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Crop Diversification and its Determinants among Vegetable Farmers in Kotagala, Nuwara Eliya District in Sri Lanka

By ARUPPILLAI THAYAPARAN[1], R. USHADHANI AND G.Y.N. GUNATHILAKA

A sound understanding of the demographic and farming characteristics of smallholder farmers and how they stimulate their crop diversification decisions would help policymakers make appropriate measures for encouraging crop diversification. The objectives of the study are to assess the degree of crop diversification and examine in what ways the demographic and farming characteristics of smallholder vegetable farmers impact their crop diversification at Kotagala area in the Nuwara – Eliya district of Sri Lanka. Cross-sectional data were obtained from 86 randomly selected farmers who were cultivating nine vegetable crops in the Kotagala division using the structured questionnaires during the period from October to November 2019. The degree of crop diversification among vegetable farmers was measured using the Herfindahl index, which has a mean value of 0.36. It shows that there is a low degree of crop diversification and the practices in multiple crop cultivation among the farmers is very low. Results of the frequency analysis revealed that 60.5 percent of the farmers are diversifiers, while 39.5 percent of them are non - diversifiers. Further, the tobit regression model was used to examine how demographic and farming characteristics of smallholder farmers influence crop diversification and its results indicated that age squared and education negatively influenced on crop diversification at a 10 percent significance level. On the contrary, crop diversification is positively influenced by the age and size of cultivated land at a 5 percent significance level. The findings of the study will assist the decision makers in developing the best possible policies to support crop diversity, which will motivate farmers to make better choices, boost production, and improve food security in the study area.

KEYWORDS: Crop diversification, demographic and farming characteristics, diversifiers and non-diversifiers, Herfindahl Index, Tobit regression model

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INTRODUCTION

The Sri Lankan economy grew at a moderate pace, and the agriculture sector has been playing a central role in improving food security (Acharya et al., 2011; Pingali & Rosegrant, 1995) and promoting economic transformation and structural changes for the Sri Lankan economy. The contribution of the agriculture sector to the Gross Domestic Product (GDP) is too low to be considered the backbone of the Sri Lankan economy and the sector contributed to approximately 4.8 percent of the GDP in 2019 and provided employment opportunities for the population in the country. The agricultural sector in Sri Lanka is dominated mainly by the smallholder farmers who lack inputs and extension services. Agriculture is a risky industry since it involves uncontrollable elements like weather and market conditions, which influence the farmers' varied choices within a given season. Vegetable crop cultivation is a significant part of the agricultural sector and has great potential to raise income levels, produce export earnings, create new job possibilities, boost farm income, and improve public health and nutrition. According to the statistics, the total cultivated area of vegetables is around 93,000 hectares and the annual production is approximately 720,000 metric tons in Sri Lanka (Economic Development Plan Nuwara Eliya Divisional Secretariat (2020-2022). In comparison to other regions of Sri Lanka, the hill country is a great location for temperate crops like carrots, leeks, cabbage, lettuce, beetroot, beans, and potatoes, and the farmers who reside in those places try to plant a variety of vegetable crops. Crop diversification in vegetable cultivation is a useful approach, especially in developing countries like Sri Lanka, where agriculture is the primary source of income. Crop diversity management on the farm is critical for reducing poverty, increasing farm revenue, creating jobs, and ensuring long-term agricultural sustainability by maintaining biodiversity, soil, and water resources.

Crop diversification, which entails cultivating a range of crops while intensifying competition among field crops for arable or cultivated land, is one approach to reducing farm revenue unpredictability. Crop diversification is a tactic for enhancing the utilization of land, water, and other resources, as well as for the general development of agriculture in the nation. It gives farmers a practical choice for growing various crops on their land. Agriculture diversification is also used to reduce risk and unpredictability brought on by climatic and biological whims (Acharya et al., 2011). Crop diversification is significantly influenced by the socioeconomic situation and technological advancement of the area, but the physical environment is more important. It

indicates that crop diversity is the result of action-reaction interactions between the physical environment and other factors (Sohal, 2003). Crop diversification also increases the year-round employment options for agricultural labourers and small farmers.

Sri Lankan farmers grow a wide range of vegetable crops in various districts and regions of the country, nevertheless, practicing crop diversification strategies at the farm level are very rare and they are influenced by many factors such as, demographic, farming characteristics, environmental and social factors.

Sri Lanka has worked hard over the past few decades to diversify its crops in order to increase farm output and enhance the standard of living for its farmers. Significant development has also been made, and a sizable area has been planted with various commodities, particularly chili and huge onions which are two crucial crops that bring in more revenue. The majority of these advancements took place in medium and large-scale plans, which led to considerable improvements in fanner participation and crop intensity (Proceedings of the Workshop Organized by the Irrigation Research Management Unit, 1996). Despite government support in the form of more accommodating laws and enhanced infrastructure for fostering diversification initiatives, farmers have gradually shifted to other vegetable crops. The majority of the crops grown by the farmers in Kotagala are carrots, and there is little crop variety among these growers of vegetables. In addition, lack of knowledge of factors affecting the respective farming systems has led to the majority of crop diversification methods failing in practice (Proceedings of the Workshop Organized by the Irrigation Research Management Unit, 1996). Therefore, a sound understanding of the demographic and farming characteristics of smallholder vegetable farmers and identifying how these characteristics influence farmers' crop diversification decision making are the main issues in the study. It would help in formulating appropriate policies regarding crop diversification levels in the study area.

This study focuses on two main research questions. They are, (1) to what degree do the vegetable farmers engage in crop diversification and (2) to what extent do demographic and farming characteristics influence crop diversification among vegetable farmers in the Kotagala area. According to these research questions, the objectives of the study are stated and they are achieved by analysing the collected data using econometric analysis.

Objectives of the study

The objectives of the study are to assess the degree of crop diversification and examine the impact of demographic and farming characteristics on crop diversification among the smallholder vegetable farmers in the Kotagala area.

LITERATURE REVIEW

The decision of farmers to diversify their crops throughout different nations has been the subject of numerous empirical studies conducted by academics. The Herfindahl – Hirschman Index was used by Ojo et al. (2014) to gauge how much agricultural diversification was occurring among the farmers, and ordinary least squares regression analysis was utilised to identify the factors affecting crop diversification in the study. The overall results in the two states combined show that the crop growers in the research area did not have a very diverse crop pattern, as indicated by the mean Herfindahl index of 0.68. Further, the results of the regression model revealed that land ownership, farm size, extension contact, and farming experience all had a positive and significant impact on the degree of diversity among the farmers in the research area. A study conducted by Dube & Guveya (2016) examined the factors influencing smallholder crop diversification in Zimbabwe using the Herfindahl index and Tobit model. The results of the index showed that the mean crop diversity index is 0.54, whereas estimated results from the Tobit model revealed that gender, education, number of livestock units, access to irrigation, membership of farmers groups, access to markets, farming experience, farms on flat terrain, farmer to farm extension, routine extension, agro-ecological zone and household income are the positive significant contributors to crop diversification in the country. In contrast, the age of the head of household and the distance of the farm homestead from the nearest town did not significantly influence crop diversification.

In a case study on the determinants and extent of crop diversification among smallholder farmers studied by Sichoongwe et al., (2014) in the Southern Province of Zambia, scholars employed a double-hurdle model to analyse the data and its results indicated that the size of landholding, quantity of fertilizer, distance to market and the type of tillage mechanism adopted, have a strong influence on whether a farmer practices crop diversification.

Aheibam et al., (2017); Inoni et al., (2021); and Mussema et al., (2015) applied Hackman's two-step method to identify crop diversification in different

countries. Crop diversification and its evidence from the Oromia region in Ethiopia were investigated by Mussema et al., (2015).

The findings imply that crop diversification in the study was primarily influenced by asset ownership, quality of soil, agricultural extension, and level of infrastructure development. The determinants and the extent of crop diversification at the household level in Manipur were identified by Aheibam et al., (2017). Results of the study indicated that the decision to diversify crops was positively influenced by the household head's education level, farming experience, and access to a plough in the study area. Another study was conducted by Inoni et al., (2021) in order to find out the drivers of crop diversification: evidence from smallholder farmers in Delta State Nigeria. Age, farm size, credit access, extension contact, and farm income all had significant positive effects on farmers' decisions to diversify their crops, according to the Heckman two-stage model results, while farm size, credit access, extension contact, and attitude to risk had a positive and significant impact on the degree of crop diversification practiced by smallholder farmers in the study.

The crop diversification and livelihoods of smallholder farmers in Zimbabwe were studied by Makate et al., (2016). The findings showed that crop diversification is influenced by factors like the size of the land, farming expertise, asset wealth, location, access to agricultural extension services, information on output pricing, affordable transportation costs and general information availability in the nation. Factors influencing crop diversification strategies among smallholder farmers in the cotton production zone were studied by Dembele et al., (2018). In order to evaluate the variables that influence small-holder farmers' diversification strategies, a multinomial logistic regression model was used. According to the study's findings, families' participation in Mali's four diversification strategies was significantly influenced by the family head's age, level of education, family size, ownership of oxen, farm revenue per capita, and crop pests. Li et al. (2021) investigated crop diversity's socioeconomic factors and their impact on farmer income in Guangxi, Southern China. According to the findings, crop diversity rose with the size of the land, and there is no relationship between crop diversity and profit variability, but farmers who had more land and a wider variety of crops were more profitable.

Esham et al. (2006) used binomial logistic regression analysis to examine the determinants influencing crop diversification in the Sri Lankan environment.

According to the findings, there are several statistically significant factors that affect crop diversification in Sri Lanka, including the availability of family labour, the amount of land that is farmed, credit restrictions, a lack of water, poor land quality, a lack of extension services, and a lack of inputs. Burchfield & de la Poterie (2018) investigated the factors influencing farmers' decisions to diversify away from rice monoculture in Sri Lanka. The findings show that many farmers are restricted in their ability to diversify the attributes of their farms, including elevation, soil quality, irrigation infrastructure, and relative location within a national irrigation system.

The Herfindahl–Hirschman Index, Simpson diversity index, Ogive index, Margalef index, Shannon index, Berger-Parker index, and Entropy index are among the most significant measures of crop diversification. The number of crops that farmers produce is another widely used indicator of crop diversification that researchers use in many studies. However, there is a lack of research done by Sri Lankan researchers using the index approach. To fill the identified methodological research gap, the study employed the Herfindahl – Hirschman Index (HHI) to identify crop diversification among vegetable farmers in the Kotagala area.

METHOD OF DATA COLLECTION

To identify the determinants of crop diversification among vegetable farmers in Nuwara-Eliya district, the Kotagala area was selected as the study area. Kotagala is a small town in the Nuwara Eliya District of the Central Province, Sri Lanka, which is located 35.8 km from Nuwara Eliya. There are 05 Divisional Secretariat divisions in Nuwara-Eliya and out of them, Nuwara-Eliya is one of the Divisional Secretariat divisions, which has 72 GN divisions. Out of these GN divisions, Kotagala GN division was selected using the purposive sampling technique. The "population" was the farmers who engaged in vegetable cultivation in the entire district, while the "sampling unit" was the household heads who were the farmers engaged in vegetable cultivation in Kotagala GN division.

This division has many villages where the farmers mainly cultivate many vegetable crops. Based on their potentiality in growing many crops, the questionnaire was issued to the 100 farmers and the data was collected during the October to November period in 2019. The farmers are requested to choose their crop from nine different vegetables such as carrot, nokol, cabbage, beetroot, potato, leeks, beans, parsley and lettuce. Out of 100 farmers, only 86 farmers who filled the questionnaire correctly were selected

in the study. Data related to total area devoted for each crop and the explanatory variables on demographic characteristics of the vegetable farmers and farm management characteristics also gathered from the survey. In accordance with the objectives of the study, the collected data were analysed utilizing a variety of analytical techniques.

METHODS OF DATA ANALYSIS

To estimate the crop diversification among farmers, HHI index measurement was used in the study and followed by independent sample t-test, chi-square test and Tobit model. In order to identify the mean differences in selected demographic and farming characteristics across diversifiers and non-diversifiers in the Kotagala area, an independent sample t-test also was employed in the study. Age, farming experience, land size, and distance to the market were considered to test their mean differences across diversifiers and non- diversifiers in the study. To assess the association between demographic and farming characteristics among diversifiers and non-diversifiers, the chi-square test was used. HHI index and Tobit regression model were discussed in depth as follows.

Crop diversification in terms of Herfindahl – Hirschman Index

There are several possible ways to measure the engagement in crop diversification using indices such as, Herfindahl – Hirschman Index (HHI), Simpson diversity index, Ogive index, Margalef index, Shannon index, Berger-Parker index, and Entropy index, all of which indicate the degree of dispersion in crop cultivation with a given time and space by a single indicator. Out of these many indices, the HHI as selected in the study to measure the degree of crop diversification, because it is widely used in agricultural diversification. It can be calculated as below:

$$P_i = \frac{A_i}{\sum_{i=1}^{n} A_i}$$

Where:

P_i = Proportion of i^{th} crop

A_i = Area under i^{th} crop

$\sum_{i=1}^{n} A_i$ = Total cropped area

i = 1, 2, 3……..n (Number of crops)

From the above formula, the Herfindahl–Hirschman Index (HHI) can be calculated by:

$$HHI = \sum_{i=1}^{N} P_i^2$$

Where,

N = total number of crops, and

P_i = area proportion of the i[th] crop in the total cropped area.

Now, Crop Diversification Index (CDI) is obtained by subtracting the HHI from one which is given by

$$CDI = 1 - \sum_{i-1}^{n} P_i^2 = 1 - HHI$$

The CDI is an index of concentration and has a direct relationship with diversification such that its zero value indicates specialization and a movement towards one shows an increase in the extent of crop diversification (Malik & Singh, 2002). Hence, it was easy to identify those farmers who practiced crop diversification and those who did not (Malik & Singh, 2002).

Tobit regression model

After estimating the crop diversification in terms of the HHI, the Tobit model is used to identify the impact of demographic and farming characteristics on the degree of crop diversification among vegetable farmers in the study. Since the values of the dependent variable CDI lie between 0 and 1, the Tobit regression model is more appropriate compared to other ordinary least squares regression models. Since the sample population is the censored type with an index that varies from 0 to 1, ordinary least squares estimation generates biased and inconsistent parameter estimates. Therefore, the Tobit model was used to examine the factors influencing crop diversification in the study. After estimating the coefficients of the Tobit model, marginal effects were also estimated in the study. One advantage of estimating the marginal effects is that it can be used to examine the impact of each explanatory variable on the dependent variable in terms of probability. Thus, in order to analyse the determinants of crop diversification, the Tobit model was employed with demographic and farming characteristics as explanatory variables, and its implicit form was expressed as,

$$y_i = \begin{cases} y_i^* = \beta X_i + \varepsilon_i & if\ y_i^* > 0 \\ 0 & if\ y_i^* \leq 0 \end{cases}$$

Where:

$$y_i^* = \beta X_i + \mu_i \quad \text{and} \quad \mu_i \sim N(0, \delta^2)$$

y_i^* = Crop Diversification Index is the dependent variable.
X_i = the vector of factors influencing farmer's participation in crop diversification
β = the vector of unknown parameters.
μ_i = is the independent normally distributed error term assumed to be normal with a zero mean and constant variance.

where y^* is a limited dependent variable that is only observed for values less than 0 and greater than 1 and X_i is a matrix of the explanatory variables that includes factors affecting diversification of crops among the farmers in the study.

Based on the previous literature support and availability of data, the following independent variables were chosen for the study.

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \varepsilon_i$$

Where:

Y_i = Crop Diversification Index
X_1 = Age of the farmer in years
X_2 = Age squared of the farmer in years
X_3 = Gender coded as 1 for male and 0 for female
X_4 = Civil status coded as 1 for single and 0 for married
X_5 = Education level coded as 1 for primary, 0 otherwise
X_6 = Distance to market in Km
X_7 = Land ownership coded as 1 for own land and 0 for tenant
X_8 = Types of labour coded as 1 for family labour and 0 for hired
X_9 = Land size in acre
β_0 = Constant
$\beta_1, \beta_2, \beta_3$ and..... β_9 are the coefficients of each independent variable
ε_i = Error term.

RESULTS AND DISCUSSION

Table 1 presents the results of the frequency analysis for selected demographic and farming variables and according to that, nearly 56 percent of the sampled smallholder farmers were males and 44 percent of them were females in the study.

Among the farmers in the sample, nearly 80 percent of them were married, while nearly 20 percent of them were single. In the case of educational levels, about 45 percent of the farmers were primary educated, and nearly 55 percent of them were secondary educated. According to the usage of labour resources, 73 percent of the farmers use family labour and the rest of the 27 percent use hired labour. On the other hand, about 80 percent of the farmers cultivate the crops on their own land, whereas nearly 20 percent of them are tenant cultivators in the study.

Table 1: Demographic profile of the farmers

Variables	Frequency	Percentage
Gender		
Male	48	55.8
Female	38	44.2
Civil status		
Single	17	19.8
Married	69	80.2
Education		
Primary	39	45.3
Secondary	47	54.7
Types of labour		
Family	63	73.3
Hired	23	26.7
Ownership of land		
Own	69	80.2
Tenant	17	19.8

Source: Estimated by authors, 2019

In the beginning, crop diversification was measured by using the HHI across vegetable farmers and based on the values, they were classified as diversifiers and non-diversifiers. Those two groups of farmers were analysed using frequency, independent samples t-test and chi-square test in the study. Crop diversification Index across vegetable farmers was measured using the HHI-score, with values between 0 and 1. The index takes a value of 1, representing perfect diversification, while 0 represent no diversification or

specialize in only one crop. Table 1 shows the distribution of the HHI among the 86 vegetable farmers in the study.

Table 2: Distribution of crop diversification index among vegetable farmers

Range of Crop Diversification Index	Frequency	Percentage
Less than 0.3	34	39.5
Between 0.3 - 0.5	20	23.3
Between 0.6 - 0.8	27	31.4
Above 0.8	05	5.8

Source: Estimated by authors, 2019

Based on the distribution of the CDI scores, 0.3 is taken as the cut off score between diversifiers and non – diversifiers in the study. The farmers who have the index less than 0.3 or closer to zero are classified as non – diversifiers and the farmers who have the index more than 0.3 are classified as diversifiers in crop diversification. According to the Table 1, 39.5 percent of the farmers attained the index less than 0.3 are considered as non – diversifiers and rest of the 60.5 percent of them who have attained the index above 0.3 are considered as diversifiers in the study. Among 60.5 percent of diversifiers, the degree of crop diversification is differed based on the range of CDI. It shows that, 23.3 percent of the farmers belong the range between 0.3 – 0.5 and 31.4 percent of them belong to range between 0.6 – 0.8. The highest value of more than 0.8 is attained by only 5.8 farmers in crop diversification.

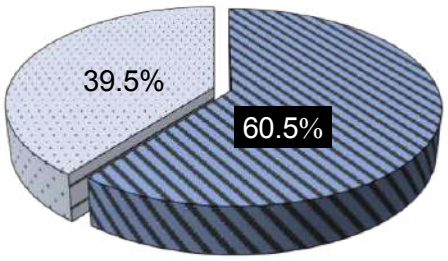
Based on the results as indicated in Table 1, the farmers were categorized as diversifiers if the index is greater than zero 0.3 and they were categorized as non - diversifiers if the index is less than 0.3 or closer to zero.

Using the above information, the frequency, independent sample t-test and chi-square test were applied in the following section.

Results of frequency

The frequency of crop diversifiers and non- diversifiers among the small vegetable holder farmers was described using the graph below.

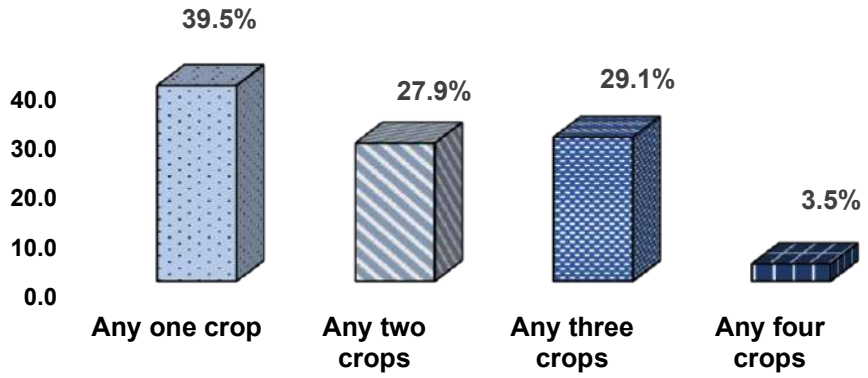
Figure 1: Frequency of diversifiers and non- diversifiers



The frequency of the diversifiers and non-diversifiers graphically shown in Figure 1 depicts that, from the total sample of 86 smallholder farmers, 60.5 percent of them participated in crop diversification, while 39.5 percent of them did not practice it. This means that, the farmers who do not participate in crop diversification as a non – diversifier cultivate only one specific specialized crop, while others who participate in crop diversification as diversifiers cultivate at least 2 or more than 2 crops in the study.

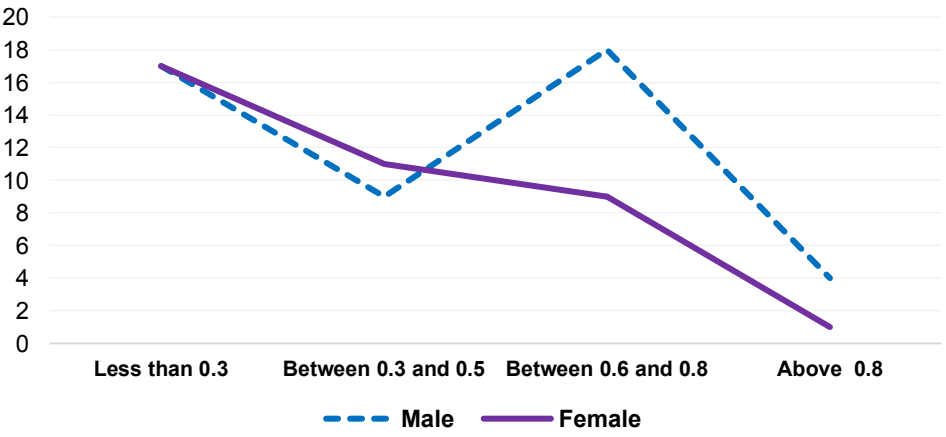
Out of 9 vegetable crop choices, some farmers choose only 1 crop, and some have chosen a different combination of the crops, but the maximum they cultivate is considered to be 4 crops. The number of crops chosen by farmers is given in Figure 3 and according to that, out of 9 vegetables, 39.5 percent of the farmers cultivate only 1 crop, while 27.9 percent and 29.1 percent of them cultivate any 2 or 3crops respectively. Only 3.5 percent of those in the sample were involved in any of the four crops.

Figure 2: Frequency of multiple crop choices



The distribution of crop diversification index across male and female vegetable farmers is shown in Figure 3.

Figure 3: Distribution of crop diversification index across gender



According to the above figure, the index range between 0.6 and 0.8 is mostly attained by male farmers rather than females. The index range above 0.8 is attained by a smaller number of female farmers compared to their male counterparts, and these results suggest that the intensity to diversify the crops

is relatively higher on the vegetable farms of males than their female counterparts in the study.

Results of descriptive statistics

Table 2 shows the results of the descriptive statistics of the selected variables, and according to that, on average, the age of the farmers was nearly 39 years, while their farming experience was about 6 years. Also, they have an average of 3.73 Ha farmland to grow different crops with a standard deviation of 1.92.

Table 3: Results of descriptive statistics

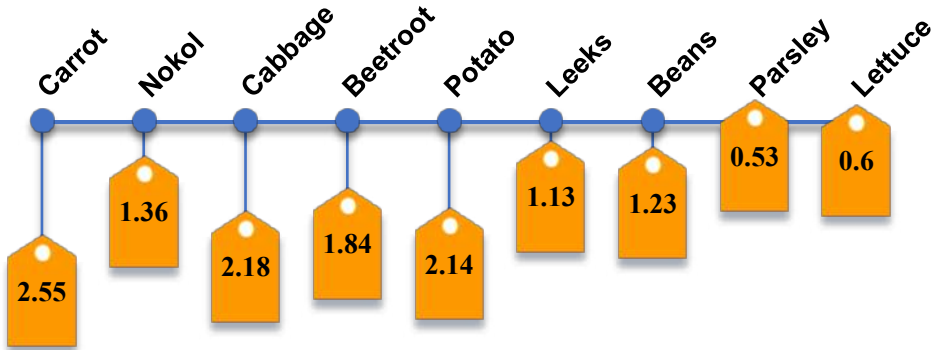
Variables	Minimum	Maximum	Mean	Standard deviation
Age in years	18	65	38.76	11.83
Farm experience in years	0.5	30	5.60	5.30
Land size in Ha	1	10	3.73	1.92
Market distance in Km	0.5	30	10.27	8.03
Crop diversification index	0	1	0.36	0.32

Source: Estimated by authors, 2019

On average, their participation in crop diversification measured by the index was 0.36, which means that the farmers are not much engaged in multiple crop diversification in the study.

The survey result presented in Figure 5 revealed that farmers allocated their total land for growing 9 different vegetable crops, which implies the practice of crop diversification adopted by the farmers in the study. According to that, the average size of land allocated for carrots is 2.5 Ha which is more than other crops and on average, only 0.6 Ha of land is allocated for the cultivation of lettuce. Among the 9 vegetables, in terms of allocated land, most of the farmers allocate their land for carrot, cabbage, potato and beetroot, while the land allocation for parsley and lettuce is smaller than that for other crops.

Figure 4: Average cultivated area under crops



In addition to the descriptive statistics, custom tables are also used to classify the characteristics of diversifiers and non- diversifiers based on gender, ownership of land, and types of labour usage.

Table 4: Results of custom tables

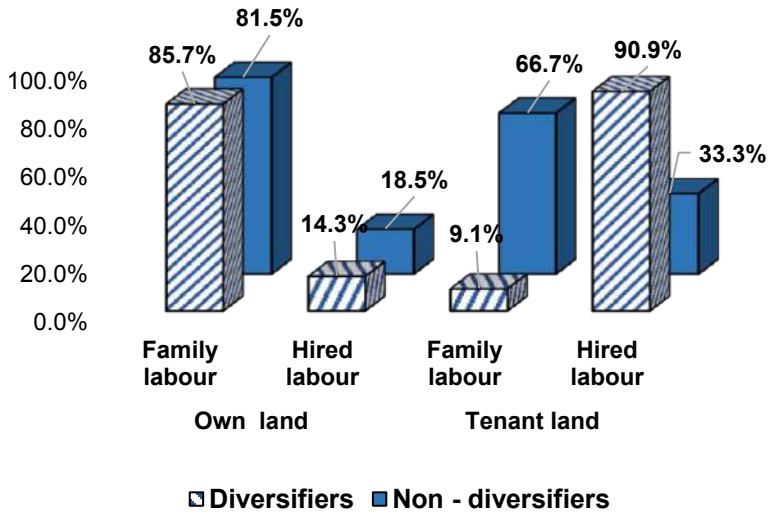
Labour	Ownership of land	Gender	Diversifier	Non - diversifier
Family	Own	Male	18	12
		Female	17	11
	Tenant	Male	0	2
		Female	1	2
Hired	Own	Male	5	3
		Female	1	2
	Tenant	Male	8	0
		Female	2	2

Source: Estimated by authors, 2019

According to the above table, 18 male farmers belong to diversifiers using family labour to cultivate their own land, whereas 17 female farmers belong to diversifiers with the same characteristics as males. No male tenant farmers belong to either diversifiers or are not using hired or family workers in the study.

Figure 5 graphically displays the frequency of farmers from crop diversifiers and non – diversifiers under different farming characteristics and its show that 85.7 percent of farmers.

Figure 5: Frequency of diversifiers and non- diversifiers across different farming characteristics



belong to diversifiers who have their own land using family labours whereas only 9.1 percent of the farmers belong to diversifiers who have tenant land using family labour. There is no significant difference between diversifiers and non-diversifiers who have their own land and use hired labour in cultivation, which is represented by 14.3 percent and 18.5 percent respectively.

Results of independent samples t-test

The independent samples t-test was carried out to test the mean differences for selected variables across diversifiers and non- diversifiers and its results are shown in Table 5.

