically while motivating intention towards a product intrinsically. The aftermath of the study suggests that extrinsic pull factors such as market potential, legal aspects, promotional events, and intrinsic factors such as intention of a consumer can boost the demand of eco-friendly fertilizers with the presence of product quality with technology adoption and environmental considerations.

## REFERENCES

Crompton, J.L. (1979). Motivations for pleasure vacation. *Annals of Tourism Research*, **4**, 408-424.

Dann, G.M. (1977). Anomie, ego-enhancement and tourism. *Annals of Tourism Research*, **4**(4), 184-194.

De Silva, L.H.N., Lakmali, C.D.A., Jayasinghe-Mudalige, U.K., Dharmakeerthi, R.S., Dandeniya, W.S., and Balasooriya, W.K. (2018). Replacing the chemical fertilizer through eco-friendly technologies developed for paddy cultivation: How much farmers are willing-to-pay for? *Applied Economics and Business*, **2**(2), 28-37.

Dharma-Wardana, M.W.C., Amarasiri, S.L., Dharmawardene, N. and Panabokke, C.R., 2015. Chronic kidney disease of unknown aetiology and ground-water ionicity: study based on Sri Lanka. *Environmental geochemistry and health*, **37**(2), 221-231.

Jayasinghe-Mudalige, U.K. and Henson, S. (2006). Use of Confirmatory Factor Analysis techniques to overcome the problems of subjectivity and unobservability of incentives. *Sri Lankan Journal of Applied Statistics*, **7**, 71-89.

Klenosky, D.B. (2002). The 'pull' of tourism destinations: A means-end investigation. *Journal of Travel Research*, **40**, 385-395.

Silva, A.P., Jayasinghe-Mudalige, U.K., Dharmakeerthi, R.S., Dandeniya, W.S. and Balasooriya, B.L.W.K., (2020). Introducing eco-friendly technologies to reduce chemical fertilizer usage in paddy farming in Sri Lanka. *Sri Lanka Journal of Economic Research*, **7**(2), 1-23.

## ACKNOWLEDGMENTS

The authors acknowledge the financial assistance to conduct this research from the National Research Council of Sri Lanka under the Research Grant: TO 16 - 07. A greater appreciation is extended to all respondents participated to the study.