As shown in Table 5, there is no significant difference between the two groups of farmers with respect to their farming experience and distance to the market, while age and cultivated land area are significantly different between the two groups. The results show that on average, the age of crop diversifiers is

greater than non- diversifiers and usually, older farmers have more experience in cultivation and thus have more interest in cultivating diversified

Table 5: Independent samples t-test

Variables	Diversifier (n=52)		Non – diversifier (n = 34)		
	Mean	**Sd**	**Mean**	**Sd**	**t -value**
Age of head of household	41.92	10.75	33.91	11.91	1.50**
Farming experience	5.98	4.82	5.01	-3.23	-2.73
Land size	4.17	2.05	3.05	5.99	9.74**
Distance to the market	11.25	6.60	8.77	-0.82	- 1.40

*Note: ** represents the statistical significance level at 5%.*
t – values are taken under the assumption of equal variances.
Sd = Standard Deviation
Source: Estimated by authors, 2019.

crops than younger farmers. It is interesting to note that participant farmers have cultivated significantly larger areas of farm land than the non - participant farmers. Farmers who have sufficient land could grow multiple crops, and they may be able to allot their land for more than one crop compared to smallholders. However, there are no significant differences in farming experience or distance to the market between the above two groups of cultivators in the study area.

Results of chi-square test

The significant association between the selected categorical variables and the status of crop diversification was measured using the chi-square test and the results are given in Table 6.

Table 6: Results of chi-square test

Variables	Diversifier (52)		Non - diversifier (34)		Chi Squared (χ^2)
	Frequency	Percent	Frequency	Percent	
Gender					0.77
Male	31	64.6	17	35.4	
Female	21	55.3	17	44.7	
Education					13.91***
Primary	32	82.1	7	17.9	
Secondary	20	42.6	27	57.4	
Civil status					5.61**
Single	6	35.3	11	64.7	
Married	46	66.7	23	33.3	
Type of labour					1.08
Family	36	57.1	27	42.9	
Hired	16	69.6	7	30.4	
Ownership of land					0.15
Own	41	59.4	28	40.6	
Tenant	11	64.7	06	35.3	

*Note: *** and ** represents the statistically significant at 1% and 5% levels respectively*
Source: Estimated by authors, 2019

Among the five variables, only the respondents' educational qualifications and civil status are significantly associated with the status of crop diversification. Education level is significant at the 1 percent level, indicating that 82.1 percent of the primary educated respondents belong to diversifiers, whereas 57.4 percent of the secondary educated respondents belong to non-diversifiers which illustrates that the majority of the diversifiers have primary educational knowledge. A smaller percentage of them have secondary education in the sample. Similarly, civil status, whether the respondent is single or married, is significantly associated with crop diversification status. 66.7 percent of the married farmers cultivated more than one crop, while 64.7 percent of the single farmers were considered non - diversifiers. Other variables, such as gender, types of labour, and ownership of land, have not been significantly associated with the status of crop diversification.

Results of Tobit regression model

Crop diversification among vegetable farmers and its determinants were identified using the Tobit model and its marginal effects. The results in the table, Pseudo R^2 has a value of 0.2686 and a probability of chi-square also significant at the 1 percent level indicates that overall, the model is statistically significant and the 9 explanatory variables used in the model are collectively able to explain the variations in crop diversification among the small-holder vegetable farmers in the study area. Nine variables related to demographic and farming characteristics were taken as explanatory variables. Out of them, the size of cultivated land and age positively impact crop diversification at 1 percent and 5 percent significant levels respectively while age squared and education level negatively impact on it at 10 percent level.

Results revealed that the gender of the household head was insignificant on the determination of crop diversification, while Dube & Guveya (2016) found contradictory results which implied that the gender of the farmer significantly and positively influences crop diversification. Further, the market distance was found to be insignificant on the determination of crop diversification in the model, which is consistent with the findings of Dube & Guveya (2016) while, Sichoongwe et al., (2014) found a significant impact on crop diversification. Ownership of land has an insignificant impact on crop diversification in the studied area, but Ojo et al., (2014) found a positive and significant effect on diversification among the farmers. Furthermore, civil status, and type of labour were insignificant in the current study. However, Esham et al., (2006) found family to be a factor that impedes crop diversification in Sri Lanka.

The age of the farmer has a positive coefficient sign with a 5 percent significant level, which implies that elderly farmers are more likely to engage in multiple crops in cultivation than young farmers and the likelihood of diversification into several crop enterprises increases with the age of the farmer. Thus, the age of the household head plays a vital role in diversification into several crops since it can be used to indicate the farmer's experience in different farming systems, which is consistent with the findings of Dembele et al., (2018) and Inoni et al., (2021), while Dube & Guveya (2016) found age to be an insignificant factor, which contradicts the findings of the current study. Further, the marginal effect of age has a value of 0.062, which is significant at the 5 percent level. This revealed that a one-year increase in age reduces the probability of crop diversification by 6.2 percent. This would happen due to older farmers putting more prominence on crop diversification than young

farmers. Because older farmers may try to attain their family's food security and raise their income by producing multiple crops than young farmers.

Table 7: Results of Tobit model and marginal effects

Variables	Coefficients	t - value	Standard error	Marginal effects
Age	0.086 (0.023)	2.32	0.037	0.062 (0.020)
Age squared	-0.0008 (0.050)	-1.99	0.0004	-0.0006 (0.045)
Gender	0.077 (0.502)	0.68	0.114	0.056 (0.500)
Civil status	0.120 (0.496)	0.68	0.175	0.090 (0.509)
Education level	-0.192 (0.070)	-1.83	0.105	-0.140 (0.066)
Market distance	0.006 (0.336)	0.97	0.006	0.004 (0.333)
Land ownership	-0.170 (0.234)	-1.20	0.142	-0.115 (0.195)
Types of labour	-0.048 (0.703)	-0.38	1.127	-0.034 (0.698)
Size of land	0.106 (0.000)	3.87	0.027	0.077 (0.000)
Constant	-2.079 (0.012)	-2.56	0.811	_

Number of observations = 86	**LR Chi^2 (9) = 37.16**
Probability > Chi^2 = 0.000	Pseudo R^2 = 0.2686
Log likelihood = -50.60	Observation summary:
	34 left censored observations at crop diversification index < =0
	51 uncensored observations 01 right censored observations at crop diversification index > =1

Source: Estimated by authors, 2019
Note: P - values are in parentheses.

The coefficient of age squared with the negative sign and the negative value for the marginal effect show that even though the farmer's age increases, after a certain age, the probability of engaging in crop diversification will reduce by 0.06 percent. The likelihood of participating in crop cultivation by the farmers who have primary education is lower by 14 percent when compared to the secondary educated farmers. Since the farmers have more knowledge, it may help them adopt new farming systems on multiple crop cultivation than

primary educated farmers. Aligned with the current study, Dube & Guveya (2016) also found that household members with secondary education significantly and positively influence crop diversification by farmers. The above Tobit model results further show that, the coefficient of land size as an independent variable was found to be significant with a positive impact at the 1 percent level on the probability of farmers diversifying the crops in the study and the study findings aligned with the findings of Inoni et al., (2021); Li et al., (2021); Makate et al., (2016); Esham et al., (2006); Ojo et al., (2014) and Sichoongwe et al., (2014). Accordingly, a farmer who has more acre of land is more likely to grow more crops than a farmer who has fewer acres of land. The marginal effect of land size is 0.077 which reveals that as the farmer increases his area of land under cultivation by one more acre it will increase the probability of crop diversification by 7.7 percent and farmers with a large size of land would have more intention to diversify their vegetable crops in the study area. This implies that, as land is one of the factors of production, it is confirmed that the farmers with sufficient land area are more likely to grow multiple crops than small landholders because, large-scale farmers may be able to allot their land for more than one crop compared to smallholders. Thus, the findings of this study concluded that land size, age squared, and education level significantly influenced crop diversification among the vegetable farmers in the Kotagala area.

Limitations of the study

In this study, determinant factors on crop diversification mainly focused on demographic and farming characteristics. But crop diversification could be influenced by many other factors such as financial return received by the farmers from each crop, market stability, irrigation systems, and requirements. Hence, the study results are limited to the demographic and farming characteristics in the current study. Further, the yield of each crop depends on the type of soil where they cultivated them, even though it was not included into the model. Because there is not much soil variation across the land where the farmers cultivated various crops in the study area. Since this is as a case study done in Kotagala division, the outcomes and findings are primarily applicable only to the specific study area, and those findings cannot be generalized to the entire country of Sri Lanka.

CONCLUSION

This study was conducted to assess the degree of crop diversification and also identify the impact of demographic and farming characteristics on crop diversification among vegetable farmers who cultivate different vegetable crops in the Kotagala area in the Nuwara-Eliya district of Sri Lanka. The Herfindahl index was used to measure crop diversification as an index, and its computed mean value is 0.36, indicating that crop diversification among vegetable farmers is low. Among the diversifiers, 8.1 percent of them attain an index value of .70 and the lowest index value of .32 is attained by 1.2 percent of the vegetable farmers in the study. The independent sample t-test was carried out to identify the mean differences in selected demographic and farming characteristics across diversifiers and non-diversifiers in the study area. Its results revealed significant mean differences in the age of the household head and size of the cultivated land between diversifiers and non-diversifiers.

Furthermore, the results showed that, on average, the age of the crop diversifiers and the size of cultivated land are greater than non- diversifiers. However, there are no significant differences in farming experience and distance to the market among the above two groups in the study. The findings of the Tobit results concluded that, the size of cultivated land, age, age squared and education level significantly impact crop diversification, while other variables related to gender, civil status, distance to the market, ownership of land and types of labour were not influencing crop diversification in the study. The age of the farmer has positively impacted crop diversification, and it can be concluded that ageing farmers were more likely to engage in more than one crop cultivation than young farmers.The coefficient of age squared negative sign reveals that as age increases, the probability of engaging in multiple crops increases. Even when farmer's age increases, after a certain age, the probability of engaging in crop diversification will reduce. The coefficient and marginal effects for land size is highly significant. This concludes that the farmers with a large area of land would have more intention to diversify their vegetable crops than the farmers with a small area of land in the study area. Thus, the farmers who have sufficient land area are able to cultivate multiple crops compared to smallholder vegetable farmers in the Kotagala area.

Recommendations and implications

The study recommends increased capacity building of young farmers in their selection and decision-making of multiple vegetable crops and providing necessary facilities to engage the vegetable cultivation in bigger areas of land as the measures of promoting crop diversification.

Implications for future research

Based on the findings derived from the study, the authors can make some suggestions for further improvement in future.

- The degree of crop diversification could be measured using various indices as mentioned in methods of data analysis even though this study focused on the Herfindahl index only. By measuring other indices, the findings may be compared across different indices in the participation of crop diversification.
- The impact of demographic and farming characteristics on crop diversification was examined by using the Tobit model. Compared to this model, ideally, the double-hurdle model or Heckman model can be used in further studies.

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Factors Affecting Urban Consumer Intention towards Online Purchasing of Agricultural Commodities in Sri Lanka

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The development of internet technology has made it possible for customers worldwide to change their daily routines. Both globally and in Sri Lanka, online retail sales have sharply increased in recent years. This study intends to identify the factors affecting urban consumers' intentions to buy agricultural Products online in Sri Lanka. The multi-stage sampling technique was used to select the most urbanised districts in Sri Lanka: Colombo, Gampaha, Kalutara, and Kandy. And using the convenience sampling technique, a total of 112 questionnaires were collected via a Google form. The research examined perceived Ease of Use and Food Quality as independent variables and dependent variables such as Perceived Usefulness, Website Trust, Perceived Risk, and Purchase Intention. IBM SPSS version 26 and IBM SPSS AMOS version 26 were used to analyse the data and develop the Structural Equation Model (SEM) to test the hypothesis. The results revealed that the influence of Food Quality on Purchase Intention, the influence of Perceived Ease of Use on Perceived Usefulness, and the influence of Perceived Ease of Use on Website Trust are significantly positive. Perceived Risk on Purchase Intention has a negative relationship and is not significant. The study suggests conducting additional research on novel marketing strategies distinct from conventional media tools and further analysing food quality.

KEYWORDS: Online Purchase Intention, Urban Consumer, Agricultural Products, Food Quality, Website Trust

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INTRODUCTION

The development of internet technology has created a path for changing consumers' day-to-day activities around the world. Through this, many offline activities have moved to online activities, and online retail shopping has seen a rapid expansion with the use of the internet in recent years. This expansion has suddenly increased due to the COVID-19 pandemic. It has changed human life from social behaviour to social distance. With the rapid growth of technology, people try to fulfil their needs as soon as possible. For that reason, supermarkets were introduced to the world. But with the fast evolution of the internet, people are tempted to bring goods to their doorstep rather than go out to supermarkets. This has become a good opportunity for sellers, and web developers have started to invent online shopping (Ranasinghe *et al*., 2019).

Technology is the primary distinction between offline and online consumer behaviour. When purchasing products and services offline, customers do not need to interact with technology, but when shopping online, customers do need to interact with technology. In this situation, as a result of information systems, physical shopping conditions have been replaced by electronic shopping (Athapaththu & Kulathunga, 2018). Electronic commerce is a term used to describe online shopping. Via the internet using a web browser, e-commerce enables consumers to purchase goods or services directly from retailers. Shoppers can purchase everything on their wish list by shopping online without hurriedly visiting physical stores. The use of online shopping prevents additional costs like transportation and also provides convenience by not having to wait in queues when paying. Customers can get their desired item delivered to their doorstep with the minimum payment. It only takes a click of a mouse (Aziz & Wahid, 2018).

Looking at the latest Sri Lankan statistics, in 2016, internet penetration in Sri Lanka improved by 30%, and online users grew by up to 6.1 million. The 1.5 million mobile phone connections and the greater than 300,000 broadband and dial-up internet connections are to blame.

This significant increase in internet availability, facilitated by various alternatives such as smartphones, broadband, and dial-up connections, has had a profound impact on the lives of Sri Lankans, particularly in areas such as e-commerce and online presence, with Facebook emerging as the most popular social network in the country (Colombo Digital Marketers, 2017).

When determining customers' purchase intention, it shows complex variations based on the attitudes, behaviours, and perceptions of consumers (Al-Ekam *et al*., 2012). While considering products consumed online, most consumers commonly consume products based on agriculture. According to Sri Lankan supermarkets, agricultural products have been classified into main categories such as vegetables, fruits, grains, and cereals; dairy products; meat and fish; and beverages. These agricultural products are generally bought online by Sri Lankans living in urban areas.

As mentioned in the 2020 census, 45.4% of people have computer literacy and 66.3% have digital literacy in the urban sector (DCS, 2020). Most of these online consumers can be found in urban areas. Colombo, Gampaha, Kalutara, and Kandy districts are identified as the most urbanised districts according to mean household income in Sri Lanka (DCS, 2019).

The general objective of the research was to determine factors affecting urban consumers' online purchase intentions for agricultural products in Sri Lanka. To evaluate the socio-demographic characteristics of online consumers in urban Sri Lanka and to analyse the relationship between identified factors and urban consumer intention towards online purchasing of agricultural products in Sri Lanka were the specific objectives.

LITERATURE REVIEW

Theoretical Background

With a few clicks of their fingers, consumers can shop from anywhere at any time. This happens due to today's rapid growth of the internet and its usage as a shopping channel (Kim *et al*., 2004). The usage of the internet by customers has had a significant impact on retail shopping in the majority of countries worldwide (Wijesundara, 2008). Also, the COVID-19 pandemic has changed human life from social behaviour to social distance, movement to no movement, and normal to new normal (Nueangnong *et al*., 2020). The development of the internet has improved consumer capacity to shop whenever they want, from wherever they are, and to buy any number of things by readily comparing value, pricing, and features before making actual in-store purchases (Athapaththu & Kulathunga, 2018).

The customer's initial internet buying actions included searching the web for products and comparing prices. After the consumer selects the product or service by providing personal details, user accounts are created and cookies, logs, and data-mining techniques are commonly used at this stage

(Athapaththu & Kulathunga, 2018). Online shoppers are reported to be less risk-averse, slightly more likely to be men and older, and have better incomes than non-shoppers. Additionally, there is proof that online shoppers are not brand- or price-sensitive and are convenience- and innovation-focused as well as variety-seekers (Wijesundara, 2008).

The COVID-19 pandemic has caused consumers to adapt to new habits that are concerned with public health, personal safety, and family stability. These practices include avoiding shopping in public settings, using face masks, and favouring online shopping (Al-Hattami, 2021). University students, who historically represented Generations Y and Z, have emerged as significant consumer demographics thanks to their high levels of computer and internet proficiency. "Their spending habits are not only influenced by their own preferences but also by the spending patterns of their parents, who may serve as role models. As these students transition into adulthood, they are likely to become important spenders themselves (Aziz & Wahid, 2018).

When compared to traditional buying, online shopping has several benefits, including time savings (Abbad *et al*., 2011; Morganosky & Cude, 2000), accessibility from anywhere at any time (Lester et al., 2005), and a wide selection of goods (Delafrooz *et al*., 2011; YMonsuwé *et al*., 2004). According to past research done in the Sri Lankan context, there have been numerous studies on ICT and the support systems for that sector, but official statistics show limited information on internet services and users in Sri Lanka (Wijesundara, 2008). Sri Lanka was the first country to have unrestricted commercial internet access in South Asia, but compared to other counterparts in the world, online shopping in Sri Lanka is at an infantile level (Wijesundara, 2008).

Sri Lankan consumers are more drawn to buying retail products through the Internet. When it released a recent in-depth analysis regarding how Sri Lankan e-commerce transactions are anticipated to increase by more than 72% in the near future (Ranasinghe et al., 2019). In Sri Lanka, most of these online consumers can be found in urban areas. It was proved by the 2020 census, showing 45.4% have computer literacy and 66.3% have digital literacy in the urban sector. Consumers' purchase intentions can be changed during the buying process, whether internal or external motivational forces are at play (Gogoi, 2013).

Perceived Ease of Use

Perceived ease of use is the degree to which users believe a given website to be simple to operate and pick up quickly. If websites are easy to use, consumers can find useful and meaningful information easily (Dachyar & Banjarnahor, 2017). In addition, consumer expectations about the procedure leading to the successful completion of a purchase are related to perceived ease of use (Ranasinghe *et al*., 2019). Which boils down to interactions between the online shopper and online stores in online buying places through website interfaces. In these circumstances, highly perceived ease-of-use websites will establish confidence, leading to fewer misunderstandings and improved ease of use. Studies in the past have discovered that perceived ease of use has an impact on customer trust through customer satisfaction in telecommunications businesses. (Dachyar & Banjarnahor, 2017).

Individual users' adoption and usage of technology and information systems were predicted by the Technology Acceptance Model (TAM). It contains two important factors that are proposed to explain technology usage behaviour. One of these is known as perceived ease of use. TAM makes it easier to comprehend the factors that influence whether people will accept or reject new technology. Web designers can incorporate many tools and approaches, such as appropriate search mechanisms and one-click transaction procedures, to establish perceived ease of use (Athapaththu & Kulathunga, 2018).

Online purchasing intent is positively correlated with perceived ease of use. Online buyers must provide convenience, effectiveness, and comfort in terms of perceived usability so that the website can benefit relatively (Hasan *et al*., 2015). Sin *et al*. (2015) mentioned in their results that perceived ease of use significantly influences the respondent's desire to make an online purchase using social media. Websites are not very handy for users if they are difficult to use, complex, or require effort to master (Sin *et al*., 2015).

Perceived Usefulness

The perception of usefulness also affects consumer intention. Perceived usefulness is the degree to which a user thinks using a given system will improve his or her performance (Davis, 1989). The extent to which a specific consumer believes that online shopping would improve their perceived shopping efficacy is known as perceived usefulness in the online shopping concept. The results of the online purchase experience relate to perceived

usefulness. The major advantages of online shopping can be listed as detailed information, availability, speed, accessibility, and ease of making orders. Consumers that have experience and are busy during traditional shopping times have more advantages in terms of speed and accessibility (Ranasinghe *et al*., 2019).

According to the TAM model, user attitudes towards information systems and their use corresponded with perceived usefulness. In the e-commerce industry, perceived usefulness is defined as the degree to which a person thinks that shopping would be more effective if they used the website to conduct their business. According to empirical research, perceived usefulness and perceived ease of use are strongly correlated (Athapaththu & Kulathunga, 2018).

Online purchasing intent is positively correlated with perceived usefulness because online businesses compete with other online retailers as well as traditional stores. Perceived usefulness is crucial for online shopping. Online merchants must provide comprehensive and useful information about the products or physical retailers to ensure customer happiness (Cha, 2011). Hasan *et al*., (2015) found in their results that perceived usefulness and online purchase intention have a statistically significant relationship.

Website Trust

A product of information technology is known as a website. Research has focused on the importance of a website, where from a technological standpoint, internet transactions are performed. Consumers need to use internet technologies at each step of the online transaction to interact with the website. Hence, in buying and selling activities, the quality of the website plays a major role (Athapaththu & Kulathunga, 2018). Trust is demonstrated by how much personal assurance is given that an online store will uphold its duties, operate as expected, and care about its consumers. When an online website can be trusted and offers benefits like information access and fulfilment of expectations, people will eventually see its value (Dachyar & Banjarnahor, 2017).

A person's level of assurance in their expectations of what other people will do going forward based on prior experiences is sometimes referred to as trust. The main reason for low customer engagement in e-commerce is a lack of trust (Dachyar & Banjarnahor, 2017). Products, business services, and promotional information all have a beneficial impact on user intention.

Additional studies have demonstrated that the accuracy, relevance, and timeliness of the material on a website contribute to its credibility (Athapaththu & Kulathunga, 2018).

In the first phase, trust is built by managing personal data and search results. By maintaining the security of the data, trust is established in the second stage. At this stage, the purchasing intention is related to both internal and external trust. The method concludes with preserving the security achieved in the last stage (Athapaththu & Kulathunga, 2018).

Food Quality

The primary factor influencing the consumer's purchase decision when considering factors that are related to the product is its kind. Depending on the kind of goods that customers are willing to buy, consumers will either buy online or offline, according to 88% of consumers. The key justification for the aforementioned decision states that consumers cannot touch or examine the products to determine their quality or pricing (Wijesundara, 2008). Currently, buyers obtain subpar goods that do not live up to the merchants' original promises, and they are taken advantage of by the original sellers (Ha *et al*., 2021).

The behaviour of consumers who buy fresh items is significantly influenced by the quality certification parameters. Because of the peculiarities of virtual e-commerce, quality and safety play a significant role in customer engagement in online purchasing. Fruit is a form of fresh product, so buyers have higher standards for quality and safety than with other goods. Fruit quality is crucial when consumers are making purchasing decisions, and they are willing to pay a premium for high-quality fruits. In the present situation of Chinese food safety problems, consumers consider quality and safety to make purchase decisions (Wei et al., 2018).

Value can be defined concerning a low price as what consumers expect from a product, what they receive in return for what they give, and the quality they receive for the price they spend (Salirrosas *et al*., 2022). Purchase intention is influenced by a variety of elements, including issues with safety and quality, environmental and health awareness, and significant product qualities including nutritional content, freshness, flavour, and price range. Price and socioeconomic considerations have less of an impact on the decision to purchase than aspects like food quality and security, brand recognition, and reliance on certification (Malkanthi, 2020). By guaranteeing that consumers can consume fresh and healthy fruits, the complete process from the

production process to the consumption via a supply chain of fresh fruit should be maintained (Wei *et al*., 2018).

Perceived Risk

Spirit costs associated with consumer purchasing behaviour that represent uncertainty about the future are defined as perceived risk. The above uncertainty directly affects consumers' purchase intentions (Wei *et al*., 2018). A consumer's perception of value and the level of risk are linked when making a certain purchasing decision. The two basic categories of risks are those that are perceived or anticipated (Ranasinghe *et al*., 2019). While shopping online, the following risks were perceived by consumers: financial risks, performance risks, personal risks, and privacy risks. Consumers in the relevant situation will make purchases that reduce perceived risk, according to the first prediction in the literature on consumer behaviour (Kim *et al*., 2004). Before buying goods, a buyer would consider the many risks connected with that transaction. In relation to e-commerce, trust will lessen behavioural ambiguity and associated risks, with the potential that an online shop may treat its client unfairly. Customers frequently believe that a reputable online company will not make the most of every opportunity. Trust will therefore lessen the perceived risk (Dachyar & Banjarnahor, 2017). Customers' impression of the potential for profit or loss in dealings with retailers or distributors is known as risk perception (Ha *et al*., 2021).

When a customer is shopping online, it is normal for them to be wary of making a purchase because the perceived risk will be higher than it would be in a more traditional setting. This is because online transactions take longer to complete than traditional ones. Consumers will consequently be aware of the risk associated with online transactions, and this risk may have an impact on their decision to buy from an online seller or not (Dachyar & Banjarnahor, 2017).

Purchase Intention

In the first stage, the customer visits the website and searches for fundamental details about the good or service they are interested in. The main measures buyers take at this stage are product and price comparisons on the web (Athapaththu & Kulathunga, 2018). Purchase intention is the intent of customers to engage in an exchange relationship at online stores, such as information sharing, sustaining business ties, and creating business

transactions (Zwass, 1998). Intention is also described as a factor used to assess the likelihood of future behaviour (Ajzen, 1985). Previous studies have revealed that customers who declare buying products online are higher compared to consumers who have no plans to purchase online (Brown *et al*., 2001).

A consumer's degree of purpose to engage in a particular purchasing behaviour online is referred to as their "online shopping intention" (Delafrooz *et al*., 2011). Due to the lack of such research in Sri Lanka, it is crucial to determine the variables impacting online retail purchase intention. This is especially true given the country's increasing Internet penetration (Athapaththu & Kulathunga, 2018). The findings of previous studies indicate that attitudes, perceptions of behavioural control, perceptions of utility, subjective standards, and trust are the primary factors influencing online consumers' intentions to shop. Also, the perceived hazards associated with internet purchasing have a detrimental impact on the intention to shop online (Ha *et al*., 2021).

The decision to use a website and make a purchase is the last step in the online purchasing process (Pavlou, 2003). Since traditional frameworks do not address technical requirements and website content together, it is important to identify the factors affecting online purchase intention and to determine the relationships between the factors identified and online purchase intention from a technological perspective (Athapaththu & Kulathunga, 2018).

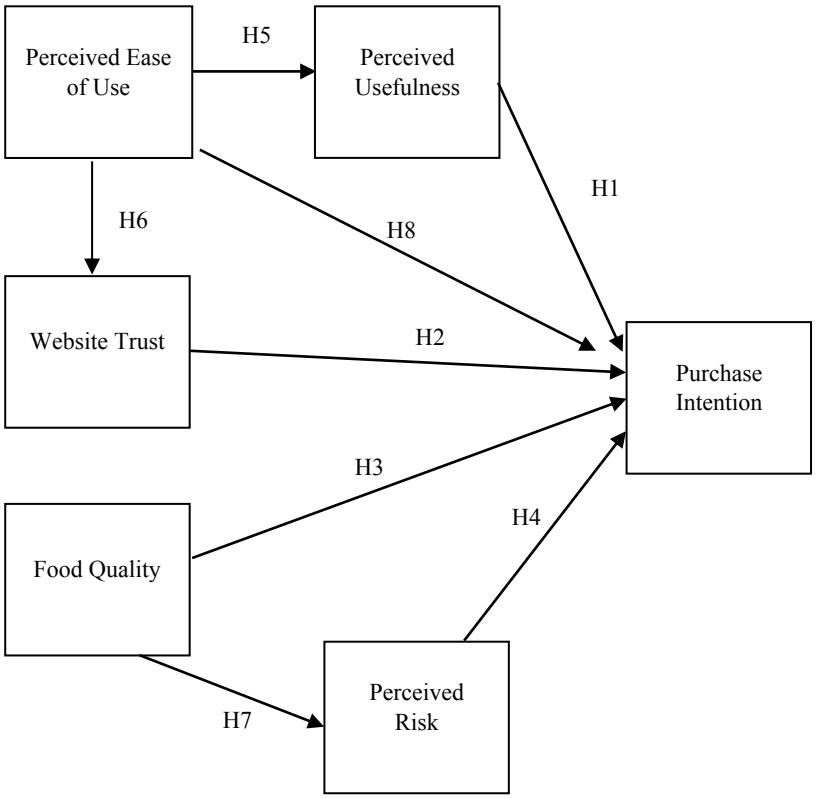
According to researchers, a consumer's decision to purchase a specific product can be categorised as an aspect of their cognitive behaviour. Additionally, they argued that consumer attitudes towards technology use and the value of the internet could affect customer intentions (Hasan *et al*., 2015). The process of determining whether to make a purchase begins with a product evaluation. To do the evaluation, people use their current knowledge, experience, and outside information. Thus, by influencing consumer perceptions, external influences also have a significant impact on the process of determining purchase intention. The Sri Lankan government and web retailers must integrate trust into their aims when making strategic decisions because the study indicated trust to be a crucial element in determining online purchasing intention. To instil trustworthiness in customers' eyes and subsequently draw customers to their online stores, web retailers may use a variety of strategies (Athapaththu & Kulathunga, 2018). Hence, taking this context into account, researchers frequently explore how these factors can

influence urban consumer intention towards online purchasing of agricultural products in Sri Lanka.

CONCEPTUAL FRAMEWORK

Based on the literature, the conceptual framework and hypotheses that follow were created.

Figure 1: Conceptual Framework



Source: Developed by Authors

As depicted in Figure 1, Perceived Ease of Use and Food Quality were independent variables, and dependent variables were known as Perceived Usefulness, Website Trust, Perceived Risk, and Purchase Intention.

Hypotheses Development

Below are six hypotheses stated according to the conceptual framework.

H1 – Perceived Usefulness positively affects Purchase Intention of consumers

H2 – Website Trust of positively affects Purchase Intention of consumers

H3 – Food Quality of positively affects their Purchase Intention of consumers

H4 – Perceived Risk of negatively affects Purchase Intention of consumers

H5 – Perceived Ease of Use has a positive impact on Perceived Usefulness

H6 – Perceived Ease of Use has a positive impact on Website Trust

H7 – Food Quality has a positive impact on Perceived Risk

H8 –There is a positive effect of Perceived Ease of use on Purchase Intention

METHODOLOGY

The research design of this research included a set of methods, techniques, and analyses to solve the research problem. Frameworks that have been made for traditional consumer purchase intentions do not explain factors that affect online purchase intentions. There are some key factors that a customer may care about when purchasing agricultural products online. This study focused on how the above factors can affect urban consumers' intentions towards online purchasing of agricultural products in Sri Lanka. The main objective of this study is to determine factors affecting urban consumer intention towards online purchasing of agricultural products in Sri Lanka. According to Sri Lankan supermarkets, agricultural products have been classified into main categories such as vegetables, fruits, grains, and cereals; dairy products; meat and fish; and beverages. Those categories were mainly considered in the study.

Data Collection

Accordingly, the descriptive research design helped identify the factors that affect consumer intention towards online purchasing. To achieve the objectives, data was gathered under a conceptual framework, and data was collected from the targeted population from August to September 2022. The multi-stage sampling technique was used to select the most urbanised

districts in Sri Lanka: Colombo, Gampaha, Kalutara, and Kandy. Those districts were selected through Western Province and Central Province. The most urbanised divisional secretariats were selected from the above districts. The convenience sampling technique was used to select a total of 112 respondents. This study used two methods for gathering data: primary data and secondary data. Primary data were gathered using a structured questionnaire. It was distributed among consumers in Sri Lanka by using Google Forms through an online platform. The questionnaire included different closed-ended questions. It consisted of questions related to consumers' socio-demographic characteristics and five-point Likert scale-type questions. Three components made up the questionnaire to simplify the analysis process. As shown in Figure 1, this research is based on a conceptual framework. It primarily included independent variables such as Perceived Ease of Use, Perceived Usefulness, Website Trust, Food Quality, and Perceived Risk, as well as a dependent variable, Purchase Intention. The existing published literature on the subject was used to gather secondary data. Online journal websites, publications, and articles were consulted for the literature review.

Data Analysis

Primary data were analysed using a quantitative approach. The responses obtained from the questionnaire were entered into Microsoft Excel software, and as a first step, data cleaning was practised. Data cleaning was done manually by reviewing for missing and duplicate data. After the data was cleaned, it was entered into IBM SPSS version 26 for reliability and validity testing. Cronbach's alpha was used to measure the reliability of variables. The data were analysed using descriptive statistics. IBM SPSS AMOS version 26 was used to build up the measurement model and structural model to test the hypothesis.The confidentiality of participants is preserved via a variety of techniques. The report did not include any personal information, and the data will be securely saved and disposed of.

RESULTS AND DISCUSSION

The first section of analysis was done using IBM SPSS version 26 software. Under that data, socio-demographic factors, platforms, and frequency of online purchasing of agricultural products and variables were interpreted using descriptive statistics.

Then reliability analysis was practised to test the reliability of the dependent and independent variables by using Cronbach's alpha module. The second section of the analysis was carried out using IBM AMOS version 26. The measurement model and structural models were developed for hypothesis testing.

Socio-Demographic Factors

The sample's socio-demographic factors are crucial in several ways. Therefore, key socio-demographic factors like respondents' gender, age, education level, employment status, monthly income of the family, and the district were thoroughly examined using descriptive analysis. The results are shown in Table 4.1.

According to Table 4.1, equal levels of gender are involved in the online purchasing of agricultural products: 56 males (50%) and 56 females (50%). The majority of consumers aged 64 belonged to the age category of 18–25. It is 57.1% as a percentage of all respondents. There were 22 respondents (19.6%), aged between 26 and 30. Thus, it is clear that the younger generation is involved in this online purchasing behaviour. According to the educational level, 11% of the respondents have completed their master's or above qualification, and 78% of respondents have studied up to Diploma or Degree level.

Among the sample, 61% of the people are employed, and 38% are stated as not employed. It shows consumers with good educational backgrounds and employment status are willing to be involved in online purchasing more than others. The highest percentage (28%) of online consumers has received an above 100000 LKR of family income, while the lowest percentage (10%) received below 25000 LKR of income.

Respectively, 17%, 19%, and 26% of respondents received family income levels between 25000–50000 LKR, 50000–75000 LKR, and 75000-100000 LKR. A study was focused on urban districts, where Colombo district had the majority of respondents, which is 35%. Accordingly, Gampaha, Kalutara, and Kandy districts had 25%, 20%, and 20% respondents, respectively. In a summary of socio-demographic statistics, the fact that 77.7% of respondents studied up to a Diploma or Degree level and 60.7% are employed suggests that the responses contain factual information. Also, equal-gender representatives are involved in the online purchasing of agricultural products.

Table 4.1: Socio-demographic factors of the respondents (n=112)

Socio-economic factor		Frequency	Percentage %
Gender	Male	56	50
	Female	56	50
Age	18 – 25	64	57.1
	26 – 30	22	19.6
	31 – 35	18	16.1
	36 – 40	08	7.1
Education Level	Grade 8 passed	01	0.9
	O/L passed	-	-
	A/L passed	12	10.7
	Diploma/ Degree	87	77.7
	Master or above	12	10.7
Employment status	Employed	68	60.7
	Not employed	44	39.3
Income Level of Family (LKR)	Below 25000	11	9.8
	25000 – 50000	19	17.0
	50000 – 75000	21	18.8
	75000 – 100000	30	26.8
	Above 100000	31	27.7
Urban District	Colombo	39	34.8
	Gampaha	28	25.0
	Kalutara	23	20.5
	Kandy	22	19.6

Source: Developed by Authors

Online Shopping Preferences

The researcher carried out a descriptive analysis of the online shopping preferences of the respondents.

Table 4.2: Platforms mostly used for purchasing agricultural products

Platforms mostly used	Frequency	Percentage %
Supermarkets (Keells, Cargills, Arpico, etc.)	61	54.5
Grocery stores or local malls	44	39.3
Online platforms like Daraz, Kapruka	7	6.3

Source: Developed by Authors

Platforms mostly used for purchasing agricultural products by respondents and how frequently they purchase agricultural products (Vegetables and Fruits, Grains & Cereals, Dairy Products, Fish, Meat, and Beverages) through online shopping were studied, and the findings are presented in Tables 4.2 and 4.3.

As shown in Table 4.2, 55% of online consumers purchase agricultural products via supermarkets (Keells, Cargills, Arpico, etc.). and 39% of respondents use grocery stores or local malls for online purchases. Only 6% of respondents mentioned that they use online platforms like Daraz and Kapruka to purchase agricultural products.

Table 4.3: Frequency of purchase of agricultural products

	Always	Often	Sometimes	Seldom	Never
Frequency of purchase of Vegetables & Fruits					
Frequency	16	15	22	14	45
Percentage %	14.3	13.4	19.6	12.5	40.2
Frequency of purchase Grains & Cereals					
Frequency	8	14	38	23	29
Percentage %	7.1	12.5	33.9	20.5	25.9

Frequency of Purchase Dairy Products					
Frequency	13	18	42	13	26
Percentage %	11.6	16.1	37.5	11.6	23.2
Frequency of purchase Fish & Meat					
Frequency	12	14	20	22	44
Percentage %	10.7	12.5	17.9	19.6	39.3
Frequency of purchase Beverages					
Frequency	9	34	37	13	19
Percentage %	8.0	30.4	33.0	11.6	17.0

Source: Developed by Authors

Variables

Table 4.4: Mean and Std. deviation values of variables

Construct	Items	Mean	Std. Deviation
Perceived Ease of Use	PEU item 1	3.43	.956
	PEU item 2	3.34	.916
	PEU item 3	3.62	1.041
Perceived Usefulness	PU item 1	3.55	.909
	PU item 2	3.29	.946
	PU item 3	3.47	1.004
	PU item 4	3.51	.959
Website Trust	WT item 1	3.45	.847
	WT item 2	3.31	.771
	WT item 3	2.74	.867
Food Quality	FQ item 1	3.10	.880

	FQ item 2	3.22	.824
	FQ item 3	3.11	.863
Perceived Risk	PR item 1	3.77	.968
	PR item 2	2.84	.926
	PR item 3	3.15	.903
	PR item 4	3.42	.926
	PR item 5	3.10	.816
Purchase Intention	PI item 1	3.09	.844
	PI item 2	3.25	.9155
	PI item 3	3.28	.785
	PI item 4	3.24	.893
	PI item 5	3.35	.846

Source: Developed by Authors

Reliability Analysis

Cronbach's alpha was used to assess the study's reliability. Each multi-item construct's reliability was verified using it. Alpha values of $\geq$ 0.70 are typically recommended for use in quantitative research (Hasan *et al*., 2015). Cronbach's alpha and the mean values of all constructs are reported in Table 4.5.

Table 4.5: Reliability statistics

Construct	No. of items	Mean	Cronbach's alpha
Perceived Ease of Use	3	3.464	0.792
Perceived Usefulness	4	3.458	0.792
Website Trust	3	3.167	0.711
Food Quality	3	3.143	0.866
Perceived Risk	5	3.255	0.717
Purchase Intention	5	3.241	0.809

Source: Developed by Authors

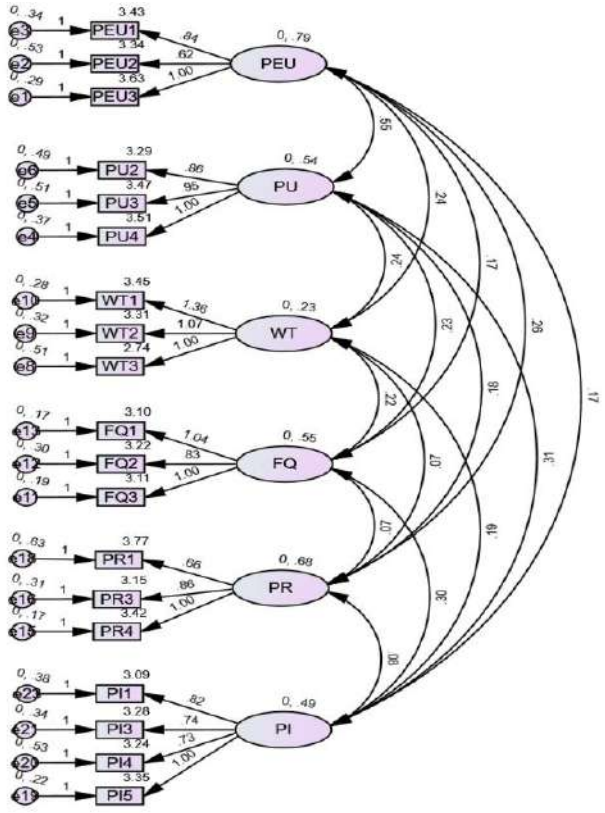
As shown in Table 4.5, every construct has Cronbach's alpha values greater than 0.7. It shows the accuracy and appropriateness of the collected data sample. Since the overall Cronbach's alpha value is higher than 7 for all the variables, the study was evaluated as reliable and accurate, and the mean values are distributed in the range of 3.143 to 3.458.

Structural Equation Modelling (SEM)

The second part of the analysis was done using Structural Equation Modelling (SEM). IBM SPSS AMOS version 26 is used in this study's SEM analysis. This study used a two-step analysis process known as the measurement model and the structural model. Under that measure, the mediating effects and complex relationships of variables. Finally, hypotheses were tested and presented.

Six constructs, namely Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Website Trust (WT), Food Quality (FQ), Perceived Risk (PR), and Purchase Intention (PI), are identified by the conceptual model. All of the provided constructs were permitted to correlate with one another for confirmatory factor analysis. The developed measurement model is shown in Figure 2.

Figure 2: Measurement Model



Source: Developed by Authors

Goodness of Fit Indices

The measurement model was assessed using the Goodness of Fit (GOF) measures of chi-square, the Root Mean Square Error of Approximation (RMSEA), the Tucker and Lewis Index (TLI), and the Comparative Fit Index (CFI). Table 4.7 illustrates the results of the Goodness of Fit indices.

Table 4.7: Goodness of fit indices

GOF indices	Recommended Values	Measurement model
x 2 /df (chi square normalised by degrees of freedom)	<3	1.530
CFI (Comparative fit index)	>0.9	0.918
TLI (Tucker and Lewis Index)	>0.9	0.898
RMSEA	<0.08	0.069

Source: Developed by Authors

The measurement model achieved a good level of fit, with a CMIN/DF=1.530, CFI=0.918, TLI=0.898, and RMSEA=0.069. TLI value is slightly near the recommended value (Aziz & Wahid, 2018) and it can take as the model was fit. Furthermore, the Chi-square statistic of 209.678 with 137 degrees of freedom and a probability value of 0.000 both indicate that the model has achieved the required.

Construct Reliability and Validity Statistics

Table 4.8 shows the Construct Reliability and Validity Statistics of the Measurement model. Internal consistency was achieved because all CR values are greater than 0.6. Convergent validity was assessed using Average Variance Extracted (AVE) and those values need to exceed 0.50 (Aziz & Wahid, 2018). AVE values of PEU, PU, FQ, and PR exceed 0.50, while WT and PI's AVE values are slightly near the recommended level.

Table 4.8: Construct Reliability and Validity Statistics

	CR	AVE	MSV	PEU	PU	WT	FQ	PR	PI
PEU	0.797	0.572	0.711	**0.756**					
PU	0.757	0.510	0.711	0.843	**0.714**				
WT	0.715	0.460	0.469	0.552	0.685	**0.678**			
FQ	0.870	0.692	0.388	0.257	0.421	0.623	**0.832**		
PR	0.798	0.576	0.132	0.363	0.298	0.179	0.111	**0.759**	
PI	0.784	0.480	0.356	0.279	0.597	0.569	0.588	0.135	**0.692**

Source: Developed by Authors

Factor Loadings

Table 4.9: Factor loadings

Variables	Factor Loadings
PEU 1	0.787
PEU 2	0.603
PEU 3	0.856
PU 1	Deleted due to low factor loading
PU 2	0.670
PU 3	0.699
PU 4	0.770
WT 1	0.779
WT 2	0.677
WT 3	0.561
FQ 1	0.881
FQ 2	0.749
FQ 3	0.860
PR 1	0.563
PR 2	Deleted due to low factor loading

PR 3	0.784
PR 4	0.892
PR 5	Deleted due to low factor loading
PI 1	0.682
PI 2	Deleted due to low factor loading
PI 3	0.663
PI 4	0.571
PI 5	0.829

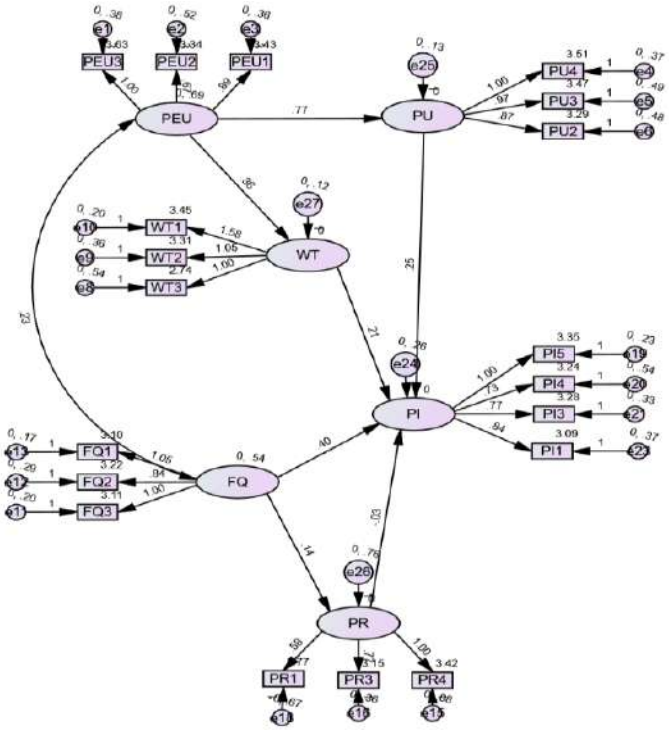
Source: Developed by Authors

Factor loadings need to exceed the value of 0.5 (Aziz & Wahid, 2018). Due to low factor loadings, four variables mentioned as PU 1, PR 2, PR, and PI 2 were deleted.

Structural Model

The structural model in Figure 3 was presented for testing hypotheses.

Figure 3: Structural Model



Source: Developed by Authors

Goodness of Fit Indices

Table 4.10 represents the results of the Goodness of Fit indices of the Structural model.

Table 4.10: Goodness of Fit Indices

GOF indices	Recommended Values	Structural model
x 2 /df (chi-square normalised by degrees of freedom)	<3	1.763
CFI (Comparative fit index)	>0.9	0.876
TLI (Tucker and Lewis Index)	>0.9	0.853
RMSEA	<0.08	0.080

Source: Developed by Authors

With a CMIN/DF=1.763, CFI=0.876, TLI=0.853, and RMSEA=0.080. CFI and TLI values are slightly near to the recommended values (Aziz & Wahid, 2018) and it can be taken that the structural model was fit. The Chi-square statistic of 253.927 with 144 degrees of freedom, and a probability value of 0.000, both indicate that the model has an adequate fit.

Hypothesis Test Results

Table 4.11 indicates the results of the hypothesis test. It includes estimated value (β value), Standard error (S.E). value, Critical value (C.R.), and results. The results show that there is a significant relationship between Food Quality (FQ) and Purchase Intention (PI), Perceived Ease of Use (PEU) and Perceived Usefulness (PU), and Perceived Ease of Use (PEU) and Website Trust (WT). Food Quality (FQ) on Purchase Intention (PI) has a positive relationship (β = .403, p < .001). The influence of Perceived Ease of Use (PEU) is significantly positive for Perceived Usefulness (PU) (β =.774, p <.001), and the influence of Perceived Ease of Use (PEU) on Website Trust (WT) is also significantly positive (β =.360, p <.001). Therefore, hypotheses H3, H5, and H6 are supported.

Table 4.11: The Standardised Regression Weights and Its Significance

		β value	T value	p-value
H1	PI ◄– PU	.250	1.932	.053
H2	PI◄–WT	.210	1.037	.300
H3	PI◄–FQ	.403	4.024	***
H4	PI◄–PR	-.028	-.396	.692
H5	PU◄–PEU	.774	7.060	***
H6	WT◄–PEU	.360	4.102	***
H7	PR ◄– FQ	.141	1.126	.260

Notes: PEU = Perceived Ease of Use, PU = Perceived Usefulness, WT = Website Trust, FQ = Food Quality, PR = Perceived Risk, PI = Purchase Intention

Source: Developed by Authors

The results also show that Perceived Risk (PR) on Purchase Intention (PI) has a negative relationship (β = -.028, p >.005) and is not significant. Perceived Usefulness (PU) on Purchase Intention (PI) has a positive relationship but is not significant (β =.250, p >.005), Website Trust on PI has a positive relationship but is not significant (β =.210, p >.005), and also Food Quality (FQ) on Perceived Risk (PR) has a positive relationship but not significant (β =.141, p >.005). Thus, H1, H2, H4, and H7 are not supported. While PU directly influences intention, PEOU indirectly influences intention through PU. The aforementioned correlations are supported by a number of further research studies conducted in an e-commerce setting (Pavlou, 2003). Thus, it has been demonstrated that clients should find it simple to shop online, and gradually they will see its value.

Structural Model to Determine Mediating Effect

According to the conceptual model, perceived usefulness and risk are mediators. The Bootstrapping method, which has been deemed one of the most effective ways to investigate mediator effects (Athapaththu & Kulathunga, 2018), was employed in this work. The H3 hypothesis was developed to check the mediation effect of PEU and PU. Results, however, showed that there is no appreciable moderating relationship between PEU, PU and PI, PR and PI.

The research shows that when individuals shop online, they are particularly concerned with the website's trustworthiness, utility, and usability. Therefore, when creating a website, web designers should give the aforementioned regions their undivided attention. As a result, the web interface needs to be simple for users to use and accommodating to their needs. According to the empirical findings, perceived usefulness and perceived ease of use are strongly correlated. In order to determine how effective a website is for customers' needs and wishes; online retailers should make it easy for people to shop online. In this context, e-retailers should pay special attention to methods and instruments they might employ to create a stress-free environment within the online store. Website designers can employ a number of tools and approaches, such as appropriate search mechanisms and one-click transaction processes, to establish usability (Athapaththu & Kulathunga, 2018).

CONCLUSION

The standard of living has significantly increased because of the development of the Internet and online shopping. This study created a model for examining the influencing elements of online purchase intention for agricultural products in Sri Lanka from the perspective of urban consumer behaviours. Perceived Ease of Use, Perceived Usefulness, Website Trust, Food Quality, Perceived Risk, and Purchase Intention were the variables included in this study.

In summary, the result shows that Food Quality significantly affects Purchase Intention and it is suggested that the most crucial aspect influencing consumers' online purchases is Food Quality. Customers are more likely to purchase food through online platforms if the food is of higher quality. While there are greater threats associated with internet purchasing than with traditional purchase channels, this may lead to shoppers being warrier about the food quality while making purchases. Perceived Ease of Use also

significantly affects Perceived Usefulness. Research demonstrated that the Technology Acceptance Model (TAM) with Perceived Ease of Use and Perceived Usefulness fared well in the analysis, and it shows that online businesses should concentrate on making their websites simple to use.

Website trust and Perceived Risk has no significant effect on consumers' purchasing intentions. The issue is that most websites' content is frequently of low quality, inconsistent with actual food facts, and typically not updated on a timely basis. Also, Sri Lankan online platforms are still in the developing stage when considering other countries. Most online users have a high level of education, a good income, and an interest in emerging technologies. As a result of this study, certain crucial variables that influence young customers' desire to make online purchases via social media were discovered. The conclusions and debates in this article may serve as guidance for businesses and individuals who seek to make online businesses using social media.

RECOMMENDATIONS

The finding revealed Food Quality significantly affects Online Purchase Intention, according to the perspective of the respondents. It is recommended to do further analysis of Food Quality to get a clear impression of it. Findings from this research could serve as the basis for further research into online purchases as a novel marketing strategy apart from conventional media tools.

Demographic characteristics could also be examined more thoroughly by specifying several ranges and observing how these aspects affect the propensity to make an online purchase. Additionally, the current study solely uses quantitative data for simplicity's sake; nonetheless, using qualitative data would be preferable.

Retailers and sellers who sell agricultural products through online platforms can improve online platforms, lower the risks involved with online purchasing, raise the quality of saleable goods, and increase the safety of online platforms to increase website trust and increase the number of consumers that shop online. While the study sample size consisted of only 112 urban people and most of them were young consumers, when developing future research can address large sample sizes by confirming their validity. Also, the degree of internet penetration varies by province in Sri Lanka, which could have an impact on consumers' intentions to make online purchases. Due to that, future research can focus on all the provinces in Sri Lanka.

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Factors Affecting Employability of Big Data Professionals: An Analysis with Special Reference to Logistics Companies in Sri Lanka

By LAHIRU GUNATHILAKE, VIHANGA WEERASINGHE, MALSHA GISHANTHI, OVINDI KUMARASINGHE & KELUM KUMARASINGHE

Big Data Analytics is swiftly growing and has revolutionised the field of business, through advanced analytics. Similarly, Sri Lanka is progressively embracing big data technology, and the pioneering adopters include logistics companies. This emerging field has opened-up many employment opportunities for big data professionals (BDP). However, Sri Lanka has encountered a shortage of BDP, amidst the significant growth in the field. Thus, this study urges to analyse the factors that potentially impact the employability of BDP in the field of big data analytics, with the motive of finding solutions to reduce the skill shortage, which serves as the main objective of the research. The study was executed by analysing qualitative and quantitative data collected through a questionnaire survey followed by a series of structured interviews. The questionnaire survey was distributed among 180 employees who are currently employed in the field of big data analytics, whereas the structured interviews were carried out with 08 experts in the field. Based on the initial Exploratory Factor Analysis conducted, Education Factors, Skills and Competencies, and Job Market Factors were identified as the three main variables that affect the employability of BDP. Subsequently, a Thematic Analysis was carried out in order to investigate the impact of the aforementioned factors on the big data skill shortage, and to navigate possible remedies for it. As implications of the study, it was revealed that certain educational and competency development factors should be considered in order to diminish the skill shortage of BDP.

KEYWORDS: Big Data Professionals, Demand, Skill Shortage, Employability

INTRODUCTION

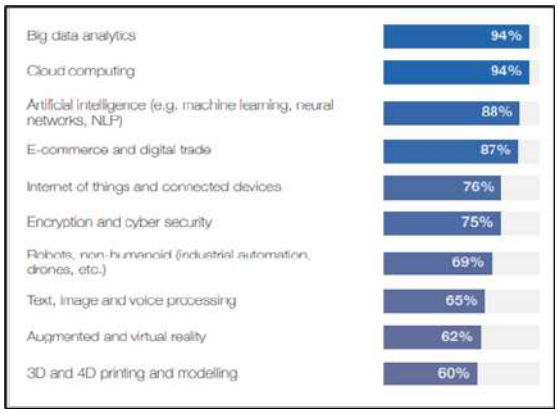
The modern world is rapidly embracing the marvels in technology. This is facilitated by the massive amounts of data generated by many sources. In the present context, data has taken a new stance called “Big Data”. It is a pool of data that is massive in volume yet, growing exponentially with time. Trottier, (2014); Santoro, et al., (2018) stated that Big data which is available freely,

determines the competitive advantage of organisations which are reengineered with business process digitisation. LIRNE Asia (2017) placed the development of Sri Lanka in the spotlight of big data, stressing the importance of up-to-date and accurate data, for a developing economy.

Big data analytics is the procedure by which collections of data are analysed by Big Data Professionals (BDP) to derive useful information (Bag, et al., 2020; Najafabadi, et al., 2015). BDP includes business profiles such as Advanced Analysts, Data Scientists, Analytics Managers, Big Data Analysts etc. (The Royal Society, 2019). Big Data is a very promising field and was the top ranked new job role business leaders are planning to hire up to 2022 (World Economic Forum, 2019). Data analytics is the fastest growing sector in the field of analytics, offering employees an above average salary (Harnham Insightful Recruitment, 2017).

The study specifically relates to the field of logistics, in order to explore the shortage of BDP. This is mainly because the traditionally secluded field of logistics is one of the pioneering adopters of big data technology. Lokanathan (2018); Marikar (2018) revealed that big data is currently used in many fields in Sri Lanka including logistics, with escalating demand for professionals locally. The field of logistics is subjected to disruption, with the invasion of the field by technological advancements such as big data analytics, to recalibrate the entire sector (Irfan, 2017).

Figure 1.1: Technology Adoption in the field of logistics and transportation

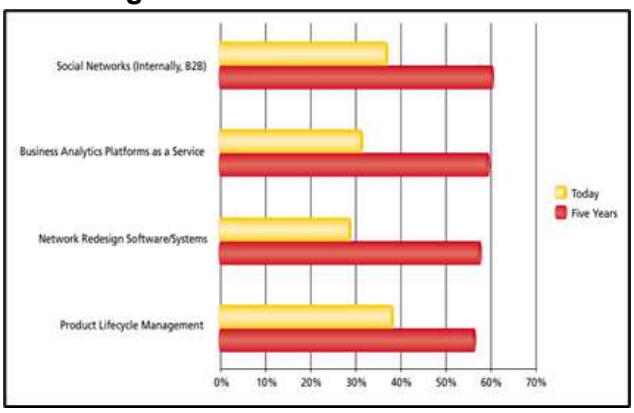


Source: World Economic Forum, (2020)

Figure 1.1 illustrates the latest statistics by World Economic Forum, regarding the technology utilisation in the field of transportation and logistics. Big data

analytics is ranked first among all the other technology enabled infrastructure, showcasing the potential of the field on logistics.

Figure 1.2: Existing and planned investment capacities for Big Data technologies



Source: BVL International, (2013)

Figure 1.2 shows the investment in Big Data in the field of logistics. It distinguishes the forecasted increase in investments within the upcoming five-year period, showing the potential impact of Big Data on the field of logistics. According to Dalsey, Hillblom and Lynn DHL, (2013), Big Data is utilised in multiple areas in the field of logistics including pickup and delivery related to customers, strategic network and operating capacity planning, last-mile and real-time route optimization, customer value supervision and risk and resilient planning. The study by Ayed (2015) mentioned that Big Data is an ideal fit for the field of logistics since it enables the systematic usage of huge sets of data from Global Positioning System (GPS) devices, vehicle sensors and customer applications which otherwise would have gone to waste.

Even though COVID-19 pandemic is a hindrance to many fields of business, experts comment that the field of Big Data has strived to find real time solutions for it. According to Haleem et al., (2020) big data technology helps in identifying the nature of the virus and finding preventive actions against it. Similarly, Agbehadji et al. (2020); Jia et al. (2020) explained that big data is heavily used to trace the contacts of infected people and their associates. FedEx is a logistics company which has utilised big data analytics to adopt its strategies in order to demand and forecast the transportation costs, during the prevailing COVID 19 pandemic (Shah & Shah, 2020).

Even though there is an increasing demand for BDP, Sri Lanka has encountered a shortage of supply of professionals to cater to this growing

demand. Similarly, World Economic Forum (2019); Part (2010); Phillips (2017); Rae (2018), examined that the job market has encountered a shortage of BDP. Similarly, Samarajiva et al. (2015); The Royal Society (2019) stated that one of the key constraints for businesses to adopt big data analytics is the shortage of skilled BDP. Even though Sri Lanka shows very promising signs regarding undertaking big data (Fuard, 2017), the skill shortage has restricted the path to excellence. Therefore, the study strives to resolve the query, “What factors would affect the employability of BDP and what remedies could be undertaken to reduce the shortage of professionals, to reach the true potential of big data analytics?”

This study becomes unique and exclusive since it strives to investigate an aspect which has not grabbed the attention of many prior researchers. At the onset, the research study intends to scrutinise the reasons for the shortage of big data skills globally and locally. Initially, the study anticipates determining the factors that affect the employability of BDP, through an Exploratory Factor Analysis. Subsequently, the analysis extended to investigate the influence of the aforementioned factors affecting the employability of BDP, by examining the present conditions of the labour market, in order to derive the most influential factor that affects the employability of BDP. The research contributes to enhancing the existing knowledge by analysing the effect of various factors on the employability of BDP. It is expected that the outcomes of the study will contribute positively to reducing the big data skill shortage in Sri Lanka and to promote the profession, emphasising its immense applications and benefits. This study will also give a summarised overview of the contribution of the Big Data skill force during COVID-19 pandemic situation.

LITERATURE REVIEW

Ohlhorst (2013) expressed that big data is undertaken by many companies in the world as a main source of competitive advantage.

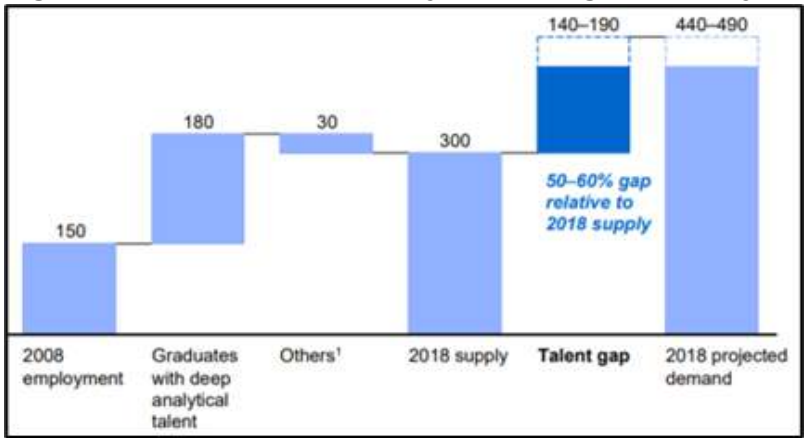
Figure 2.1: Forecasted demand of the data science and big data analytics workforce by 2020

Economy	Current DSA Workers	Projected DSA Workers Needed	Percent Change
Malaysia[24]	4,000 (2016)	20,000 (2020)	400%
The Philippines[25]	147,420 (2016)	340,880 (2022)	131%
Singapore[26]	9,300 (2015)	15,000 (2018)	61%
Canada[27]	33,600 (2016)	43,300 (2020)	33%
United States[28]	2,350,000 (2015)	2,720,000 (2020)	16%

Source: Pompa, et al., (2017)

Figure 2.1 emphasises that the big data skill shortage is linked to the demand for professionals. Even though the demand for BDP is rapidly increasing, the job market has encountered a significant gap in BDP, implying that the supply of professionals to the job market is poor, even though they are in high demand.

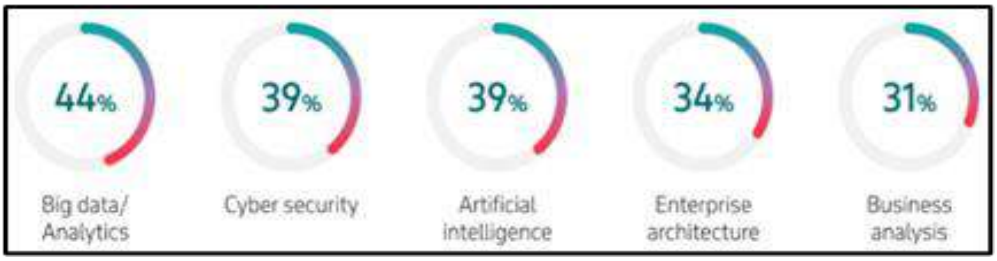
Figure 2.2: Demand and Supply Gap of Big Data Analysts in US, 2018



Source: McKinsey Global Institute, (2011)

Figure 2.2 shows the forecasted gap in-between the supply and demand of BDP in the US, for the year 2018. Based on that, the projected demand is much higher than the forecasted supply, resulting in a shortage in big data skills of 50%-60%.

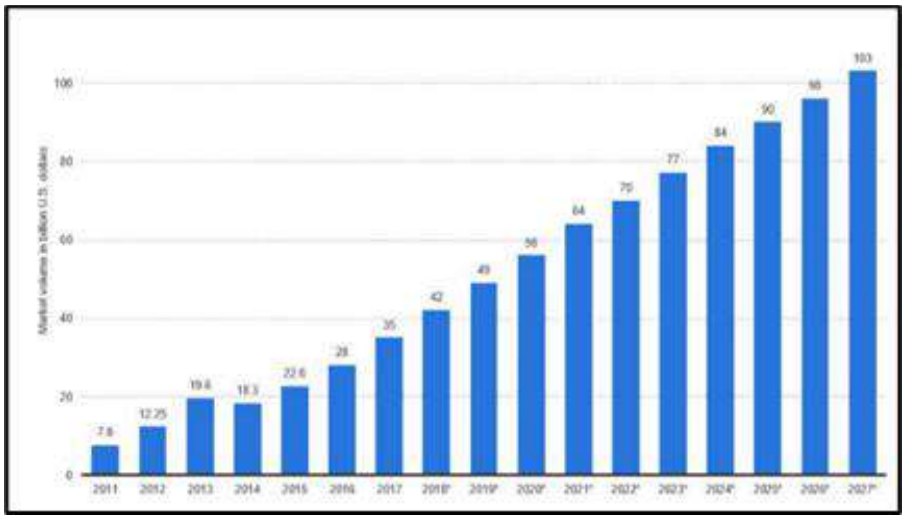
Figure 2.3: Top 05 most scarce skills



Source: Harvey Nash/ KPMG CIO, (2019)

Figure 2.3 shows that big data analytics is the scarcest skill in the global corporate field. Wegner & Kückelhaus (2013) elaboratively mentioned that Big Data is an untouched asset which can be successfully exploited by companies once they undergo a paradigm shift in mindset as well as infrastructure. As shown in Figure 2.4, the market size of big data is expected to grow at a rapid rate.

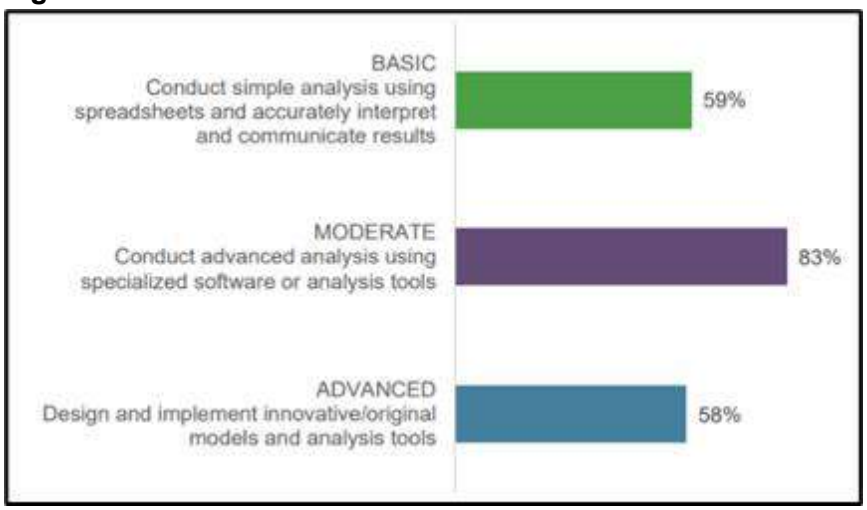
Figure 2.4: Expected growth of Big Data Market from 2011 to 2027



Source: Columbus, (2017)

Right human skill is critical in big data analytics (Dubey et al., 2019; Wamba et al., 2017). According to SHRM, (2016), 59% of organisations expect to elevate the job positions which require the skill of data analysis from 2017-2021.

Figure 2.5: Demand of different skill levels for BDP



Source: SHRM, (2016)

Figure 2.5 interprets different skill levels required by employees. The analysis revealed that 60% of the organisations demand BDP with the ability to interpret and communicate results.

Education and subject related knowledge are core factors anticipated by employers, when recruiting BDP. Gibson (2017); Kalota (2015) explained that employees' understanding of big data analytics, adds value to organisations.

DASCA, (2020) is a pioneering credentialing body for the data science profession. SAS, (2020) is an international institute which offers certification to BDP, which is a value addition for them in career progression. In the long run, the recognized professional bodies collaboratively assess the quality of the accreditations, in order to uplift the standard of data related programs and platforms (The Royal Society, 2019).

The time duration of higher educational qualifications plays a significant role since it gives a gist of the quality and capacity of the specific qualification.

Table 2.1: Time duration of Undergraduate and Postgraduate Big Data related programs in Sri Lankan public and private Universities

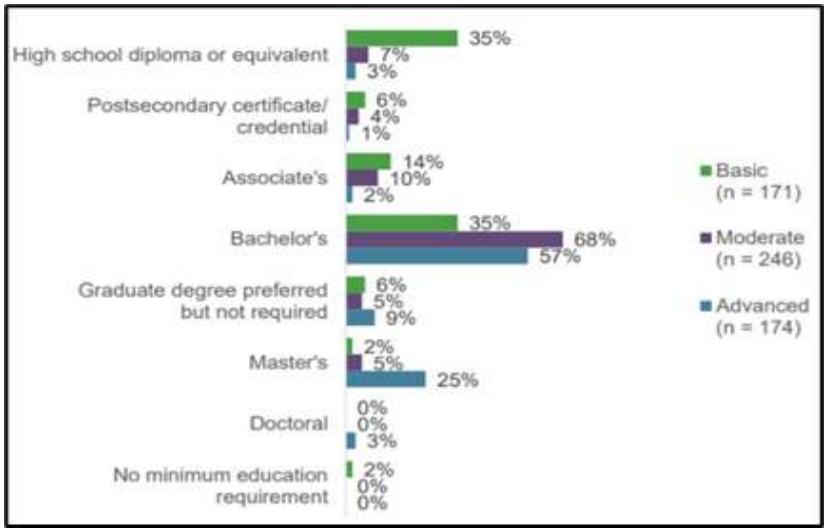
Type	Name of the University/Institution	Academic Program	Time Duration
Public	University of Moratuwa	Postgraduate certificate in data analysis and pattern recognition	1 year
	University of Colombo School of Computing (USSC)	Master of Business Analytics	2 years
Private	Informatics Institute of Technology (IIT)	BSc (Hons) Artificial Intelligence and Data Science	4 years
	Sri Lanka Institute of Information Technology (SLIIT)	BSc (Hons) in Information Technology Specializing in Data Science	4 years
	National Institute of Business Management (NIBM)	BSc (Hons) Data Science	3 years
	National Institute of Business Management (NIBM)	Advanced Diploma in Data Science	1 year
	NSBM Green University Town	Professional Diploma in Data Science	1 year

Sources: IIT, (2020); NSBM, (2020); SLIIT, (2020); UOM, (2019); USSC, (2020)

The time durations of local undergraduate and postgraduate programs relating to big data and advanced analytics are indicated in Table 2.1. It shows that even though most undergraduate programs are offered for three-four years, almost all postgraduate programs are conducted for a shorter duration.

International educational platforms for big data analytics, such as Pearson and Lytics Labs facilitate mainstream physical or virtual learning of various modules (Williamson, 2017). The Data Skill Taskforce is a UK based establishment which encourages data skills and ethical practices of main institutions. There are new forms of hybrid education and apprenticeships emerging in the field of work related to data (Blake, 2019).

Figure 2.6: Educational Requirement at each level of recruitment



Source: SHRM, (2016)

Figure 2.6 is a breakdown of the big data workforce, according to their educational qualifications. Even though most entry level requirements are just a diploma, it is very critical to pursue bachelor's, master's and PhD studies when climbing up the corporate ladder.

IBM Data Science Professional Certificate is a platform which offers a vivid range of courses for professional BDP, which can be pursued independently even while engaging in employment (Widjaja, 2019). University of Oxford, along with the University of Harvard, are offering short term professional courses for BDP (Dhawan & Zanini, 2014). Samarajiva et al. (2015) mentioned that LIRNEasia, which is a Sri Lankan policy regulation institution in the field of ICT, has demonstrated the value of big data. Apart from the traditional academic platforms, many MOOCs (Massive Open Online Courses) and boot camps are launched in the field of Big Data (Burtch Works, 2018).

Hetherington (2019) mentioned that the field of data science and advanced analytics is inherently multidisciplinary and includes statistics, mathematics, data and computational research. Sedkaoui (2018) expressed that BDP requires brilliant analytical skills, with a capacity to comprehend, manipulate and interpret data. DHL, (2013) emphasised that the key to successful Big Data implementation in companies is a remarkable workforce with exceptional skills. Similarly, Bag et al. (2020) emphasised that the

technological and managerial competencies of BDP are brought about through their talent capabilities, which are crucial in the path to success.

Park City Math Institute (2016) prioritised communication skills as a core competency for Big Data graduates. This is mainly because the findings of data analytics should be effectively communicated by BDP to superiors, team members and also the general public. The study also emphasised the importance of group analytics and presentation skills for a Big Data graduate.

Ohlhorst (2013) stated in his study that BDP should not only have technical skills but they should be well-nurtured by business skills as well. Big Data strives to harmonise a synergistic approach to solve organisational problems and enable effective decision making (Park City Math Institute, 2016). The study also describes the significance of exposing BDP to ethical approaches in data security, data privacy, transparency and professionalism concerns, which are compelling areas in the current context.

However, the study by Ajah & Nweke (2019) revealed that many organisations are not sufficiently equipped with the knowledge and skill to implement big data analytics or to interpret the results of it. Therefore, it suggested the importance of building an organisational culture oriented on analytics by bridging this skill and knowledge gap. With the outbreak of the COVID-19 pandemic, most companies are shifting to business process digitization. Based on this, Harvey Nash/ KPMG CIO, (2020) revealed that 35% of employers are anticipating transforming the workforce to polish their technology-related competencies. Most companies take a strong stance on uplifting their financial and operational performance by adopting big data analytics (Duan, et al., 2019; Dwivedi et al., 2019; Dwivedi et al., 2017; Swink & Srinivasan, 2017)

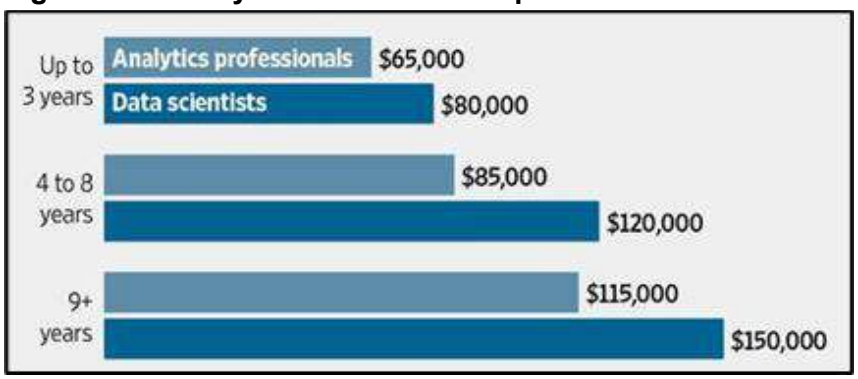
Figure 2.7: Workforce entry by prior experience

DSA Framework Category	Postings Requesting Experienced Workers (at least 3 Years Prior Work Experience)
All	81%
Data-Driven Decision Makers	88%*
Functional Analysts	71%
Data Systems Developers	84%
Data Analysts	76%
Data Scientists & Advanced Analysts	78%
Analytics Managers	94%*

Source: Columbus, (2017)

According to Figure 2.7, more than 76% of employers anticipate recruiting experienced BDP. The study of Park City Math Institute (2016) stated that "Capstone projects" should be a mandatory component of the experience and internship programs for Big Data employees since it strives to polish the problem solving, critical thinking, teamwork, communication and research skills of employees.

Figure 2.8: Salary of BDP with the experience level



Source: Waller, (2014)

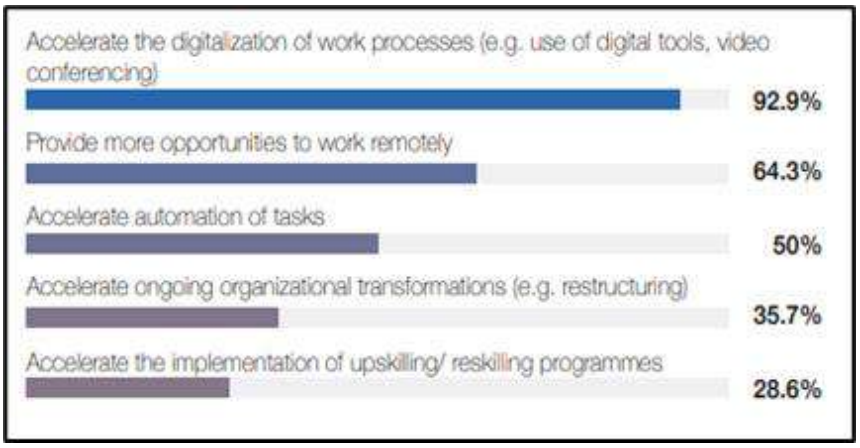
Based on Figure 2.8, as the experience grows, the remuneration of the big data employees increases. Thus, it further emphasises the significance and importance of prior industry experience for BDP.

Blake (2019) claimed that the field of data sciences is a very gratifying career which is increasingly relied upon by society. The study of Burtch Works LLC, (2018) stated that due to the increasing recognition of the field, many professionals from other business fields tend to shift towards the field of Big Data, undergoing a career change, leading to a continued escalation in the pool of talent.

Aryal et al. (2018); Cao (2017); Columbus (2017); Wamba et al. (2019) showed that embracing big data technology in organisations requires high level software like Hadoop, Apache Pig and database management systems –NoSQL. In addition, Song (2016) mentioned that tools such as IBM Watson Analytics and other automated software will instil a remarkable effect on the process of training BDP, to achieve better in their career.

The extensive utilisation and exchange of data followed by the strive for innovation has paved the way to an interdisciplinary workforce enriched with unique, novel and emerging skills and competencies (The Royal Society, 2019).

Figure 2.9: Impact of COVID-19 pandemic on logistics and transportation companies



Source: World Economic Forum, (2020)

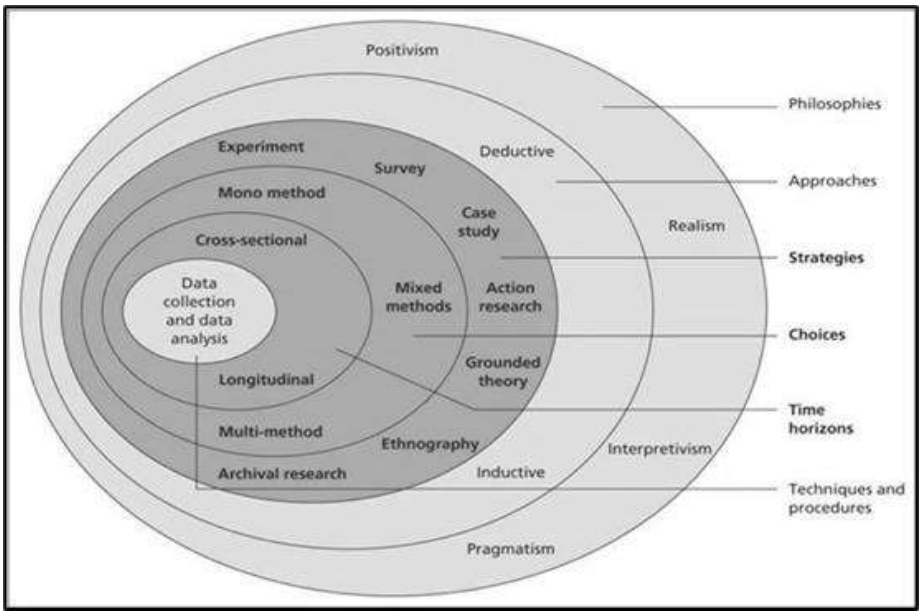
Figure 2.9 is a representation of different strategies that global logistics companies follow to adapt to the “New Normal”, post COVID-19. Most companies have considered work process digitalization as the most viable option, creating space for big data and other advanced analytics platforms to revolutionise the field of logistics. Similarly, certain companies have also started initiatives to upskill and reskill the current employees, in order to move forward with the digitalization of business processes. These practices

enhance the potential of growth and further integration of fields of logistics and big data, empowered by the nurturing of a skilled workforce.

METHODOLOGY

The research onion (Figure 3.1) which was developed by Saunders et al. (2009) explains the stages to be followed when developing a research strategy.

Figure 3.1: Research Onion



Source: Saunders et al., (2009)

This study is conducted based on Pragmatism. Vallack (2010) explained that this philosophy is ideally used for research studies conducted based on a mixed method. The study began with a qualitative notion of inquiry and qualitative data facilitates to assess the current demand for big data professionals while the quantitative method is useful in establishing the relationships.

An inductive approach is selected based on the layout and execution of the research study.

The study involves the use of structured interviews and questionnaire surveys as its research strategies to collect qualitative and quantitative data. Quantitative data is used for statistical analysis. Meanwhile, qualitative data

is utilised to draw conclusions based on underlying relationships. Thus, this study adopts a mixed method.

This study uses a cross sectional approach, where the information is gathered at a particular point in time.

Population

The target population for the series of structured interviews is the experts in the field of Big Data, in the Colombo District. Since the experts in the field of Big Data are unknown, the population of the study is also unknown. The respondents for the questionnaire survey are employees of selected logistics companies in the Colombo District.

Sample

In order to collect data for the questionnaire survey, the sample size of 180 operational and management level respondents in the field of technology are requested to participate to fill out a questionnaire. The sample size was determined by the use of the rule of thumb method and convenience sampling method used to collect data under non-probability sampling technique. Structured interviews were conducted with selected industry experts in the field of Big Data, and the sample size was decided by locating the saturation point after investigating the responses.

Exploratory Factor Analysis

This research is a salient collaboration of big data analytics, which is a heavily technical aspect, with the availability of proper human resources in the field. It is a very unique study and it explores an area which has not been overlooked by many prior researchers. Thus, the researchers lacked firm theory and substantial models to support the conceptual framework in order to develop hypotheses. Therefore, an Exploratory Factor Analysis was conducted at the beginning in order to determine the factors which affected the employment of BDP.

Determining the factors

The researchers initially determined certain indicators that would possibly be affecting the employment of professionals in the field of big data analytics. Those indicators were chosen randomly based on the literature survey. The aforementioned indicators include Competency of Employees, Academic

Knowledge, Higher Educational Qualifications, Remuneration, Experience, Soft Skills, Managerial Skills, Orientation of Qualifications, Professional Qualifications, Existing professionals in the field, Recognition, Infrastructure, Accreditations, Professional Networks and Time Duration.

Data Collection

Based on the indicators identified by the researchers, a questionnaire was developed and circulated among the employees in the field of big data analytics, who are currently employed in local logistics companies. The researcher considered the responses of 180 operational and managerial level employees in order to conduct the Exploratory Factor Analysis.

Preparation of data for analysis

Removing outliers

Based on the data collected, there were four potential outliers have been excluded from the dataset, as shown in Table 4.1.

Table 4.1: Data Screening

Questionnaire responses collected	180
Questionnaires discarded	26
Questionnaires considered	154
Outliers Removed	04
Questionnaires utilized	150

Source: Sample Survey (2020)

Table 4.2: Guidelines for KMO Values

Indicator	Value
Poor	<0.5
Average	0.5 – 0.6
Acceptable	0.6 – 0.7
Good	0.7 - 0.8
Excellent	>0.8

Source: Hutcheson & Sofroniou, (1999)

Table 4. 3: KMO Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.693
Bartlett's Test of Sphericity	Approx. Chi-Square	502.064
	Df	78
	Sig.	.000

Source: Sample Survey (2020)

According to Table 4.3, the output indicates that KMO sampling adequacy value is 0.693, which is considered as an acceptable value according to Hutcheson & Sofroniou (1999). The matrix can be ruled out if the Sig. Value of the test is less than 0.005 (Field, 2000; Pallant, 2013). Therefore, since the Sig., Value in Bartlett's Test of Sphericity is less than 0.005, the data set is adequately sampled.

Principal Component Analysis

A Principal Component Analysis (PCA) was conducted in order to distinguish the factors affecting employment of BDP. According to the initial analysis conducted, Higher Educational Qualifications, Academic Knowledge and Remuneration were identified as three doubtful indicators. This was because their communality value was below 0.3 and the value in the component matrix was less than 0.5. If the communality value is less than 0.3, then it means that only less than 30% of the variance in this indicator shares a common origin with others. Therefore, those indicators should be excluded from the analysis (Hadi, et al., 2016). The component matrix displays the factor loadings without rotating the variables. If it contains any indicator less than 0.5, then the impact of that indicator on that specific variable is considered to be negligible.

After filtering those three indicators, the same Principal Component Test was carried out. Then the researchers considered the output of the "Total Variance Explained" in Table 4.4.

Table 4. 4: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.953	24.607	24.607	2.953	24.607	24.607	2.471	20.595	20.595
2	2.357	19.641	44.248	2.357	19.641	44.248	2.174	18.120	38.715
3	1.344	11.198	55.447	1.344	11.198	55.447	2.008	16.732	**55.447**
4	1.077	8.972	64.419						
5	.879	7.328	71.748						
6	.722	6.016	77.763						
7	.664	5.535	83.298						
8	.563	4.689	87.988						
9	.453	3.771	91.759						
10	.372	3.101	94.860						
11	.335	2.792	97.652						
12	.282	2.348	100.000						

Extraction Method: Principal Component Analysis.

Source: Sample Survey (2020)

Table 4.4 revealed that 55.47% of the total variances were achieved from the first three factors collectively. It indicated that 03 independent variables could be determined by clustering all the indicators into three main categories. However, the fourth indicator also showed a value greater than one. Therefore, a parallel analysis was conducted in order to verify the total number of variables.

Table 4.5: Parallel Analysis

Component Number	Eigenvalue from the PCA	Parallel Analysis Value	Final Decision
1	2.953	1.519	Accept
2	2.357	1.386	Accept
3	1.344	1.281	Accept
4	1.077	1.192	Reject

Source: Sample Survey (2020)

The parallel analysis in Table 4.5 shows how the number of variables was determined to carry out factor extractions. In this process, the Eigenvalues obtained from PCA were compared with the Eigenvalues generated by Patil et al. (2017). The two values were compared in a way that if the Eigenvalue

generated from PCA was greater than that of the parallel analysis, then the indicator was accepted (Horn, 1965).

After determining the number of independent variables for factor extractions, then the factors were rotated for further analysis. The main motive behind factor rotation is to align them in a way which makes it more convenient for interpretations.

Table 4.6: Rotated Component Matrix

	Component		
	1	**2**	**3**
Existing professionals	.786		.185
Recognition in the local job market compared to foreign job market	.756		
Adoption of new infrastructure	.686		.118
Effect of industry experience	.643		
Professional networks	.596		
Presence of sufficient local qualifications		.827	.230
Crash courses to be completed in less time		.804	.204
Accreditation body provide guidance	.131	.636	.215
Professional qualifications		.611	-.126
Effect of business and managerial skills		.130	.827
Satisfaction level of local graduates compared to foreign graduates			.801
Effect of soft skills		.148	.691

Source: Sample Survey (2020)

Based on the Rotated Component Matrix in Table 4.6, the researchers loaded the factors to three main variables. The factor loadings were done so that the factors with a value of more than 0.5 are grouped into categories based on their orientation.

Table 4.7: Labelling Factors

Factors	Labelled Factors	Indicators	Factor Loadings
01	**Job Market Factors**	Existing Professionals	.786
		Recognition	.756
		Infrastructure	.686
		Experience	.643
		Professional Networks	.596
02	**Educational Factors**	Orientation of Qualifications	.827
		Time Duration	.804
		Accreditations	.636
		Professional Qualifications	.611
03	**Skills and Competencies**	Managerial Skills	.827
		Competency of Graduates	.801
		Soft Skills	.691

Source: Sample Survey (2020)

The researchers labelled the factors based on the composition of indicators in them. This was based on developing the conceptual framework for the study.

Normality

Table 4.8 shows the normality measures of the data set of the research study.

Table 4. 8: Skewness and Kurtosis

	Education Factors	Skills and Competencies	Job Market Factors
Skewness	-.187	-.613	-.403
Std. Error of Skewness	.198	.198	.198
Kurtosis	-.208	.119	-.267
Std. Error of Kurtosis	.394	.394	.394

Source: Sample Survey (2020)

Rose et al. (2015) mentioned that if the standard error of skewness and Kurtosis are within the range of +1.96 and -1.96, then the data set is normal. Since the standard errors of the data set shown in Table 4.8 are in between this range, it can be concluded that it is normal.

Testing for Validity and Reliability

The researchers utilised the Expert Validity technique since the relationship between variables are yet unknown until the Exploratory Factor Analysis is conducted.

The reliability test is done by getting Cronbach's alpha value in SPSS. Bernstein, (1994) confirmed that the standard value for Cronbach's alpha could be more than 0.6, which Bagozzi R.P. (1988) previously recommended. Table 4.9 represents the reliability values of each variable utilised in this research study along with the number of indicators in each variable.

Table 4. 9: Reliability for each variable

Variable	Cronbach's Alpha	No of Items
Educational Factors	.715	4
Skills and Competencies	.620	4
Job Market Factors	.718	6
Employment	.644	3

Source: Sample Survey (2020)

Testing for Multicollinearity

Table 4. 10: Multicollinearity

	Tolerance	VIF
Education Factors	.961	1.040
Skills and Competencies	.994	1.007
Job Market Factors	.899	1.112

Source: Sample Survey (2020)

If the tolerance value of the variables exceeds “one”, then there is no multicollinearity between the variables. However, if this value equals “zero”, then the variables show perfect multicollinearity. Therefore, based on Table 2.10, the variables considered in the study are proven to have no multicollinearity. The acceptable range of VIF value is between 10 and 0.1 (Field, 2005). The variables of the study abide by this rule as well. Hence, it shows that there is no multicollinearity prevailing among the variables.

Descriptive Statistics

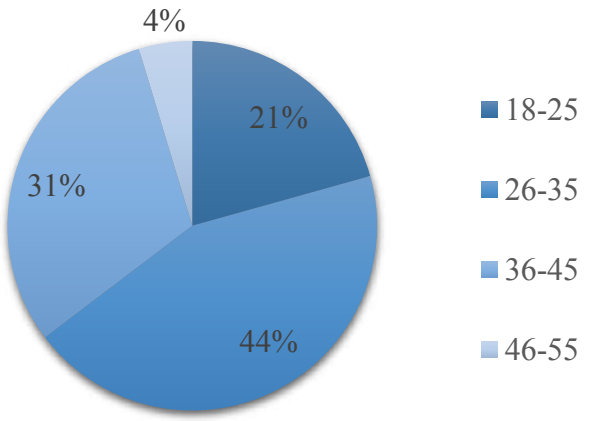
Demographic profile

The 150 respondents were categorised into five groups under different age levels as 18-25, 26-35, 36-45, 46-55, 56 and above. Among them, the age group between 26-35 represented the majority (44%) of respondents. Many of these respondents are enriched with more than three years of working experience, hence could be currently in the initial stages of career progression. The second highest rate was recorded from 36-45 age category, which amounted to 31%. The majority of the respondents of this age category might be employed in higher executive positions in the organisational hierarchy with a good experience in the field. The third highest rate was recorded by employees at the age limit 18-25, which summed up to 21%. It could be assumed that many of the respondents in this age group are newly recruited to the company or in their probationary period. Finally, the least responses were recorded from the age group 46-55, accounting for 4% of the total respondents. Furthermore, there are no responses recorded from the 56 and above age category. This gives an indication of the novelty of the field of big data. Since only a very few respondents above the age of 46 have responded to the questionnaire, it could be assumed that the field of big data is not much embraced by the employees belonging to that age limit. However, the high response rates from early and mid-career professionals show their interest and involvement in the field of big data analytics (Figure 4.1).

Figure 4. 1: Age

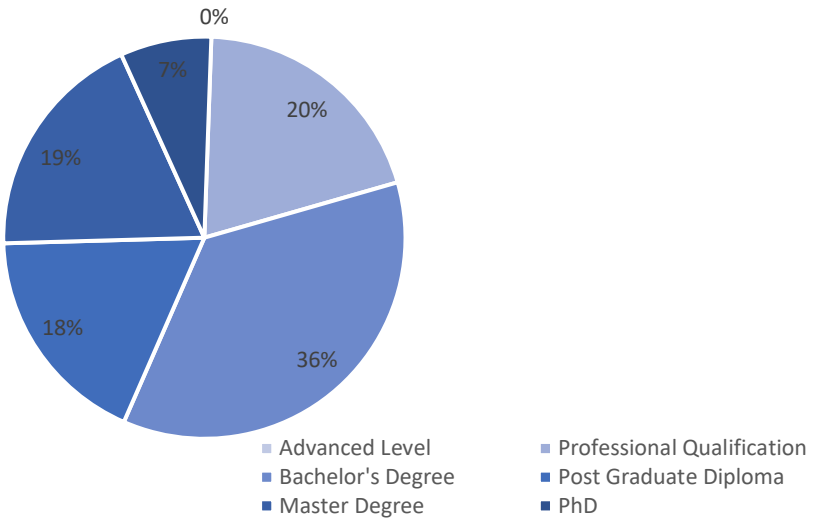
Source: Sample Survey (2020)

When considering the Highest level of education, only 7% of the respondents



belonged to the category of PhD, depicting that there are very few professionals in the field of big data analytics locally who have completed their Doctor of Philosophy in the same field. The highest percentage of respondents are in the group who have completed their Bachelor's Degree (55%). Second highest category includes the employees who have acquired Professional Qualifications from the field of big data analytics. It is represented as a percentage of 20%. The successive highest category of respondents is from the BDP who have completed their Master's Degree. The employees who have completed Post Graduate Diplomas in big data analytics amount to 18%. As Figure 4.2 demonstrates, all the respondents have acquired more qualifications than Advanced Level.

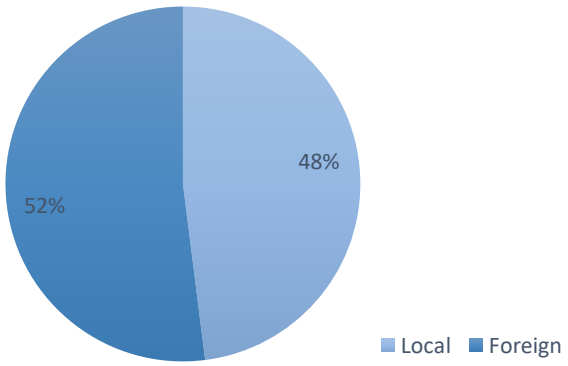
Figure 4. 2: Highest Educational Qualification



Source: Sample Survey (2020)

The researchers further analysed whether the respondents had acquired their highest educational qualification from a local or a foreign University/institution. Among the 150 respondents, the majority have acquired their highest educational qualification from foreign Universities/institutions, and it amounts to 52%. The are 48% of employees have acquired their highest education qualification locally, which is comparatively less than graduates from foreign Universities. This demarcates the lack of higher educational platforms for BDP locally. Figure 4.3 shows the orientation of the educational qualifications of respondents based on the country and region.

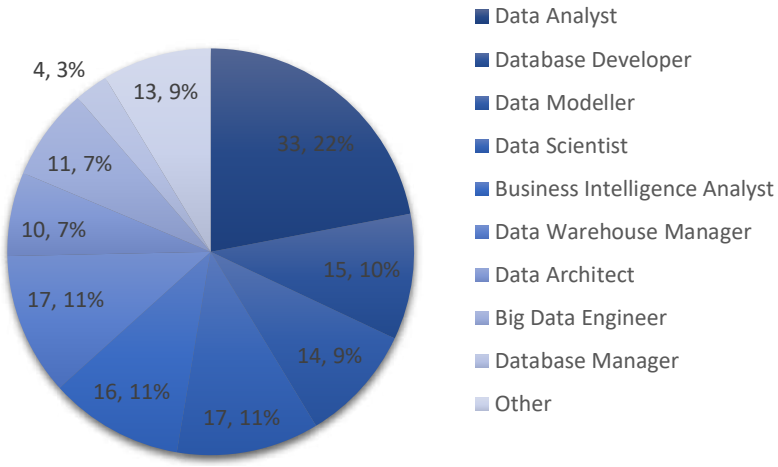
Figure 4. 3: Local/Foreign Qualifications



Source: Sample Survey (2020)

Based on Figure 4.4, the majority of the respondents were data analysts, which summed up to a percentage of 33.22%. Both data scientists and data warehouse managers represented 17.11% each, which was the second highest. Business intelligence analysts, database developers, data modellers and other professionals have also responded to the survey. There are 11.7% of big data engineers along with 10.7% of data architects. Meanwhile, the respondents include only a very lesser number of database managers.

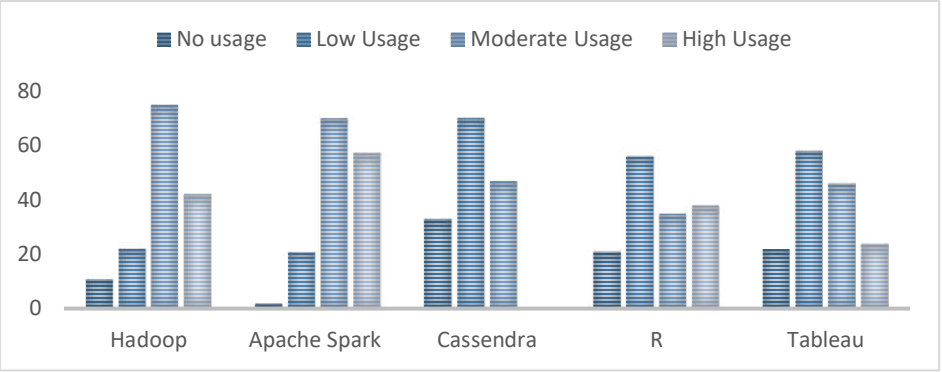
Figure 4. 4: Job Profile



Source: Sample Survey (2020)

In order to analyse the most commonly utilised software in Sri Lanka, five main types of software which are commonly used by BDP are considered, and the respondents rated them based on their level of utilisation. According to Figure 4.5, most professionals heavily utilise Apache Spark, while Hadoop is ranked second based on high usage. Meanwhile, Hadoop and Apache Spark are utilised mostly in the moderate usage category as well. Cassandra and Tableau are rated as low usage software by the respondents. Cassandra is the software that many respondents have rated as “no usage” as well.

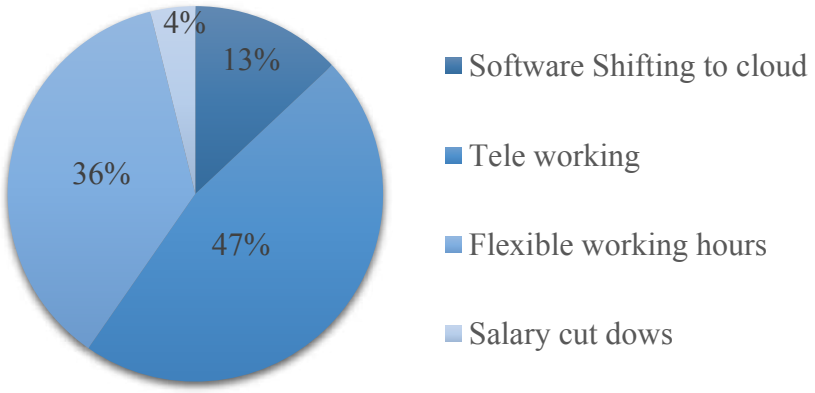
Figure 4. 5: Infrastructure Usage



Source: Sample Survey (2020)

Researchers intended to analyse the impact of the COVID-19 pandemic on big data employees. Based on their responses, most companies have initiated teleworking platforms due to the "New Normal" culture in the business sector. This was mentioned by 47% of the respondents, which summed up to be the highest impact on the field from the pandemic. 36% of the employees have mentioned that they have been introduced to flexible working hours such as flexed time and roster plans. 13% of the respondents have commented that all the traditional big data related platforms were transferred to the cloud so that the employees could remotely access the databases. Based on Figure 4.6, only a few numbers of employees experienced salary cut downs. This implies that the COVID-19 has very slightly impacted the field in a negative manner.

Figure 4. 6: Impact of COVID-19



Source: Sample Survey (2020)

Thematic Analysis

The research study employs thematic analysis to review and analyse qualitative data collected through a series of structured questionnaires.

Initial Reading of Texts

Braun & Clarke (2012) explained that this initial step is very vital to understand the content and the basic idea derived from various aspects. In this research study, the interviews conducted with experts in the field of big data were initially transcribed. Then they were reviewed by the researchers in order to understand the true narration of the respondents.

Coding the Texts after Repeated Reading

The interview texts are repeatedly read in order to absorb the true message delivered through them. According to Attride-Stirling, (2001); Braun & Clarke (2006); Lincoln & Guba (1985), each consecutive reading enhances the scope of vision of the researchers, and by doing so, they will be able to create as many codes as possible from the given data set. In this phase, the transcribed interviews were extensively analysed, by comparing the similarities and differences between each other in order to determine the codes. The researchers generated 108 basic codes after the comprehensive analysis of the responses.

Generating Themes through Codes

The concept behind the generation of themes is the process of consolidation of the codes into like groups (Attride-Stirling, 2001; Braun & Clarke, 2006; Lincoln & Guba, 1985). In order to generate themes for this study, the researchers carefully analysed all the codes generated and divided them into groups initially based on their common characteristics. Those categories served as the bases for developing themes covering up a few individual variables each. The final result obtained by the researchers included three main themes called Educational Factors, Skills and Competencies and Job Market Factors. Apart from that, another two codes; namely, Importance of Big Data in Logistics and Impact to the field of COVID-19, were separately considered by the researchers, based on their significance to the field.

The Table 5.1 is a presentation of data that the researcher coded initially along with the themes generated through them.

Table 5. 1: Code Structures

Codes	Number of Responses
Importance of Big Data in Logistics	
* High	C01, C15, C29, C42, C55, C69, C83, C96
* Moderate	
* Low	
Educational Factors	
● **Accreditations**	
▪ Local	
* Ample	
* Scarce	C02, C16, C30, C43, C56, C97
▪ Foreign	
* Ample	C02, C16, C30, C56, C97
* Scarce	C43, C84
● **Time Duration**	
* Have Crash Courses	C03, C31, C85, C98
* No Crash Courses	C17, C44, C57, C71
● **Local/Foreign Qualifications**	
* High local standard	C58, C72
* High foreign standard	C04, C18, C32, C45, C58, C86, C99
● **Professional Qualifications**	
▪ Local	
* Ample	
* Scarce	C05, C19, C33
▪ Foreign	
* Ample	C05, C19, C33, C73, C87, C100
* Scarce	
Skills and Competencies	
● **Soft Skills**	
* Important	C06, C20, C34, C46, C60, C74, C88, C101
* Unimportant	

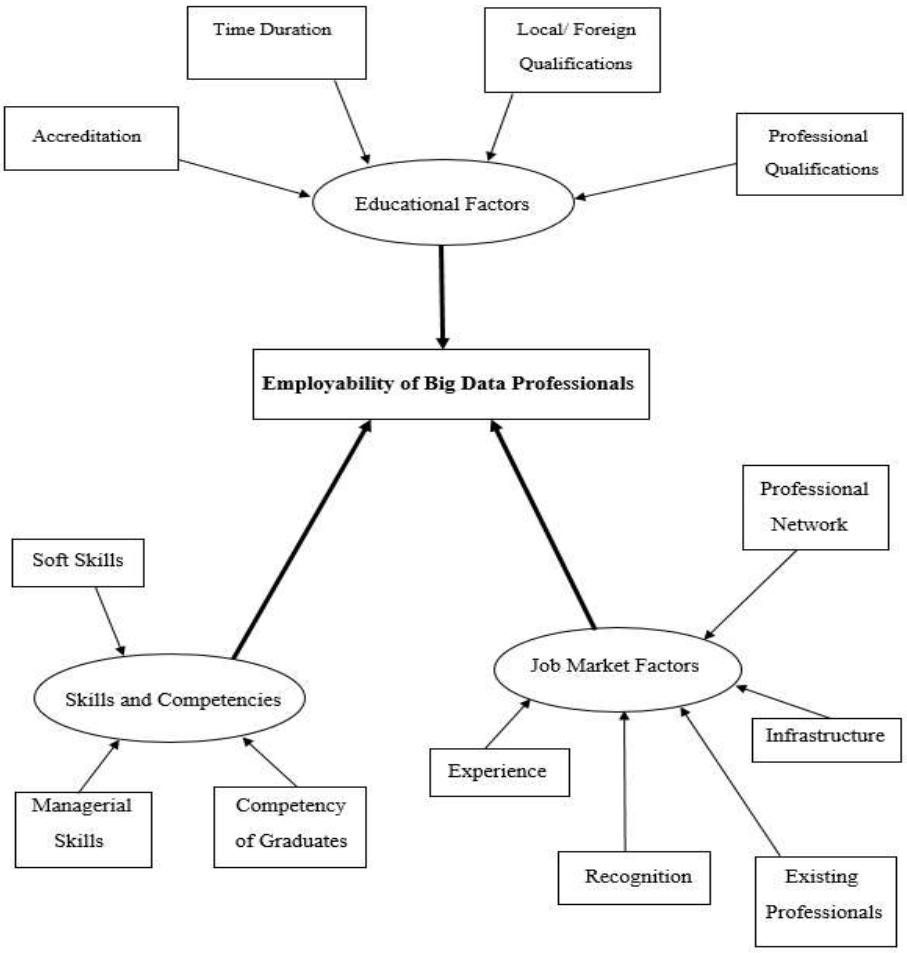
● **Managerial Skills**	
* Important	C07, C21, C35, C61, C75
* Unimportant	C47, C89, C102
● **Competency of Graduates**	C36, C62, C90, C103
* Ample competency development programs	
* Less competency development programs	C08, C48, C76
* No competency development programs	C22
Job Market Factors	
● **Experience**	
* Important	C09, C23, C37, C49, C63, C77, C91, C104
* Unimportant	
● **Recognition**	
* High	
* Moderate	C105
* Low	C10, C24, C38, C50, C64, C78, C92
● **Existing Professionals**	
▪ Number	
* High	
* Moderate	
* Low	C11, C65, C79, C106
▪ Expertise and Knowledge	
* High	C51
* Low	C25
● **Infrastructure**	
* Constantly updated	C12, C26, C52, C66, C80, C93
* Not constantly updated	C39
● **Professional Networks**	
* Important	C13, C27, C40, C53, C67, C81, C94, C107
* Unimportant	
Impact to the field from COVID-19	
* Positive	C14, C28, C68, C95
* Negative	C41, C108
* No impact	C54, C82

Source: Sample Survey (2020

Thematic Network

The thematic network shown in Figure 5.1 was developed by the researchers by investigating the codes developed through the interview texts.

Figure 5. 1: Thematic Network



Source: Sample Survey (2020)

Data Analysis

The data analysis is conducted by analysing the themes and codes generated by the researcher.

Importance of Big Data in the field of Logistics

All the respondents agree that big data is perfectly compatible with the field of logistics. They placed the value of big data for the field of logistics in the "High" category, since it is a unique yet valuable integration of two fields. Many respondents justified their argument, saying that big data is already acclimatised in many logistics giants such as DHL and UPS. According to Respondent eight, the massive amount of data received by supply chain logistics is utilised to implement big data analytics.

Educational Factors

Accreditation

Based on the comments of the respondents, many have agreed that there are no recognised accreditation bodies locally. However, 63% of the respondents have commented that there are ample recognised accreditation bodies for big data professionals globally. Adding to this, Respondent eight has stated that there are recognised accreditation bodies for BDP, such as DASCA, IOA and CAP by Informs. Conversely, Respondent four and Respondent seven have brought about a contradictory argument saying that there are only a limited number of accreditations internationally as well.

Time Duration

Half of the respondents commented that there are crash courses for BDP. Justifying this, Respondent seven has said that there are online platforms like Coursera. Meanwhile, Respondent eight has also said that there are online crash courses offered by IBM and Google. Conversely, the remaining 50% of the respondents have commented that there are no crash courses for the employees in the field of big data analytics.

Orientation of Qualifications

This indicator investigates the standard of local qualifications in comparison to foreign qualifications. Respondent five and respondent six have commented that the standard of local graduates who graduate from local Universities is high when compared to foreign graduates. However, the majority of the respondents have stated that the quality and standard of foreign qualifications are high when compared to local qualifications. Respondent five has implied that both local and foreign qualifications are standardised, but from different perspectives. He has expressly mentioned that local graduates have more capacity to work than foreign graduates, but foreign graduates prioritise the quality of work rather than quantity.

Professional Qualifications

Three Respondents have commented that professional qualifications are scarce in the local context. The majority of the respondents have agreed that there are ample professional qualifications available for BDP internationally. Respondent one has mentioned Udemy and Coursera as examples in order to justify her point of view. Respondent two, respondent three and respondent six have commonly mentioned AWS as a recognised professional qualification. Respondent seven has given multiple examples such as Cloudera, Hortonworks, Elasticsearch, AWS, Azure, Cloud, Datadog and Snowflakes.

Skills and Competencies

Soft Skills

All the respondents have commonly expressed that soft skills are very important for BDP. They have specifically said that communication is the most important skill since it enables the professionals to express their findings to the top management and to the clients. Respondent two has given a different point of argument, saying it is very critical for a big data employee to manage the stakeholders throughout the day. Therefore, he should possess collaborative skills for that.

Managerial Skills

The majority of the respondents have agreed that managerial skills are critical for BDP. Justifying this, many respondents have collectively stated that people handling, time management, cost management, critical thinking and project management skills are vital for BDP. Respondent seven stated that the chance that people will try to cheat will reduce if big data employees have knowledge of managerial aspects as well. However, respondents four, seven and eight have mentioned that it is not very critical for big data employees to possess managerial skills since they engage in a technical role rather than a managerial role.

Competency of Graduates

Four respondents have stated that many companies implement ample competency development programs for employees in the field of big data. Respondent seven has interestingly mentioned that even though his company extends training and development programs for BDP, they mostly expect the employees to be self-taught. Respondents one, four and six mentioned that there are only a lesser number of competency development programs for

BDP in local companies. Respondent four has justified his viewpoint saying that his company conducts competency development programs only catering to the specific requirements of employees. Also, Respondent six has stated that the company he is employed in has newly initiated training and development programs for BDP. However, respondent two has strongly mentioned that there are no competency development programs for BDP as at now.

Job Market Factors

Experience

All the respondents have commonly agreed that level of experience is a major factor affecting the employment of BDP. Respondents one and five have mentioned the importance of experience in driving the performance and career progression of an employee. Respondent two stated that experience boosts the confidence of BDP, whereas respondent six has mentioned that the knowledge of BDP should be up-to-date even though they have a very high experience level.

Recognition

The researchers identified that the majority of the respondents' opinion was that big data analytics as a profession is not yet recognised in Sri Lanka. According to Respondents one, three, four, five and seven, the field is still in the emerging stage, which is the main cause for the lack of recognition. Respondent two has captivatingly mentioned big data analytics as a "Surprise Field". However, respondent eight has a different opinion regarding the recognition of the profession. He states that it is moderate in recognition since it is growing at a rapid rate.

Existing Professionals

Based on the responses received, respondents one, six and seven have mentioned that the number of existing professionals in the field locally are very less. Meanwhile, respondent two has mentioned that the existing professionals have so much to improve when compared to foreign professionals. However, respondents four and five have given contradictory thoughts regarding this, saying that existing professionals are knowledgeable. Respondent four has specifically given an interesting comment saying if the elderly people retire soon then the hindrances for the young professionals to grow and develop will be less. Meanwhile, respondents three and seven have not specifically mentioned anything about this factor.

Infrastructure

The majority of the respondents have stated that most companies in Sri Lanka constantly update their infrastructure related to big data analytics. Respondent two has stated that three main factors should be looked into when updating the existing infrastructure. They are the cost, the number of cases that can be captured and the type of data collected. Meanwhile respondent five has stated that big data related infrastructure should be compatible with other software used in the company. Meanwhile, respondent six stated that their company conducts a lot of research on the latest developments in infrastructure. However, respondent three has given a contrary opinion saying that local companies do not regularly update their infrastructure.

Professional Networks

All the respondents have commented that professional networks are of utmost importance to employees in the field of big data. Many have justified their opinions by saying that their networks help them immensely as advice and knowledge sharing platforms.

Impact of COVID-19 to the field of Big Data Analytics

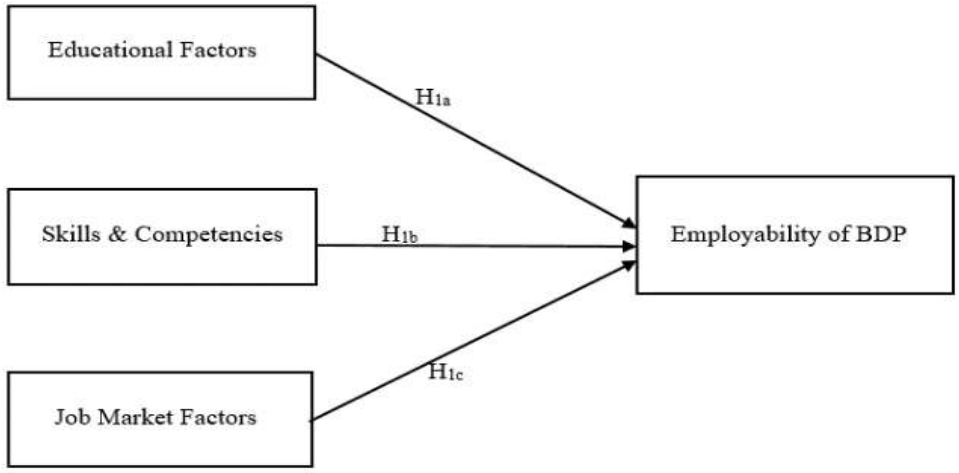
Four respondents have said that there is a very high positive impact between the two. According to the respondents, one and two, big data is used in suspect detection, when it comes to mitigating the effect of the pandemic. Respondent two stated that “It would be more appropriate to analyse the impact of Big Data to COVID-19, rather than considering the other way round”, emphasising the important role that big data plays during the current pandemic. Meanwhile, respondent five said that their company utilises big data in order to track consumer behaviour and deliver items to households efficiently, during lockdown periods. Respondents three and eight have mentioned that the impact of COVID-19 on the field is negative. This is because of reasons such as cutting down investments in the field and risks of data divulging due to teleworking. However, respondents four and six have stated that there is no specific impact of the pandemic on the field of big data.

DISCUSSION AND CONCLUSION

Discussion

The conceptual framework (Figure 3.2) was developed by the researchers, based on the Exploratory Factor Analysis conducted at the onset of the research study. The relationship and correlation between the Independent Variables and the Dependent Variable were revealed through that and this model was developed as an outcome of that.

Figure 3.2: Conceptual Framework



Source: Developed by the researcher

Considering this, three main hypotheses were developed.

H1a – Educational Factors Impact the Employability of BDP

H1b –Skills and Competencies Impact the Employability of BDP.

H1c –Job Market Factors Impact the Employability of BDP.

The outcomes of both the Exploratory Factor Analysis and the Thematic Analysis displayed a significant similarity in spite of the slight differences between responses. Hence the overall findings of the study were justified by two gears, which increased the accuracy and fidelity of the final outcomes.

H1a: Educational Factors Impact the Employability of BDP

DASCA, (2020); the standards body ensures that all its accredited institutions are hiring destinations that are preferred by most organisations. Thus, accreditations of local and foreign bodies have a high impact on the

employability of BDP. Many industry experts commented that there are international accreditation bodies for BDP, which ensures the delivery of quality education to professionals in the field. According to the majority of the respondents, the accreditation bodies of their educational qualifications provide constant guidance and updates about the new trends and developments in the field. This undoubtedly contributes to more updated knowledge of professionals; hence, employers prioritise the standard of accreditations when employing BDP.

Based on the research findings, there are many contemporary crash courses in big data analytics as well; namely, Coursera (2020); EDX, (2020). Industry experts say that these crash courses are effective platforms for learning big data and data analytics, within a shorter time duration, even at a very low cost. They further mention that professionals can be “corporate-ready” after following such standard crash courses.

Even though there are only a few local qualifications on big data analytics, there are many foreign qualifications. SAS in collaboration with Birmingham City University has launched a program called SAS Student Academy, in order to educate potential BDP, with the motive of catering to the growing demand of the professionals (Dhawan & Zanini, 2014). Many local BDP declare that there are not much recognised higher educational platforms for big data analytics in Sri Lanka, which has to become a major concern in order to increase the number of professionals in the job market. Similarly, the interviewers strongly highlighted that many foreign qualifications on big data analytics are much advanced and standardised than local qualifications, which definitely has an impact on the employment of local BDP.

Apart from the traditional academic qualifications, BDP is also offered various platforms to engage in professional education. The experts in the field of big data explicitly mention that platforms such as (AWS, 2020) facilitate this. The Majority of the respondents have stated that they constantly feel the need of a standard professional qualification when working in a corporate setting, in order to update their knowledge and climb up the corporate ladder. However, a concern is brought on the lack of professional qualifications locally, which might be an influential factor contributing to the current big data skill shortage.

H1b: Skills and Competencies Impact the Employment of BDP

Interactive disciplines of Big Data Analysts should embrace soft skills such as critical thinking, creative thinking and communication (Song, 2016). All the respondents of the questionnaire survey commented that soft skills are of

utmost importance to big data employees as well. The industry experts prioritise the communication skills of BDP, since it has a major impact in sharing the findings of big data analytics with the stakeholders. The importance of managing stakeholders, working in teams and being attentive to others are also highlighted as key soft skills required by BDP.

SAS, The Tech partnership, (2014) specified that the employers are explicitly interested in potential BDP with interpersonal, management and business insights. Therefore, managerial skills are another value-added skill for BDP. The majority of the respondents, along with a majority of the interviewers, have agreed that managerial skills are important for employees in the field of big data. The most important factors that managerial skills for BDP include people management, time management, decision making and cognitive skills. However, few experts in the local big data industry have commented that managerial skills do not play much of a big role since big data analysis is a technical field rather than a managerial emphasis.

Royster (2013) stated that rounded up knowledge about the industry that the BDP is employed in will uplift their contribution to the sector. In order to do so, they should possess many competencies polished with traditional and up-to-date proficiencies. Based on the responses of the questionnaire survey, it was concluded that the competency level of local BDP is satisfactory when compared with foreign professionals. However, few experts commented that the possible improvements in competencies are very high. Furthermore, the majority of the experts in the field mentioned that there are competency development programs conducted for BDP by their companies.

H1c: Job Market Factors Impact the Employment of BDP

In Sri Lankan context, JKH (2020) and PickMe, (2016) have specified a minimum of two years of experience in the field for an employee to be recruited as a big data employee. All the industry experts have commented that experience is very important when employing BDP in an organisation. Similarly, big data employees mention that the experience, skills and competencies that they have acquired through past experience has immensely helped them in performing their current job.

Certain employees find their career path based on the prestige of the field. Similarly, BDP also considers the recognition of the profession when engaging in employment. According to Hopkins and Hawking (2018), big data analytics is growing in recognition in the global job market with its rapid evolution and potential strategic competitive inferences. Even though big data analytics is high in recognition in the international job market, it is not so in Sri

Lanka. Industry experts comment that this is mainly because the industry is still in the early stages of emergence. They further explain that only the professionals in the field are aware of the term “Big Data Professionals” and are referred to as “Computer Engineers” in layman terms.

Carillo et al. (2019); Carillo (2017); Intezari & Gressel (2017); Murawski & Bick (2017) stressed the importance of on-the-job training, career guidance and continuous professional development programs to develop analytical and technological skills. Similarly, Wickramasinghe (2017) stressed on “Retrain to retain”, to overcome the employee shortfall by training the existing workforce to possess futuristic yet vital data analytic skills.

Many experts mention that even though the existing BDP in Sri Lanka are well-knowledged and talented, there is a scarcity of professionals in order to cater to the growing demand. However, they further mentioned that when compared to the professionals in developed countries, local BDP has so much to develop. When considering the age of professionals, it is very visible that most employees in the field are young and energetic and not very mature in age.

Ferraris et al. (2019) mentioned that efficient implementation of big data analytics should be unquestionably supported by high level software such as NoSQL and Hadoop. Many respondents commented that even though the Sri Lankan big data field is still at maturity levels, their companies adopt new advancements in infrastructure. According to many industry experts, companies consider numerous factors before investing in infrastructure and engage in a lot of research.

Ajah & Nweke (2019) in their study described big data as the Universal Data Fabric and the central core for the entire set of contemporary computing, which creates strong inter-institutional linkages for all corporate employees to work together as a team. Similarly, the majority of big data employees agree that their professional networks help them immensely in performing their current jobs. Whereas industry experts justify this fact by saying that professional networks serve as knowledge bases and information sharing platforms, which help employees gain more exposure and experience.

Conclusion

The research study identified that the employability of BDP is affected by educational factors, skills and competencies and job market factors. The findings were done with reference to the data gathered by big data employees in local logistics companies. The literature review unveiled that big data employees are lacking in the job market at a significant level due to various weaknesses in the aforementioned three factors. Similarly, the industry experts specifically revealed the lack of engagement with the profession locally. Hence, possible actions should be taken to uplift their representation as a prestigious career by mitigating all the shortcomings. The researchers determined that the local higher educational platforms and professional qualifications should be improved and standardised as the initial steps to mitigate the skill shortage of professionals. Similarly, the local employees should be extended with systematic competency development programs in order to continuously nurture their skills. Meanwhile, the profession should be firmly embraced and promoted by local companies with the motive of a "win-win" approach to both the company and BDP. Their remuneration should be improved in line with the amount of value addition they bring to the company. These are possible paths to be ventured in order to bring out the true potential of big data analytics by overcoming the compelling skill shortage of professionals. The study further highlighted the contribution of big data analytics to the battle against the current pandemic situation. Therefore, companies should expand their horizons to grasp this enticing field as a source of growth and competitive advantage.

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Role of Mindfulness in Entrepreneurial Success: A Review

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The life of an entrepreneur is often stressful with more time spent at work making decisions, facing ever-growing market competition, and undertaking business risks. An entrepreneur is so deeply involved in their business that it is difficult to demarcate between the venture and the owner. The success of the venture highly reflects the competence and focused mindset of the entrepreneur. Such a dynamic business nature requires best practises that can enhance the cognitive capabilities of the entrepreneurs and make them more aware or mindful of present moment phenomena. In a context where many studies are done to unveil success factors of entrepreneurial ventures and still a significant portion of them struggle to survive and succeed in the market, it is high time to view factors affecting entrepreneurial success from a novel angle. Accordingly, this review aims at uncovering the links of mindfulness to entrepreneurial success via an extensive critical review of the extant literature. Considering the vast array of benefits of being mindful, it is recommended for entrepreneurs to engage more in practising mindfulness to make them more vigilant in capturing opportunities, making decisions, and escaping the failures of the past and anxiety about the future. However, given the controversial nature of certain findings in literature and the dearth of studies on mindfulness and entrepreneurial success, the increasing necessity of further conceptual and empirical research in this area is explicit.

KEYWORDS: Entrepreneurial success, Mindfulness

INTRODUCTION

Mindfulness, or being attentive to the present moment, is a buzzword in psychology that has gained wide scholarly attention of late as many surprising links of mindfulness and many other constructs have been uncovered. There is a surge of research across the areas of clinical and counselling psychology, neuroscience, medicine, and education on mindfulness and its properties,

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seeking further impact on physical and psychological phenomena (Brown, Ryan & Creswell, 2007; Dane & Brummel, 2013, Dane, 2011; Gelderen, Kibler, Kautonen, Munoz & Wincent, 2019). Irrespective of the recent interest in mindfulness as a scholarly discipline, the concept of mindfulness was embedded in ancient Eastern spiritual traditions, especially in Buddhism, where being conscious of the present moment is practised via meditation. Some have used the terms meditation and mindfulness interchangeably. The concept seemed transcendental or mystical, so the investigations were limited to the areas of psychology and religion, where much scientific inquiry was not encouraged (Baer, Smith & Allen, 2004; Dane, 2011). However, with the studies available, being mindful has proven to be beneficial in terms of improved physical and mental health, conscious self-monitoring, interpersonal relationship quality, behavioural regulation, and work performance (Gelderen et al., 2019).

With the recognition of mindfulness as an area of scientific inquiry, many empirical studies were conducted in numerous disciplines, including management. However, there is a dearth of research on mindfulness where the workplace is considered, especially on its influence on individual task performance (Dane, 2011; Gelderen et al., 2019). Dane (2011) emphasises the relevance of mindfulness as an attention-related construct in studies of an individual's organisational behaviour, citing previous research results that demonstrate how individuals' focused attention affects strategic decision-making. When considering many workplace issues arising from negligence, ignorance, and lack of focus among employees, it can be argued that if a state of consciousness is present within individuals, such issues can be minimised, and the desired results can be gained. Mindfulness can help an individual work through problems, assess environments, and clarify vision in both their professional and personal lives. Research suggests that when the working environment is dynamic, it demands more mindful actions (Dane & Brummel, 2013).

However, among studies conducted on mindfulness, those linking mindfulness dimensions to organisational variables are limited. Entrepreneurship is an area where discussions on mindfulness are even rarer (Gelderen et al., 2019) though the nature of entrepreneurship showcases the relevance of mindfulness in every step of an entrepreneur's journey.

The entrepreneurial process takes place within a very dynamic environment where risk is high at each step and the future remains highly uncertain. The

influence of many intrapersonal and contextual factors is essential to being successful in such a context. The attributes of the entrepreneur are highly influential on how the enterprise is developed and maintained. Among many such entrepreneurial attributes, mindfulness is one that can further entrepreneurial actions through the alertness and flexibility it develops within the entrepreneur (Gelderen et al., 2019). However, how such alertness can drive the entrepreneur towards success or what the real significance of mindfulness is in an entrepreneurial setting remains largely underexplored (Gelderen et al., 2019). Therefore, this concept paper mainly aims at bridging the two concepts of mindfulness and entrepreneurial success drawing evidence from the extant literature. Accordingly, in this review, we intend to identify the factors so far identified in the literature as antecedents of entrepreneurial success, to identify dimensions of mindfulness, and to explore the possibilities of linking different facets of mindfulness with those of entrepreneurial success. In order to achieve the research objectives, scholarly work in the areas of mindfulness and entrepreneurship success from 2006 to 2022 has been critically reviewed and presented within the paper.

LITERATURE REVIEW

Entrepreneurial Success

Entrepreneurship or entrepreneurial ventures have become very popular in the modern context, where an increasing number of individuals are seeking opportunities to start their own business rather than trying to be an employee under a “Big Boss” (Ref?). There is enough evidence locally and internationally that many entrepreneurial establishments initially established as small and medium enterprises grow into large-scale enterprises, sometimes even reaching international markets. Also, the role of these ventures in the economy is vital as it addresses issues of sustainable development, job creation, economic growth, and overall market stimulation in a country (Kuruppuarachchi et al., 2017). No matter how big or small, success in their entrepreneurial activity is the ultimate goal of any entrepreneur. As every step of the entrepreneurial process involves risk, becoming a successful entrepreneur is challenging.

Even in the face of risk and many challenges, individuals are still willing to be entrepreneurs. The literature is rich with studies that investigate reasons why individuals engage in entrepreneurial activities rather than choosing traditional employment. Scholars like Katz and Gree (year?), Longenecker et

al. (year?), Timmons and Spinelli (as cited in Fisher, Maritz & Lobo, 2014), and Sivarajah and Achchuthan (2013) summarise factors like independence, escape from difficult employment situations, increased satisfaction, contribution to the community, flexibility of personal and family time, opportunities for growth, and rewards. To my surprise, money is not considered a popular reason for engaging in entrepreneurial activity in several similar studies. However, the role of rewards or money as a reason for starting entrepreneurship has been controversial to date. Given the increasing expenses in the modern world, this controversy poses the question of whether the previous claims that money is a lesser reason for becoming an entrepreneur are still valid or not.

A universal operational definition is difficult to find in the literature due to the very subjective nature of the construct of entrepreneurial success (Fisher et al., 2014; Rauch & Frese, 2000). Therefore, it is considered a phenomenon that should be explained in the context of its implications (Fisher et al., 2014). What is considered success by one individual may not be included in the definition of success from another individual's point of view. Thus, success can be both objectively and subjectively interpreted, depending on the indicators used in such a definition (Fisher et al., 2014). Most objective determinants are the easiest to measure, such as a firm's growth, personal wealth creation, turnover, profitability, return on investment, etc. (Amit et al., 2000; Makhbul & Hasun, 2011), where one can benchmark the criteria under concern to determine their success.

When reviewing literature, it is evident that definition of success of entrepreneurs is dependent mostly on individual perspective (Rauch & Frese, 2000), gender (Fisher et al., 2014), type of entrepreneurship (Austin et al., 2006; Fisher et al., 2014), phase of entrepreneurship life cycle (Van Gelderen et al., 2006), etc. For a profit-oriented entrepreneur, wealth maximisation is the prime indicator of success, whereas for a social entrepreneur, funds will be only a means of survival and the continuation of entrepreneurial activity. Such social entrepreneurs measure success based on the contribution they make to society and its welfare (Austin, Stevenson & Wei-Skillern, 2006). The definition of success also differs across genders. For instance, men use external standards like recognition and prestige to measure success, while women use internal standards of self-satisfaction with goal achievement as benchmarks (Burger, 2008; Fisher et al., 2014). In a nutshell, entrepreneurial success is a highly subjective phenomenon that is contingent upon many

factors, and sometimes the success of the entrepreneur is connected to the venture's success as well.

Prevailing research suggests a number of antecedents to entrepreneurial success. According to Rauch and Frese (2000), economic factors such as effective use of planning and strategies, innovation, entrepreneurial orientation, and tough environmental conditions affect entrepreneurial success. Management-related factors include visioning, bootstrapping, the qualifications of entrepreneurs, the training scheme utilised, etc. (Brush, 2008; Bonet, Armengot & Martin, 2011). Psychological factors also play a major role in the success of the entrepreneur, and those factors include the need for achievement, locus of control, low risk taking, human capital, problem-solving orientation, assertiveness, interpersonal reactivity, a positive attitude, and self-leadership. Social factors, as suggested by Brush (2008), Walske, Zacharakis & Smith-Doerr (2007) and Bandara (2016) include the strength of social networks and the social skills of the entrepreneur.

Identifying the business failures of entrepreneurial establishments is equally important as identifying success factors. Success and failure are two sides of the same coin and depend on how well the owner manages the critical success factors of the enterprise. Even though, in entrepreneurial literature, many studies are available to unveil factors affecting the failure of entrepreneurial establishments and to give recommendations, the failure rate of SMES in Sri Lanka is around 45% (Bandara, 2016). Also, according to Bandara (2016), poor business planning, poor record keeping, issuing post-dated cheques, lack of budgetary controls, poor staff quality, improper basis of recruitment, and lack of owner commitment are the key factors pertaining to entrepreneurial failure in the Sri Lankan context. A higher SME failure rate, irrespective of the many studies done on entrepreneurial failure, suggests a gap and the necessity of a new perspective to view entrepreneurial behaviour.

Conceptualising Mindfulness

Mindfulness, in its simplest terms, can be considered living in the present moment. Human beings who have a strong memory capacity and sound visionary skills most of the time dwell in the past or plan for the future. Of course, learning from the past and visioning for the future are important, but it is equally important to be mindful of the present moment, as it carries many physical and psychological benefits and, as has been proven recently, has many favourable outcomes for workplaces as well (Dane, 2011). Definitions, conceptualizations, and theorizations of mindfulness are still young, but the

growing academic interest in the subject will lead to many significant achievements in the coming future.

As previously mentioned, the terms mindfulness and meditation are being used interchangeably, as meditation has been used for centuries to practise mindfulness in religious traditions, thus always linking the two aspects. These traditions suggest that the practise of mindfulness can reduce suffering and develop positive attitudes and qualities such as awareness, insight, wisdom, and compassion (Goldstein, 2002; Kabat-Zinn, 2003). However, recent studies on mindfulness propose that meditation is not a necessary condition to be mindful, as it is within the reach of any individual to the extent that they focus their attention on events taking place in the present moment (Brown & Ryan, 2003; Dane, 2011). Accordingly, mindfulness skills can be taught, and individuals can be trained to become mindful independent of their spiritual origins (Kabat-Zinn as cited in Baer, Smith & Allen, 2004). This new conceptualization paved the way for various empirical studies on mindfulness and its impact on many different aspects of human life, including their work lives.

Mindfulness is a way of directing attention and keeping one's consciousness alive to the present reality (Baer et al., 2004). Even though mindfulness is a construct that is within human nature, it is not much subjected to empirical research to properly conceptualise or measure it. There are several conceptualizations of mindfulness; those roots can be traced back to historical and philosophical usage (Dane, 2011). According to Dane (2011), many prominent definitions of mindfulness tend to converge on academic and philosophical aspects of the construct.

One of the most quoted definitions of mindfulness has been forwarded by Brown, Ryan and Creswell who define mindfulness as "receptive attention to and awareness of present-moment events and experiences" (2007, p. 96). It highlights the undivided attention given to what is happening now rather than what happened in the past or what may occur in the future. The focus should be non-judgmental in nature, where individuals accept the way the experience occurs in the present moment (Kabat-Zinn, 2000). It can be contrasted with states of mind in which attention is focused elsewhere, including mind wandering, preoccupation with memories, past worries, fantasising, counterfactual thinking, and behaving automatically without awareness of one's actions (Baer et al., 2004; Dane, 2011). According to Kabat-Zinn (2003), mindfulness is an inherent human capacity, and the

degree of being mindful is contingent over time. and the tendency to be mindful is likely to differ from person to person.

Dane (2011) has categorised different definitions of mindfulness according to their domain: Academic, Buddhist, medical practise, and as a blend of these domains. For instance, he has classified definitions by Brown et al. (2003), M. Epstein (1995), Harvey (2000), Herndon (2008), Lau et al. (2006), Weick and Sutcliffe (2006), and Rosch (2007) as academic and definitions by Hanh (1976) and Nyanaponika (1972) as related to Buddhism. The conceptualization of Thondup (as cited in Dane, 2011) is a blend of academia and Buddhist tradition, where he defines mindfulness as “Giving full attention to the present without worrying about the past or future”. Definitions belonging to the academic domain include the flavour of scientific inquiry, where mindfulness is considered a mental factor that can be present or absent in a moment of consciousness (Rosch, 2007). On the other hand, Buddhist or philosophical definitions are more into the true transcendental nature of Mindfulness. For instance, as per the definition of Nyanaponika (1972), mindfulness is “the clear and single-minded awareness of what actually happens to us and in us at successive moments of perception”. However, when taken together, all these definitions make it apparent that all of them share some common features that constitute the core of mindfulness: mindfulness is a state of consciousness, such a state of consciousness is characterised by attention focusing on present-moment phenomena, and mindfulness involves attending to external and internal phenomena (Dane, 2011).

As a state, mindfulness is not a quality or characteristic that some individuals possess and some lack. As Kabat-Zinn (2005) states, it is inherent to humans, and the degree of mindfulness can vary across individuals or different circumstances. However, from a dispositional point of view or when mindfulness is considered a trait, some people may be in mindfulness states more often than others (Dane, 2011). Also, it emphasises the consciousness of the “here and now” rather than being preoccupied with the thoughts of the past and future (Brown & Ryan, 2003; Herndon, 2008). It is the most common feature of all definitions, as mindfulness itself is defined as being in the present moment. According to Harvey (2000), it can also be considered awareness of one's physical and mental phenomena. It reflects that this requirement is necessary because attending to the present moment includes attending to both internal and external phenomena. When someone lacks focus on either of them, it may result in a lack of mindfulness (Dane, 2011). Having considered all the above common characteristics, Dane (2011)

defines mindfulness as “a state of consciousness in which attention is focused on present-moment phenomena occurring both externally and internally” (p. 1000). According to Dane, this definition helps to differentiate mindfulness from other mental states such as mind wandering, absorption, and fantasising.

When considering the available literature on mindfulness and its measurement, many have taken a dispositional approach to conceptualising the concept. It is known as trait mindfulness, which reflects individual differences in the general level of mindfulness across time and situations. Simply put, it is the level of mindfulness one is experiencing at any given moment. When searching for possible relationships between entrepreneurial success and mindfulness, it was evident that a considerable number of studies were assessing the potential of identifying mindfulness as an entrepreneurial trait.

Trait Mindfulness

According to Conze (as cited in Mesmer-Magnus, Manapradagada, Viswesvaran, & Allen, 2018), mindfulness was historically conceptualised as a state of consciousness that is achieved through mediation. It can be named "state-mindfulness,” where mindfulness is considered a “state” that one should achieve. However, most contemporary research has found that the frequency with which individuals experience mindfulness states is not the same across people (Brown & Ryan, 2003; Giluk, 2009). This depicts a dispositional tendency towards mindfulness or treating mindfulness as a trait within individuals. Trait mindfulness is defined as “stable individual differences in mindfulness” (Glomb, Duffy, Bono & Yang, 2011). Studies on trait mindfulness, especially those focused on finding correlates with workplace behaviours, are limited in the literature. The existing research suggests personality-related traits like mindfulness have large correlations with conscientiousness and emotional stability (Mesmer-Magnus, 2018).

Available studies on examining the outcomes of trait mindfulness come more from disconnected disciplines like psychology, management, medicine, social work, and religion, which make it difficult to discern the real outcomes of the construct (Mesmer-Magnus, 2018). However, the outcomes that have been recognised in the studies are significant. According to Dane (2011), mindfulness tends to not only increase physical and mental health, but also improve two important workplace characteristics: behavioural regulation and

interpersonal relationship quality. He further suggests that maintaining wide attentional breadth and present-moment orientation would be beneficial to performance in dynamic environments like legal contexts, negotiations, emergency response operations, and crisis management situations. Similarly, Glomb et al. (2011) argue that mindfulness would be beneficial to both subjective well-being and the workplace. He further argues that the underlying key processes of mindfulness can promote improved decision-making, communication, problem solving, sustained goal-directed behaviour, the ability to perform under stress, creativity, job satisfaction, organisational commitment, and interactional justice. Moreover, mindfulness processes promote positive subjective well-being in the form of enhanced physical and mental health and improved life satisfaction, which in turn affects the workplace favourably (Mesmer-Magnus, 2018).

Similarly, mindfulness has been proven to reduce psychological distress by keeping the individual away from negative thoughts and reducing perceptions of work-related stress and burnout (Mesmer-Magnus, 2018). Also, those individuals who possess mindfulness traits tend to spend less time rehinking negative past incidents and less time worrying about future failures, which decreases perceptions of stress, depression, and burnout. Also, mindfulness encourages non-judgmental evaluation of events and labelling of events as negative or positive but encourages identifying events as just workplace outcomes, which in turn reduces work-related stress (Langer, 2004). According to Dane (2011) and Langer (2004), mindfulness is also likely to accompany benefits for job performance and satisfaction, as mindful individuals find it easier to pay attention to what they are doing and identify when something is not correct.

Measurements of mindfulness are still emerging, as mindfulness was only recently recognised as an empirically testable concept. When some scholars argue that mindfulness is a unidimensional construct, others, like Dimidjian and Linehan (2003), Romer and Orsillo (2003) and Bergomi, Tschacher and Kupper (2013) argue it is multi-dimensional with facets of observation, undivided attention, a nonjudgmental stance, etc. Accordingly, in the literature, several well-cited instruments like The Mindful Attention Awareness Scale (MAAS), the Freiburg Mindfulness Inventory (FMI), and the Toronto Mindfulness Scale (TMS) are evident, which represent a unidimensional conceptualization of mindfulness.

Among multi-dimensional instruments, the scale developed by Baer, Smith and Allen in 2004 is considered the most quoted and a base document for

other mindfulness measurements. This is one of the first instances in which mindfulness was identified as a multidimensional construct and an instrument was developed to measure each dimension separately. It is named “the Kentucky Inventory of Mindfulness Skills”. This measurement specifically considers mindfulness as a trait that has four facets: Observing, describing, acting with awareness, and accepting without judgement.

Role of mindfulness in entrepreneurial success

An individual’s choice of employment or career path is a blend of many different aspects. Not only the most quoted factors of education qualifications, salary expectations, expected benefit packages, preference for the private or public sector, job security, and pension schemes, but also many psychological and personality factors affect the decision on career choice. Those who are risk-averse and not ready for higher responsibilities or challenges will seek routine eight-to-five-hour jobs and enjoy life while staying secure in their comfort zones. On the contrary, there is a segment that has been growing for the past few decades: those who step out of their comfort zones to seek independence, autonomy in decision-making, challenging work assignments, and unlimited financial gains. They want to be their own “Boss' ' and the decider of their own fate. With the emergence of new technologies and drastic business and natural environmental changes, individuals encounter abundant opportunities to exploit in the market. Given the extraversion and challenge-seeking nature of recent generations, self-employment and entrepreneurial activities are drastically increasing in local as well as global contexts.

Irrespective of the fact that the mindfulness concept does not appear much in entrepreneurial literature, there are certain interesting links between these two concepts uncovered by scholars. Many aspects of entrepreneurship, when coupled with mindfulness, show a promising path for success and growth.

Being mindful allows an individual to see things that he or she would not normally take notice of and opens a vast array of opportunities. For a business owner, this is highly important, as identifying opportunities is central to business success. Entrepreneurship itself begins by identifying opportunities, and it is a continuous journey of opportunity recognition over competitors. Mindfulness widens one’s attentional breadth so that he or she observes hidden opportunities in the internal and external environment. The role of

mindfulness in opportunity recognition can be elaborated using several key mindfulness dimensions. According to Kelly and Dorain (2017) and Tuan and Pham (2022), mindfulness not only makes entrepreneurs aware of business opportunities but also makes them more compassionate and ethical while doing business. They have suggested incorporating mindfulness as a significant factor within the Social Entrepreneurship Intention model as a novel perspective, thereby increasing positive attitudes towards social entrepreneurship.

Observing this aspect of mindfulness reflects how often an individual attends to internal experiences as well as the outside environment. This perspective may allow individuals to avoid staying focused on a single event (Emanuel et al., 2010). Noticing or attending to various internal and external phenomena can be considered vital to opportunity recognition and decision making. For a better identification of opportunities, it is necessary to attend to internal phenomena like bodily sensation, cognitions, and emotions, as well as many external phenomena (Baer et al., 2004; Kabat-Zinne, 1995).

Further “describing” facets of mindfulness, which refer to labelling observed phenomena with single words or phrases in a non-evaluative or non-judgmental way (Fisher et al., 2014; Jacobs, 2016), enable an individual to identify opportunities as they are. As this labelling is done without any conceptual analysis, it encourages the individual to refrain from making judgements on a certain phenomenon, like “good or bad”. When a phenomenon is labelled, the individual may move away from such situations, resulting in erroneous decision-making. For an entrepreneur, labelling internal or external phenomena with a pre-judgment is detrimental, leading to many missed opportunities. Accordingly, non-judgmental labelling may improve opportunity identification in any favourable or unfavourable situation for an entrepreneur and lead him or her towards success.

Accept without judgement and refrain from unnecessary evaluations of events around them. In literary terms, it is accepting reality as it is without attempts to avoid, escape, or change it by applying evaluative labels (Baer et al., 2004; Marlatt & Kristeller, 1999). When faced with an unwanted phenomenon, individuals are encouraged to observe it, label it, and allow it to be present without self-criticism or evaluation (Segal et al., 2002). Such skills are believed to encourage more adaptive and flexible responses to problematic situations by preventing automatic, impulsive, and maladaptive behaviours (Baer et al, 2004).

It is always important to identify the true nature of external and internal events that entrepreneurs encounter in the day-to-day operations of their business. It emphasises the necessity of not being subject to emotions when making decisions on the opportunities or threats they face and assessing their own strengths and weaknesses. It ultimately brings the individual's focus back to the ultimate goal of the particular action. According to Ellen Langer (year), when an individual is mindful, rules, routines, and goals guide them, not govern them.

Envisioning the future is a key ability that any prospective entrepreneur should possess. Some might find that being in the present moment and planning for the future are contradictory. Nevertheless, being mindful does not necessarily mean that one should not have a plan for the future. Being in the present moment can avoid distracting feelings like anxiety for the future and regrets about past decisions or events. It is true that for any individual, lessons learned from the past and projections into the future are important. For entrepreneurs, it would be more important, considering the nature of their business. They need to learn from their failures in the past and always have a plan. It emphasises that emotional regrets from the past and unnecessary worries about the future should not deter the entrepreneur's mind from attending to what is there in the present. Such deviation may lead to missed opportunities and false decision-making. Therefore, entrepreneurs should only investigate the past if they are trying to figure out how to make changes in order to get to their destination more efficiently. Continuously looking back at where mistakes were made takes the focus off the road to the achievement of set goals for the business.

Another burning issue in the life of an entrepreneur is balancing work and family. This is, of course, a critical factor in the success of the venture itself. Mindfulness encourages work-life integration rather than work-life balance. While "Balance" separates work and life into two different categories, "integration" creates more synergies between all aspects of life and work (Afif, 2018). It is managing one's work responsibilities while fulfilling their duties to family. This is highly important for entrepreneurs and small business owners, as it is not possible to demarcate the line separating the business owner and the business. Hence, the opportunities that are provided by mindfulness practice make it easier for him or her to integrate the personal and work aspects.

Mindfulness as an entrepreneurial trait

Ultimately, it is possible and timely to list mindfulness as a trait of a successful entrepreneur. Apart from the most quoted factors for entrepreneurial success, owner-specific traits or attributes also play a major role in determining the success or failure of the business and how it unfolds over time (Frese & Gielnik, 2014). As the entrepreneur is involved in the business since its inception, their competencies are recognised as critical to entrepreneurial success (Mitchelmore & Rowley, 2010). Among such traits, the alertness and flexibility of the entrepreneur are considered prominent, and a mindful entrepreneur exhibits such attributes more than an individual with an inconsistent mindset. However, among many personality theories and famous trait approaches like the Big Five traits, the attention given to novel concepts like mindfulness is very minimal.

Moreover, entrepreneurs can avoid mistakes by inculcating mindfulness traits within them. Mistakes often occur due to a lack of clarity. When an individual is dealing with several different objectives at a time, his or her thoughts can cloud his or her ability to see things in a coherent way. The practise of mindfulness enables two parts of the brain to function smoothly, including our ability to develop and continue activities. So, the importance of undivided attention is emphasised as a mindfulness trait.

In the country, there are some studies in the literature that argue how low levels of mindfulness can spark entrepreneurial actions. According to Rerup (2005) and Gelderen et al. (2019), the cautious nature of mindfulness may refrain an individual from taking entrepreneurial action, especially when value creation and value appropriation associated with new venture creation are considered. According to Gelderen et al. (2019), even though individuals with low mindfulness tend to take more entrepreneurial actions, those with high mindfulness and experience are taking drastic steps when it is decided to start an enterprise. However, most of such studies are conceptual in nature, and the available empirical studies present controversial conclusions.

The table below summarises the key discussion themes of this review.

Sub theme	Contributing Authors	Key findings cited within the paper
Entrepreneurial Success	Kuruppuarachchi et al. (2017)	Entrepreneurial ventures play a key role in a country's economic and social development

	Fisher et al., (2014); Sivarajah and Achchuthan (2013)	Identified factors such as independence, escape from difficult employment situation, increased satisfaction, contribution to the community, flexibility of personal and family time, opportunities for growth and rewards as reasons for individuals to engage in entrepreneurial activities
	Fisher, et al., (2014); Rauch & Frese (2000)	Suggested the complexity of constructing a universal definition for entrepreneurial success due to its subjective nature. Therefore, it should be interpreted based on the indicators used
	Amith et al., (2000); Makhbul et al., (2011)	Objective determinants of entrepreneurship considered as easiest to measure
	Fisher, et al., (2014); Rauch & Frese (2000); Austin et al., (2006)	Definitions of entrepreneurial success are mostly dependent on individual perspectives
	Austin et al., (2006)	Determinants of social entrepreneurial success
	Brush (2008); Bonet (2011); Walske et al., (2016); Bandara (2016)	Management, psychological and social antecedents of entrepreneurial success
Mindfulness	Dane (2011)	Benefits of mindfulness at workplace

	Kabat-Zin (2003); Goldstein (2002)	Link between mindfulness and meditation and mindfulness as a teachable skill
	Dane (2011)	Categorization of definitions of mindfulness into Academic, Buddhist and medical practise
	Nyanaponika (1972)	Conceptualising mindfulness with its transcendental aspect
	Harvey (2000)	Mindfulness is the awareness of one's physical and mental phenomena
	Mesmer-Magnus et al., (2018); Brown & Ryan (2003); Giluk (2009); Glomb et al., (2011)	Trait mindfulness and its conceptualizations
	Dimidjian & Linehan (2003); Romer & Orsillo (2003); Bergomi et al., (2013)	Multidimensionality of mindfulness
Linking Mindfulness and entrepreneurial success	Baer et al., (2004); Emanuel et al., (2010); Fisher, et al., (2014); Jacabos (2016)	Relationship between facets of mindfulness with entrepreneurial opportunity identification and success
	Gelderen et al., (2019)	previous experience in business affects the relationship between mindfulness and tendency to take entrepreneurial actions
	Rerup (2005); Gelderen et al., (2019)	Low level of mindfulness and high entrepreneurial orientation
	Kelly & Dorain (2017); Tuan and Pham (2022)	Social Entrepreneurial Intention and mindfulness

	Afif (2018)	Mindfulness enhances work-life integration of entrepreneurs

Source: Developed by the Authors

CONCLUSION

Entrepreneurship is booming as an academic discipline as well as a prospective career choice for individuals. As much as it is challenging as a career, it is equally challenging as an area of academic inquiry. Entrepreneurship has a considerable research history where scholars have examined various aspects ranging from the conception of entrepreneurial ideas in the mind of an individual to the termination and aftermath of an entrepreneurial activity. There are studies available on the characteristics of entrepreneurs, motives that drive entrepreneurs, antecedents of entrepreneurial success and failure, strategies to manage entrepreneurial business, managing strategic social networks, etc. Even though these studies enormously contributed to the theoretical and empirical knowledge of entrepreneurship, the findings and conclusions made are increasingly becoming obsolete with the advent of new technologies, changes in political policies, changes in market and customer preferences, more provisions for entrepreneurial education, and continuously changing human behaviour. What one identifies as the motives behind entrepreneurial activity may not be the same in a few years' time. Hence, it demands continuous research in entrepreneurship, which can investigate many unexplored areas of the discipline (Tuan & Pham, 2022).

Even in the presence of research on various aspects of entrepreneurship, many small and medium enterprises are failing, while others struggle to survive in the market. This demands the necessity of novel angles to view entrepreneurial behaviour and the subsequent success of business activities. As per the extant literature, the psychology of the enterprise owner is one such critical factor, and the research attention given to such areas also remains inadequate.

This research effort is to identify the role of one such psychological factor, i.e., mindfulness, on the successful operation of entrepreneurial ventures. The use of mindfulness in disciplines other than medicine and clinical psychology was limited until recently. However, now it is emerging as an area of interest in the fields of management and other social science research as well. The concept of mindfulness emphasises the importance of being aware of the

present moment and acting non-judgmentally when encountered by internal and external stimuli.

Within the limited literature linking mindfulness and organisational behaviour, it can be conceptualised that the presence of mindfulness traits within organisational members can lead to improved work behaviours as well as enhanced organisational performance. When applied to the entrepreneurial context, the presence of mindfulness traits among business owners has been conceptualised as leading to perceived venture success. Entrepreneurs always embrace risks, and in an urge to build their business further, identifying and assessing the events in the external and internal environment is significant. Identifying reality as it is without any preoccupied mindset and being aware of the present moment carry a vast array of benefits that business owners may lose with the presence of mind wandering and stereotyped mentality.

There is no doubt that the entrepreneurial business environment is more complex than other structures. In such a context, mindfulness can improve productivity, awareness, opportunity-seeking, focus, positivity, character, and individual health and happiness. For a busy and vigilant entrepreneur, it is an essential and long-term practise that can benefit not only their work but also their lifestyle. Therefore, there is a high need for more studies covering entrepreneurs from diverse contexts, diverse samples, and diverse industries to explore further the applicability of the mindfulness concept and its related dimensions to foster entrepreneurial success.

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A Review of the Modern Methodological Approaches to Tracking Elephant Intrusion in Sri Lanka

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This review aims to address the prevailing issues of elephant intrusion and the subsequent Human Elephant Conflict (HEC) in Sri Lanka, particularly in villages where the seasonal concentration of elephants can be observed in agricultural and surrounding wetlands. The episodic gatherings of elephants in these specific areas are a serious concern due to the lack of integrated control measures. The incidents of elephant gatherings are increasing in rural villages, especially during the off-season of paddy cultivation or nearing the harvesting period, as well as during the blooming times of fresh grass in the riverbeds. These interactions with people along their range lead to the onset of HEC scenarios. If these elephant gatherings are left without solutions, it could pose a significant threat to the affected areas, settlements, and economic values, making them highly vulnerable. Therefore, this paper suggests a holistic approach that integrates modern techniques with a literature review to explore and assess existing methods and identify viable ones to control elephant intrusion and mitigate the impacts on the affected areas and Sri Lanka as a whole.

KEYWORDS: Elephant intrusion, human elephant conflict, seasonal concentration, holistic approach

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INTRODUCTION

Human Elephant Conflict (HEC) is defined as complex interactions between humans and elephants that result in negative effects on human social, economic, or cultural life and/or on elephant conservation and the environment (Parker et al., 2007). It is a situation in which elephants cause problems for people by damaging agriculture, settlements, and properties and threatening their lives in retaliation. Humans also react against elephants by considering them as elephant vermin, a term that denies society's understanding of the nature of wildlife, thereby allowing their killing and ultimately leading to HEC.

HEC cases have been documented in regions across Asia and Africa, presenting a critical issue that requires sustainable solutions. It has multifaceted impacts on human life, including mortality, crop raiding, and property damages. Additionally, it leads to the death of elephants due to poaching and killing for tusks (Anni and Sangaiah, 2015). In India, 100 elephants and 400 people die annually during conflicts, impacting around 500,000 families socioeconomically. Annually in Sri Lanka, over 70 people and around 200 elephants die during conflict incidents (Fernando and Pastorini, 2011; Shaffer et al., 2019). Between 2007 and 2011, there were 1,123 elephant deaths and 335 human deaths (Kuruwita, 2022), averaging 225 elephant and 67 human deaths per year. From 2012 to 2016, there were 1,169 elephant deaths and 361 human deaths recorded due to HEC. According to Prakash et al. (2020), around 405 elephant deaths were reported in Sri Lanka in 2019, along with around 121 human lives lost in the same year. Based on the 2022 Environmental Statistics in Sri Lanka, an average of 134 elephant and 60 human deaths occurs each year. It is evident that human-to-elephant deaths are occurring and increasing due to HEC in a roughly 1:3 ratio. Most of the elephants live outside protected areas, where the land has been converted to agriculture, restricting their access to water and other resources as well as their movement through traditional corridors. Furthermore, during the dry season, elephants intrude into human settlements in search of water resources (Anni and Sangaiah, 2015). Deforestation, habitat fragmentation (Thennakoon et al., 2017), and agricultural expansion in Sri Lanka have contributed to the loss of forest habitats for wild elephants (Dombois, 1972). Asian Elephants *(Elephas maximus)* mostly prefer lower visibility habitats to avoid humans due to the prevailing conflict (Pastorini et al., 2015; Prakash et al., 2020). The massive agricultural development projects under the Mahaweli Development Scheme

in the past four decades in the dry zone of Sri Lanka have significantly increased habitat fragmentation and HEC incidents (Fernando et al., 2005).

Asian and African countries experience food shortages and displacement due to crop-raiding activity and the exploitation of elephants in slash-and-burn agricultural fields (Ville, 1995; Nelson et al., 2003). As the elephant population increases, habitat loss leads to elephants exploiting farmland due to food shortages in the wild. According to Fernando et al. (2021), elephants and people co-occur in approximately 70% of the current elephant range in Sri Lanka, and HEC arises in almost all areas where they intersect. However, the majority of HEC incidents have been reported in proximity to protected areas within a 5 km radius of a protected area (Rathnayake et al., 2022).

Historically, in Sri Lanka, the wet zone contained numerous elephants. During the colonial period from 1505 to 1948, the wet zone was converted into fields of commercial crops such as tea, coffee, rubber, and coconut, which led to elephants being considered vermin, and many of them were shot dead which resulted in their elimination from the wet zone (Jayewardene, 1994). Consequently, the elephants moved towards the dry zone, where their population and density increased due to the presence of numerous abandoned reservoirs that provided water sources (Fernando et al., 2011).

Several districts in Sri Lanka experience HEC cases, mostly in areas where agricultural lands are abundant. Significantly, elephants are living in eastern, northern, northwestern, southern, northcentral, and Uva provinces in the lowlands (Gunawansa et al., 2023). The availability of food determines the seasonal gatherings of elephants. Elephants prefer grass, and during the dry season, fresh grass grows in the riverbeds (Karunatilaka et al., 2021), leading them to travel long distances in herds.

In this context, the review aims to discuss the application of modern techniques that can be employed to manage HEC cases, minimise the loss of lives (human and elephant), minimise property damages, and maintain sustainable agriculture in Sri Lanka.

Contextual Methods

The main goal of this paper is to articulate modern and applicable methods, considering the context of various research studies implemented in other countries or partially in Sri Lanka. The prevailing issue of elephant gatherings in human settlement areas for crop raiding needs to be curbed in a holistic

and integrated manner. The review has been designed as an approach to managing the HEC in Sri Lanka, suggesting several modern techniques to be used in different contexts. Accordingly, it aims to find a solution for the prevailing concentration of elephants in rural areas, considering the future consequences both for the human environment and the elephant population, which are the royal symbols in Sri Lanka (Köpke et al., 2021). Finding a solution to the Elephants' intrusion and HEC in Sri Lanka is a challenging task that needs a long period of institutional engagement. However, the implementation of a holistic and integrated approach to address and find solutions to such problems is happening slowly or hardly at all mainly because of negligence. Many state-of-the-art techniques and methods that have mostly been used in various areas and countries have been discussed in the paper, and out of these, viable and modern methods have been discussed to provide insights regarding their viability. The prime expectation of the paper is to find a sustainable solution to the prevailing imminent hazard in the affected area through an integrated approach since agriculture is a major livelihood in several parts of Sri Lanka.

LITERATURE REVIEW

As humans and wildlife, particularly elephants, increasingly share land resources, competition arises. As the elephants' natural habitat shrinks, they are progressively compelled to confront humans, which results in severe damage to people and elephants alike (Shaffer et al., 2019). The major factors for declining wildlife are loss of habitats, land use changes, land ownership changes, and the growth of the human population (Kioko and Seno, 2011; Rathnayake et al., 2022). Many countries where the HEC prevails follow a few methods through which the targeted objectives cannot be achieved because of inefficiency, and they are futile methods to do so. HEC is connected with the behavioural changes of elephants and humans. It is important to compromise the HEC while understanding the behaviours of elephants when chasing or escaping humans from their territory. Many human lethal cases have occurred without any basic understanding of the elephants' behaviour. Also, as humans encounter the elephants without any understanding of their behaviours, the conflict becomes a serious situation where the losses are uncountable for both sides.

When the elephants enter with human-dominated areas, particularly agricultural and settlement areas, they are chased away by numerous methods. According to Fernando et al. (2011), farmers shoot them with

handmade guns to protect the crops and use hakkapatas, which are small exploding mines hidden in vegetables and fruits that harm the jaws of the elephants when biting (LaDue et al., 2021). It should be highlighted that many elephant deaths have occurred in several regions of Sri Lanka. According to the BBC (2019), in the year 2019, around seven elephants were killed due to suspected poisoning, and one elephant in that herd was pregnant, resulting in the death of the fetus as well.

The idea of constructing electric fences is also lethal to elephants and humans when it is used illegally or indiscriminately. In two ways, the electrocution cases occur that lead to the deaths of the elephants; one factor is when the electric wires sag and electrocute, and the second factor is the illegally formed high-power fences, which are immediately fatal (Kalam et al., 2018). The illegal electric fences erected by villagers near the forest and farmlands or to protect the settlement by farmers and/or villagers are fatal for the elephants. The elephants are trapped by such electric fences, causing death, and such illegal electric fences should be eradicated (Gunarathne and Premarathne, 2006) with the proper monitoring system by the respective authorities.

Every year, Sri Lanka loses a significant number of elephants due to electrocution caused by illegally erected substandard electric fences (Daily News, 2022). Also, in a couple of months in the year 2021, out of 100 elephant deaths recorded, 21 were from electrocution. There is no way to increase the number of electric fences, which are illegally formed and hooked up with the electric lines indiscriminately. Consequently, illegal set-up of electric fences causes fatal incidents for humans as well (Mongabay, 2021). Many people have so far been accidentally electrocuted by illegally formed electric fences that were indeed set up for the elephants. Measures are pivotal to monitor the elephants that are outside of the protected areas to curb the existing HEC (Compos et al., 2009).

Loss of Traditional Corridors and Consequences

The extirpation or partial loss of the elephants' corridor is a serious concern that should be discussed. Since there is fragmentation occurring in their traditional corridors, the consequences are dire for the HEC. The fragmentation of the protected areas has the potential to cause adversarial impacts on the animals, which tend to range for a long time and a long distance (Adams et al., 2016). The developmental activities in many countries pose threats to the traditional corridors through which elephants used to roam. According to Chakraborty and Paul (2021), the existence of the broad railway

through the elephants' habitat is a major inducing factor for HEC in West Bengal, India. Also, Sri Lanka is placed first in the row of deforestation in Asia (LaDue et al., 2021), destroying or fragmenting numerous traditional wildlife corridors that connect to the protected areas.

The elephants have broad home ranges within which they can move a long distance in a single day (Pan et al., 2009). Also, they tend to move to various habitats at different times (Kioko and Seno, 2011). Human-influenced changes in the physical environment have the potential to make the HEC (LaDue et al., 2021). The destruction of their traditional wildlife corridors due to developmental activities such as highway expansion affects the elephants seriously (Joshi and Singh, 2007). They tend to select another route that is not familiar to them, leading to the aggressive behavior of elephants, perhaps if the route is connected to agricultural lands (Kangwana, 1995; Nelson et al., 2003). The traditional corridors should be renovated or linked with the protected areas through corridors whereby the elephants can safely move within their ranges (Kikoti, 2010).

It is evident that the postwar development process, *viz*., major irrigation projects, has resulted in many habitat losses for the elephants. Also, agriculture for commercial purposes by the state and private corporations for fruits and sugarcane production and the encroachment activities of humans into the forest lead to the fragmentation of the elephants' habitat and resulting HEC (Fernando et al., 2011). Sustainable solutions are needed to protect the elephants living outside the protected areas. As the elephant population increases, the existing corridors are insufficient for them to move. Thus, it is important to identify corridors (Liyanage, 2012) that have not been declared yet to mitigate HEC.

Fernando et al. (2005) recognised that the protected area provided elephants with a refuge and food during the rainy season when the single annual crop was grown. During the dry season, elephants moved into slash-and-burn areas and utilised leftover crops and pioneer vegetation in fallow fields. Large, protected areas with traditional slash-burned agriculture practices facilitated co-existence, whereas monoculture agriculture practices led to year-round conflict. The study suggested that areas managed according to traditional land use practices should be part of an elephant conservation strategy where people and elephants must share resources.

Seasonal Gathering of Elephants

Understanding why elephants select specific times for crop raiding (Santiapillai and Read, 2010) and concentrate in particular locations after spending months in a particular area is crucial. Several factors influence the elephants' choices, including the availability of forage, water resources, vegetation, and topographic features of the land (Verdade et al., 2014; Garstang et al., 2014; Karunatilaka et al., 2021). In the past, people predicted rainfall when elephants appeared at the end of the dry season in Kenya, and in India, the advent of elephants was believed to bring monsoonal rainfall (Garstang et al., 2014). During the dry season, elephants tend to gather for food in areas where fresh grasses grow due to water released from reservoirs for irrigation and power generation (Karunathilaka et al., 2021). These seasonal gatherings at reservoir-bed grasslands involve various activities such as roaming, playing, fighting, and raiding. Additionally, when crossing main roads, elephants display alert behaviour to cross safely. One of the most significant seasonal gatherings takes place in Minneriya, where around 400 elephants gather (Karunatilaka et al., 2021).

Elephants at the Dumping Sites

Improper waste management poses a major environmental issue and threatens wildlife in their day-to-day lives. Many wild animals and birds mistake waste, plastic, and polythene for food, leading to health issues and mortalities among these species. Elephants, too, scavenge and rummage through waste at dumping sites in search of food. The dumping sites contain a variety of waste from different sources, providing a high-nutrition food source for elephants. Relative to their body size, elephants require a large quantity of food, consuming 150 kg to 300 kg of food while spending around 18 hours a day feeding (Liyanage et al., 2021).

Due to the improper waste management system, landfilling, combustion of waste materials, and lack of environmental awareness, protected areas for Asian elephants are under threat (Puri et al., 2020). Sri Lanka is no exception, as elephants are known to consume garbage in many parts of the country, including the Pallakadu area and Oluvil. Elephants scavenging at dumping sites tend to consume polythene materials, leading to several deaths, and food poisoning has also been identified as another cause of mortality among elephants rummaging at dumping sites (Mongabay, 2022).

However, it is important to note that according to Liyanage et al. (2021), the consumption of garbage is not a significant health problem for elephants. While elephants do spend some time at dumping sites, garbage consumption is not their primary activity. Nevertheless, incidents of toxic or food poisoning cases resulting from garbage consumption need to be identified through necropsies (The Morning, 2019).

Traditional and Modern Methods to Detect Elephant Intrusion

Various methods are employed to divert elephant intrusion and protect agriculture and settlements. These methods include igniting fires, drumming techniques, beehives, chili fencing, electric fencing, and early warning systems using different technologies (Hahn et al., 2017; Karidozo and Osborn, 2015). Electric fences are commonly used globally to control elephant intrusion; however, systematic operation is needed to make them more effective (Liyanage, 2012).

The existing electric fences are not entirely efficient, as elephants still intrude through them. Proper planning mechanisms should be considered when erecting electric fences, including ecological boundaries rather than administrative boundaries. Moreover, proper maintenance is crucial to ensure the efficacy of the electric fencing system (Global Wildlife Programme, 2017).

As modern techniques, satellite telemetry can form an early warning system to alert people, GPS tracking (Pastorini et al., 2015) allows monitoring elephant movement, seismic sensors accurately detect elephant movement where GPS trackers may not have access, hovering drones provide surveillance (Hahn et al., 2017), and counting the number of elephants are used in many countries.

Automatic early warning systems with infrared technology (Sugumar and Jayaparvathy, 2014; Rathnayaka et al., 2020; Chakrabort and Paul, 2021) are also commonly used. Unmanned aerial vehicles are employed to observe elephants' movements, providing real-time data (Hartmann et al., 2021). Satellite images combined with artificial intelligence are efficient for surveying and counting elephants, preventing double counting of the same elephants (Hahn et al., 2017; Livescience, 2021; The Hindu, 2021).

In summary, the issues of elephant intrusion and HEC cases continue to increase due to insufficient preventative measures. The existing techniques and methods are not fully effective, as reflected in the literature. Given the

significance of elephants in agriculture and socioeconomics, strategic conservation measures are necessary to protect and preserve these magnificent animals.

RESULTS AND DISCUSSION

In the Sri Lankan context, the major source of income for the villagers is agriculture. At the same time, elephant intrusion during the post-harvesting period is rife, where the reflection of human activities lowers and elephants directly intrude on the targeted places. Consequently, the socio-economic well-being of the people is under threat. Earlier, there was an issue with a few elephants or a single elephant's intrusion into villages or agricultural lands. Presently, the seasonal gathering of the elephants as a herd (more than 100) has several ramifications for the settlement area, agriculture, and even urban areas.

According to Karunarathne et al. (2021), a household survey in Ekgaloya in Ampara District indicated that 17% of Paddy *(Oryza sativa)* and 15% of Maize *(Zea mays)* were lost due to crop raiding within the cropping season. Whenever the elephants intrude on the agricultural fields and surrounding wetlands, there are several possibilities for accidental confrontation with humans, which leads to the HEC and causes deaths and injuries to humans and elephants. During the post-harvesting period, the ranging and gathering of more than 200 elephants, according to locals, takes place in paddy lands and surrounding wetlands in Nintavur and nearby villages. The gathering of the elephants lasts for over a month, which is an attractive scene along the areas where a part of the A4 road, i.e., the Colombo-Batticaloa highway, crosses from Akkaraipattu to Kalmunai.

There is a growing concern about the seasonal gathering of the herd of elephants in the Nintavur area because perhaps any incident, intending to disperse them or if they are provoked, would have an unimaginable result, particularly because the people would be endangered due to the elephants' attacks, and on the other hand, the elephants would also be threatened due to the retaliation of the people, which would finally result in the loss of elephants, where only around 5,879 elephants exist in Sri Lanka (öpkeetpkeet, 2021).

It is a tricky matter to consider that since a couple of years ago, the elephants' concentration has been on the rise in the particular area, and the reason why they gather and from where they travel should be investigated to control their

intrusion in a mindful manner. Diverting the elephants or driving them to another place is a challenging and life-threatening hazard because when they get angry, the result would be serious. Still, during the gathering period, several youths try to provoke the elephants because of their irritation and exasperation. The elephants chase them, which perhaps leads to the conflict. According to the locals of the area, during the gathering of elephants, the nighttime travels for emergency purposes, transportation from one place to another via the nearby roads, and the settlements close to the elephant's concentration point are challenging. Some of the individual elephants that are veering from the herd tend to roam the nearby villages, which is a major threat to the people living there.

It is also evident that in the range of the elephant, there are many local dumping sites, particularly in Kalmunai wetland areas and Nintavur, with the major dumping site being located in the Pallakadu Oluvil area. People reportedly say that the elephants come to find garbage in the areas, but there is no clear-cut evidence for this since they come to concentrate in nearby Nintavur. It is vital to know the movement of elephants when they move, why they move, and from where they move to successfully conserve and manage them and to minimise HEC cases (Bohrer et al., 2014). According to a study by Prakash et al. (2020) study, 479 HEC incidents have been reported in Ampara District from 2010 to 2019.

Dumping sites attract elephants when they range along their trails. At the Pallakadu dumping site, located in Ampara District, more than 10 elephants can be seen daily scavenging the garbage. Elephants tend to consume garbage (Liyanage et al., 2021) and according to the Voice of America (2022), since the last eight years, around 20 elephants have died consuming waste, including plastics (polythene), in the Pallakadu area of Oluvil. However, there is another counterargument by Liyanage et al. (2021) that feeding garbage to elephants in the Uddakandara garbage dump in southern Sri Lanka showed that elephants feeding on garbage had better body condition than non-garbage consuming elephants, indicating that garbage provides better nutrition than fruits and vegetables, which should be deeply investigated. It is important to identify whether the concentrating elephants in Nintavur area mingle or interact with the elephants in Pallakadu area in Oluvil or whether they are permanently occupying elephants at the dumping site. If they are permanently occupying elephants, it should be found out how the gathering elephants move along the dumping site area and how they behave with the already existing elephants in the dumping site.

Figure 1 shows the dumpsite in Pallakadu, Oluvil, in Ampara District. It is a pathetic situation where the treasure trove of the country is left to consume waste without any consideration, knowing the dangers of waste consumption. As shown in Figure 2, a wild elephant has died in an open landfill in Pallakkadu village in Ampara District. Thus, an integrated approach is a must to control the elephants' intrusion and HEC since many of the traditional corridors of the elephants have been modified due to human activities. Before the imminent issues arise in the areas of Sri Lanka where elephant seasonal gathering and intrusion occur, it is indeed needed to control them in a tackling manner. To do so, the tracking of elephants is important using GPS technology, which can give real-time monitoring of the elephants' movements and routes, with which the entire route of the elephant can be identified.

Figure 1: Pallakadu dump site, Oluvil area

Source: Voice of America, 2022

Figure 2: Dead Elephant in Pallakadu area, Oluvil

Source: Arab News, 2022

There is a vital need to conserve elephants as well as the socio-economic condition and lives of the people in Sri Lanka in a tackling manner. During the raids of the elephants, numerous varieties of crops such as banana, rice, corn, coconut, and home gardens consisting of fruits and vegetables (Köpke et al., 2021) were affected or destroyed completely. In the Ampara District, particularly in the coastal villages, agriculture is one of the major socio-economic sources of the people. However, the recent elephant gathering incidents harm the socio-economic system and the security of the inhabitants. A holistic approach is needed to minimise the present HEC incidents and future possible impacts mentioned earlier. The elephant's tracking is the utmost task to be done to pinpoint the movement of the elephants along the areas.

Tracking the Elephants' Movement

It is vital to find the source of the location in which the elephants come and concentrate in a particular area with the view to knowing the exact factors affecting the recent peak of the gathering of elephants. GPS (Global Positioning System) collars are the best method to track elephants' movements (Pastorini et al., 2015; Rajalakshmi et al., 2021). The GPS collaring process can be done for a few elephants from the gathering to track their real-time movement with the support of respective organisations, *viz.,* the Department of Wildlife Conservation, and the Forest Department. The GPS tracker SIM would give the movement data of the elephants all the way.

Also, the system is nowadays commonplace, whereby the movements of other wild animals and birds are also tracked (Allan et al., 2013).

Based on the tracking of the elephants, it can be found from where the elephants move, where their traditional corridor has been affected, and at which point the diversion of the elephants happens. Then, we can analyse the problems with the field visits to investigate what happened to their traditional corridors, why they ranged along the route, and what happened to the electric fences to control them.

Having identified the track of the elephants, early warning systems with modern technology and novel methods, which have been discussed below, can be applied to alert the area to the elephants' intrusion. Once the intrusion is known, the people will be aware of the alert messages and announcements to the villagers who are in the paddy field or perhaps heading to the hazardous zone. Generally, in Sri Lanka, the integrated and holistic approach to elephant intrusion to minimise HEC cases is lacking, as already discussed. In the HEC regions, the integrated ways to find elephants' intrusion and to control the HEC could be adopted as an exemplary method with the following state-of-the-art technology and the support of state and international agencies that are keen to support such purposes, particularly for socio-economic enhancement of society.

One of the existing methods to control elephants' intrusion is electric fences, which alone cannot control the elephant intrusions (Gunaratne and Premarathne, 2006; Nadeeshani and Perera, 2021), and it can be understood that the use of electric fences to control the elephant intrusions is not applicable since they are crossing over agricultural lands. Even for erecting electric fences, the source of the location from which the herd comes should be understood.

Also, the geofence biotelemetry system is a cutting-edge and novel technique to solve HEC. Coupling web-mobile applications and geofencing techniques is useful to detect the elephants' intrusion in HEC alert areas (Rajapaksa et al., 2022). The geofencing prototype model was tested in Udawalawe National Park in Sri Lanka to control the HEC and protect the elephants. Elephant movement and their home range can be detected using the biotelemetry system and unmanned aerial vehicle surveys, which are useful to delineate virtual boundaries in vulnerable areas.

Unmanned Aerial Vehicles (UAV) are nowadays used to study in many sectors. To monitor the elephant intrusions in the hard-to-reach areas, drone-based observation is performed. When the elephants raid from forest to agricultural lands, it is difficult for them to monitor until they reach proximity to human settlements. Using drones, they can be monitored from remote areas in order to instruct people to be alert and cope with the situation. Also, during the night, rough elephant hideouts can be detected using thermal cameras fixed on the drones. Also, satellite-based monitoring helps to detect the periodic movement of the elephants, which can be identified after analysing the satellite images (Gunawansa et al., 2023).

Early Warning Systems in Elephant Corridors

Modern technological instruments can be applied to mostly all sectors for observation, monitoring, management, and historic analysis. Likewise, globally, several technological inventions have been applied to control elephant intrusion and HEC too. The loss of crops, property, and human lives has so far been reported, mostly due to the sudden confrontation of elephants in agricultural and settlement areas. This situation can also be controlled using the early warning system in potential locations. In a few locations, the early warning systems are in practice, which is also challenging. According to Sugumar and Jayaparvathy (2014), it is recommended to form an early warning system along the areas where the elephants' intrusion happens, and for that, an algorithm-based elephant intrusion detection system can be used whereby the elephants' intrusion happens in a particular corridor.

Many researchers have introduced modern techniques to find the elephant intrusions in advance, to take immediate action, and to alert the people. eCameras and remotely functioning instruments and sensors are the best tools to transfer data from the source to the receiver, with which information can be obtained from faraway places. According to Sugumar and Jayaparvathy, (2014), with the use of cameras mounted on trees or towers, images can be captured of intruding elephants, which are then sent to the base station via a radio frequency (RF) network. The images can be processed on the computer at the base station and compared with the stored database. Every five (05) seconds, a snapshot can be taken and compared with the database. Then, once the images match, via the global system for mobile communication (GSM) connected with the computer, send a short message service (SMS) to the officials to alert them. The method can be

applied in the Sri Lankan context, particularly in areas where seasonal elephant intrusion takes place, with the view to minimising the impacts.

Rathnayaka et al. (2020) also developed elephant intrusion detection with IR (infra-red) beam detectors (100m) and Passive infrared (PIR) sensors (12m), deterrence; with speakers and mp3s of bee buzzing sounds to chase or threaten the elephants before intrusion and alerting with signal lights for wireless communication in the range of 1 km with the alert SMS with Google Maps and an online database and warning system. It can also be applied in places where the elephants have the potential to intrude, particularly in the corridors. This holistic approach for elephants' intrusion detection, deterrence, and warming system is an astonishing method in Sri Lanka, which is indeed a need in the locations where HEC is rife.

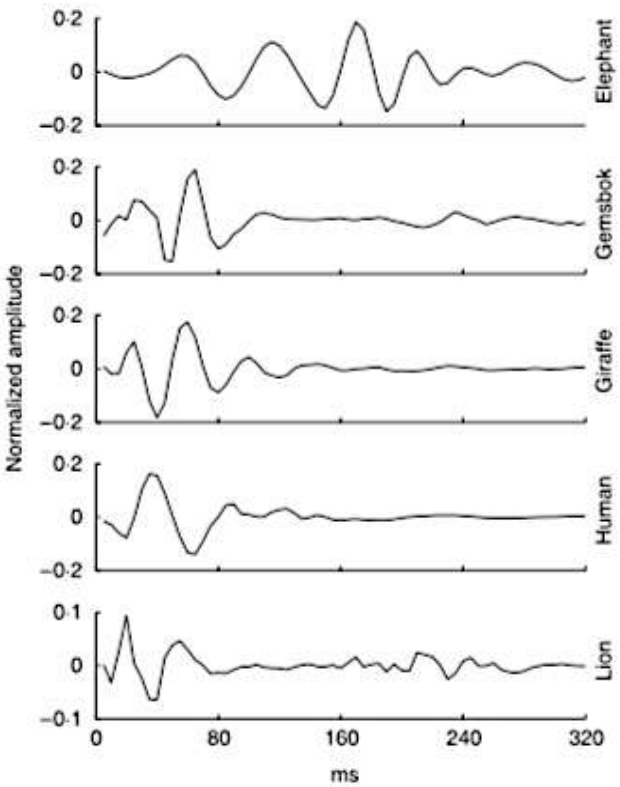
Seismic Sensors Application to Recognise the Elephants' Movement

Detecting elephants' movements with seismic waves is a more advanced method used in many countries. The large herd of elephants' intrusion should be carefully traced for precautionary activities and to minimise the impacts. Since the elephant's movement happens in thick forest areas where perhaps the signal for the GPS is inaccessible, seismic waves are a suitable method to detect the movement. If the movement is understood at an early stage within a forest area, then diverting or dispersing them without concentrating on their destination is a handy task to minimise the impact. For this process, the early stages of the elephant's movements should be detected and known. Wood et al. (2005) have conducted research based on the seismic waves to detect the animal's movement, within which they have distinguished the elephant's movement.

Seismic waves have the potential to pass through solid materials (University of Oxford, 2021). Historically, the geophone sensor system has been used for many purposes. During the Vietnam War, the United States military used geophone sensors to detect the troops and the movement of vehicles (Wood et al., 2005). Nowadays, seismic sensors are widely used to find the elephants' movements with the view of detecting the elephants' intrusion and to control HEC within the forest-settlement borders. According to Wood et al. (2005), seismic sensors were used to find the elephants' movements after comparatively studying the spectral differences of some selected species, *viz.,* lion, giraffe, Gemsbok, elephants, and including humans (Fig. 3). For this, a single 4.5 Hz geophone (vertical) was placed into the ground at around 1 m depth. Then, a preamplifier was used to enhance the recording and to

convert the signal from analogue to digital, a sound card was used. Consequently, it was recorded on a laptop with the Cool Edit Pro Software. Front footfalls were considered since rear footfalls have lower amplitudes. Then, the footfalls were uploaded to the Matlab software to create a power spectrum plot for each footfall with the Fast Fourier Transform. After processing, they have differentiated the species and the individuals with the integrated systems within which the elephant's footfall mostly differed from the other animals' spectral signature. Figure 3 shows the spectral variation of the selected animals (Wood et al., 2005), whereby the elephant's spectral signature can easily be understood compared to other animals. Therefore, the movement of the Elephants in the forest areas can be traced with the view of alerting and warning the people in advance, and if possible, they can be diverted within the forest environment with possible actions before they begin to intrude into unprotected areas.

Figure 3: Spectral differences within species



Source: Wood et al., 2005

Having tracked the route of the elephant and the location where tracking is impossible due to signal weakness and thick forest corridors where early warning systems cannot work, the seismic sensor method can be applicable in a place where the herds of elephants roam for a long distance.

CONCLUSION

Elephant intrusion and consequent HEC are escalating issues in Sri Lanka, particularly in the villages where agricultural land expands towards their traditional corridors. It is crucial to acknowledge that agriculture is the major socio-economic activity of the people in the villages, which must be safeguarded to meet their needs. Additionally, it is essential to protect the elephants. This necessitates a thorough investigation to trace the source-land of the intruding elephants, understand why they come along the areas and gather or concentrate in specific places, and determine what happened to their traditional corridors, all through a holistic approach. Various methods have been explored to find the source of the elephants' gathering and modern techniques to detect and control their intrusion to minimize HEC.

Furthermore, it is imperative to educate people about the behavioural changes of elephants when they encounter or confront humans. Many HEC cases have occurred without an understanding of the elephants' behaviour. As elephants are a vital resource that interacts with the human environment, especially outside of protected areas, raising awareness about elephant behaviour from the grassroots level is necessary. This can be achieved through community engagement, stakeholder participation, and institutional support, which can be applied to cases involving concentrating elephants in specific areas to mitigate potential threats and dangers.

In conclusion, a holistic approach is required to address HEC cases in Sri Lanka, considering that agriculture is a major livelihood. The review suggests several modern techniques that can be applied in different parts of Sri Lanka in a viable manner since relying on a single method to control elephant intrusion and manage HEC cases is not efficient and effective. For instance, in canopy areas where detecting elephant movements using GPS or aerial views is difficult, seismic sensors prove to be more effective. Similarly, geofences are more practical than physical electric fences, as the latter can be inefficient in various parts of Sri Lanka due to the intricate movement of elephants and fragmentation.

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Economics: In Search of Relevance and Excellence in University Teaching in Sri Lanka

By S.R.S.D. K. WEERAWANSA & T.U HEWAGE

This is an essay on Chapter 4, 'Economics: In Search of Relevance and Excellence in University Teaching, of the book "*Beyond Boundaries: One Hundred Years of Humanities and Social Sciences in Sri Lankan Universities; Volume II: Social Sciences* / Premakumara de Silva. [et al.] University Grants Commission, Government Press, Colombo: 2021, 282 pp. (ISBN 978-624-5980-02-4)" reviewed as a commentary on the evolution of tertiary-level Economics Education under the umbrella of Social Science Education in Sri Lanka. This essay will provide an in-depth and holistic analysis of the content of Chapter 4, highlighting the interconnectedness of most of the disciplines in the social sciences. The chapter attempts to blend the historical orientation of economics with contemporary historical, philosophical, and political developments by taking the reader back in time through the Evolution of Economics teaching in Sri Lanka from university college days to what it is today. It is not unreasonable to conclude that the socio-political culture of the country, together with a lack of knowledge about basic economics, among other things, have been instrumental in leading Sri Lanka to its present predicament. Therefore, understanding and analysing the evolutionary process of economic education has never been more important for Sri Lanka, especially if the country is determined to avoid repeating the same mistakes in the future.

KEYWORDS: Social Sciences, Sri Lanka, Universities, Economics, Education, Political Science

DISCUSSION

Gary Becker, Nobel Prize winner for Economics in 1992, dedicated his time to researching the economic aspects of various social issues such as education, crime and punishment, and family relations. He introduced the concept of "human capital" in 1964 in his book by the same name, where he views education not as a form of consumption that represents a costly expenditure for government but as an investment that improves the economic

worth of individuals (e.g., human capital) and thereby raises the country's overall productivity and economic competitiveness. Though there has been a continuous effort to strengthen STEM (science, technology, engineering, and mathematics) education, specifically over the last two decades, educators all over the world agree that a complementary effort to strengthen humanities and social sciences education is equally important, if not more important (American Academy of Arts and Sciences, 2013). In a world where the physical and mental satisfactions of human beings are directly affected by economic, military, ecological, religious, and technological challenges, the extraordinary promise of being knowledgeable on all fronts of the Humanities and Social Sciences cannot be overemphasised (Mapping the Future, 2013). Faced with the unenviable task of preparing the next generation of citizens to be educated in the broadest possible sense so that they can participate in their own governance and engage efficiently and productively with the rest of the world, it is very timely that the University Grants Commission embarked on this massive task of summarising and analysing the hundred-year history of the evolution of humanities and social science education in Sri Lankan universities.

This review focuses on Chapter 4, 'Economics: In Search of Relevance and Excellence in University Teaching', of '*Beyond Boundaries: One Hundred Years of Humanities and Social Sciences in Sri Lankan Universities; Volume II: Social Sciences'*, as a narrative of the evolution of Economic Education within the Sri Lankan university system. Thoughtfully chosen quotes by Mahatma Gandhi, Judith Butler, and Gunapala Malalasekara in the introductory chapter appropriately set the tone for the rest of the chapters, arousing the curiosity of the reader to find out the way social sciences would essentially connect the three ideologies. Though Volume II covers the disciplines of Social Sciences, the simple description of the difference between the two sets of disciplines the world has come to accept under Humanities and Social Sciences seems appropriate since the introduction covers the Hundred Years of Humanities and Social Sciences in Sri Lankan Universities as a wholesome evolution. It is especially commendable that the discussion is not only about the achievements but also about the setbacks and the relevance and legitimacy of the questions such as the quality of the graduates, the quality assurance of study programmes, and most importantly, the employability of the graduates with degrees in the Humanities and Social sciences. Concluding the introduction with a self-evaluation about the UGC itself, the policymakers in general, and the academic community not being

serious enough in making a legitimate effort to bring sustainable solutions to improving the Research and Development (R&D) culture and the employability of the graduates in these disciplines could certainly be appreciated as an unbiased self-criticism.

The transition from Geography in Chapter 3 of the book to Economics in Chapter 4 seems to have taken a natural path, showing the interconnectedness of the two disciplines from the early days since human survival depended on "accurate knowledge of places, the probable locations of enemies, edible plants, water, and cave home sites''. The explanation about the change in humans' geographic perspective due to surplus farm production, where field boundaries, city lines, market centres, and communication routes had to be defined, fits well with the explanation Adam Smith provides in "*An Inquiry into the Nature and Causes of the Wealth of Nations*" as follows: "As soon as the land of any country has all become private property, the landlords, like all other men, love to reap where they have never sown, and so demand a rent even for its natural produce" (Smith 1976a: 56). Known as the "Queen of Social Sciences," Economics is the focal discipline of Chapter 4 by renowned Economist Prof. W. D. Lakshman. The importance of Economics, which has become an interdisciplinary subject in many faculties dealing with Social Sciences, is recognised by every human being since we are all practising economists. This chapter tries to blend the historical orientation of economics with contemporary historical, philosophical, and political developments by taking the reader back in time through the evolution of Economics teaching in Sri Lanka from university college days to what it is today.

Though the transformation of Economics taught in English to *svabhāṣā* (people's own language) in the 1970s was a challenge due to the dearth of teaching material in *svabhāṣā*, the challenge was overcome as a result of the commitment of many Economists who were committed to filling the vacuum. As a result, the number of students who opted for Economics soared, and graduates with degrees in Economics showed greater success in securing better jobs than those who specialised in other disciplines, mainly due to the value placed on the degree programmes in economics by the changing dynamics of the socio-economic and political landscape of the country and around the world as well.

Merriam-Webster Dictionary defines "Economics" as "a social science concerned chiefly with the description and analysis of the production,

distribution, and consumption of goods and services" while Adam Smith (1776) defined it as “An Inquiry into the Nature and Causes of the Wealth of Nations”. The Online Etymology Dictionary shows that the origin of the word “economy” can be traced back to the Greek word “Oikonomia" which means “Household Management” and therefore “economics” would mean the “knowledge and principles of household management”. The economic philosophy of the Hebrews dating back to about 2500 BC did not consider any economic problem without connecting the dots with the existing philosophical, ethical, and political framework at the time. The brief description of the transformation from the colonial era to the beginning of the free education system in the country and the evolution of university-level economic education through a multi-disciplinary framework to a monolithic specialty as we have come to accept it today is an intriguing journey for the reader to have their receptors open for the rest of the chapter. The Author goes on to say that “The interdisciplinarity in Economics teaching at these early stages enabled students to gain a more broad-based knowledge of Economics as a Social Science discipline. In a philosophical sense, the study of Economics internationally has moved away from the perception of it being a Social and Behavioural Science.”

Explaining the mismatch between the graduates and the job market in Sri Lanka, the author states that the youth insurrection in 1971 was because the educated youth were against the higher education system of the country as it did not make the youth eligible for worthwhile employment after graduation. Subsequently, specialisation options were motivated by the widely discussed contemporary issue of making the degree more employment oriented. In the process, many subject areas were added to suit market demand. However, the author does not agree with the objective of making graduates able to find remunerative employment soon after graduation, as it has proven to be elusive, even after a series of curriculum reforms extending over several decades. The author is of the view that the issue involved went beyond university curriculum reform and extended into the performance of the overall economy of the country as well as various other factors influencing labour market movements. The appropriateness of such a view was proven by Sri Lankans when they demonstrated their dissatisfaction and disagreement, through the ‘Aragalaya’ or ‘struggle of the people’, with the decisions of the rulers of the country that brought the economy of the country down to unprecedented levels by the year 2022.

Systematic analysis of global transformations affecting international markets, international trade and payment systems, relationships between nations, foreign exchange rate regimes, and wars in different regions of the world and their impact on the Sri Lankan economy and economic education under several sub-themes makes it much easier for the reader to grasp the interconnectedness of almost all the disciplines of the social sciences. Economists, in general, agree that using mathematics and statistics as and when needed with the proper intentions is both necessary and helpful. The use of mathematics in this context is seen not only in economics but also in almost all other disciplines, irrespective of their categorization as being in the physical or social sciences. Disciplines coming under the physical sciences usually welcome mathematization with open arms, with the feeling of welcoming a long-lost family member who is back to help them out in a difficult situation. But the concern about the overuse of mathematical theories in economics, sometimes even overriding the inapplicable and unrealistic nature of outcomes, is what created opposition to the mathematization of economics. This overreliance on mathematics may have contributed to economic disasters around the world over the years, including the failure to predict international financial crises in time to make relevant players aware of the imminent dangers. No matter how beautiful the mathematical theories look and how smoothly the models work in a perfect environment defined by the variables included in the model and subject to the assumptions made, there is a very good chance that they will not work in real life since it is impossible to formulate human actions. The narrative of the evolution of the system in general and economic education in particular over the last one hundred years, about half of which is through the author's own intellectual journey from his undergraduate days all the way to becoming a senior professor in Economics and the Vice Chancellor of the University of Colombo, provides a holistic view about not just economics but the progression of social science education within the system of Sri Lankan universities.

DIVERSITY AND INCLUSIVITY OF SOCIAL SCIENCES

The intimate connection between the two disciplines of Geography and Economics and with Sociology, Social Anthropology, Political Science and Public Policy (Park,1921) could easily be viewed through this one-hundred-year evolutionary process of Social Sciences in Sri Lankan universities if the reader focuses on Chapters 7 and 8 right after Chapters 3 and 4. Two veterans in the field of Sociology and Anthropology, Professors Kalinga Tudor

Silva and Sasanka Perera, have organised Chapter 7, “Sociology and Anthropology: Evidence-Based Inquiry into the Social World,” into a logical sequence of six themes starting from “Origin and Development” all the way to suggestions for “Way Forward,” covering the contributions made to Sri Lankan society through the education process of the discipline with a brief comparison to that of the Indian system. It is important to note the fact that Sociology, Anthropology, or any of their cognate subjects were not taught in the Sri Lankan university system, University College, at that time, during the first twenty-one years of its existence. The introduction of Sociology to the University of Ceylon as a separate department under the leadership of the American Sociologist Bryce Ryan and offering the subject as a specialisation within the Economics study programme is an interesting turn of events, to say the least. The authors have highlighted this in the introduction as follows: “In any case, it is important to point out that the discipline of Sociology was established in Sri Lanka under the influence of American Sociology rather than British Sociology or Social Anthropology, even though Sri Lanka was a British colony, and the University of Ceylon was established under the leadership of Ivor Jennings, who came from Cambridge University”.

Moving on to Chapter 8, ‘Political Science and Public Policy: Cultivating the Critical Spirit,” the reader can experience the intimate connection of the discipline with Sociology, Economics, and Geography. Professors Navaratne Bandara and Jayadeva Uyangoda, both veteran political scientists, not only as academics but also as real-life political activists, display the wealth of experience they have had both on and off the academic stage, taking the reader through a fascinating journey in this chapter. It is interesting to notice here again that the British tradition of political economy, which focused on interrelationships between the government and economic policy, was highlighted through political science education. Not only do they mention the 1971 insurgency, ethnic conflict, and internal war during the 1980s but also the politicisation of academic and student communities as well as the university administrations as major factors influencing the intellectual life in all Sri Lankan universities since the early 1970s. Among many other contributions described in the chapter, what stands out the most are the books on all different aspects of the Sri Lankan political landscape by Professor A. J. Wilson, who has also been an advisor to President J. R. Jayewardene in drafting the constitution in 1978. Though the system has produced numerous world-class academics who have significantly contributed to the field of

Political Science education, the chapter opens the possibility for a reader to wonder why the system has not been able to produce a single sensible politician who could have accelerated the development of the country with the knowledge gathered through the programme over all these years. It seems almost natural for the readers of Chapter 4 about the hundred-year history of Sri Lanka's economics education to ask a similar question about the country's economists too.

CONCLUSION

As the concluding remarks of the book mention, "Re-establishing the connection between Social Science and social problems should be a high priority for all of us - social scientists and citizens alike. The importance of this remark, especially about the connection between knowledge of basic economics and social problems, couldn't have been emphasised more than by the celebratory behaviour of the people after hearing the news about the approval of the IMF loan in March 2023. The social problems (deepening poverty, deepening inequalities of wealth, income, and quality of life, violence against individuals and groups, oppression of women and girls, climate change, resource exhaustion, environmental degradation, persistent authoritarian regimes, imperfect democracies, corruption, inadequate systemic response to disaster, etc.) we face are crucially important, they are intractable, and they are often trending in the wrong direction. The solutions for such problems will require the artful design of new institutions and new ways of coordinating social behaviour." It shows that the education system of the country has a greater responsibility in addressing these issues. Education, though it is considered a discipline under the umbrella of Social Sciences, will have to take a lead role in guiding all the disciplines in the right direction, starting from the primary and secondary levels all the way to postgraduate research and knowledge production and raising the level of awareness of society in general.

Renowned economist Prof. W. D. Lakshman, the author of Chapter 4, successfully explores the central role of Economics, considering it a prominent discipline often referred to as the "Queen of Social Sciences". Readers can appreciate the way the evolution of Economics into an interdisciplinary subject due to its relevance to our everyday lives is presented throughout the chapter. However, the author's observation of the influence of the general perception of 'Economics' brought in by the wave of numerous

Faculties of Management and Business Studies across the spectrum of Sri Lankan state universities will certainly entice the inquisitive reader.

The very first goal in the list of seventeen SDGs is 'End poverty in all its forms everywhere' by the year 2030. However, with all the difficulties created by COVID-19, even the UN experts are now saying that it is highly unlikely that the world will be able to achieve not only the first one but also the other SDGs by 2030. Though it is understandable that the world would need a bit more time to recover from the economic and psychological shocks brought on by the pandemic, a more important inquiry would be to analyse whether any of these SDGs would have been achieved by 2030 even if there had been no pandemic. Poverty is an issue the UN and other forums have been addressing through all types of different formats, such as reduction, alleviation, or eradication, long before the current SDGs came into being, though without much success. The first report, Implementation of the First UN's Decade for the Eradication of Poverty (1997–2006), was tabled at the sixty-second General Assembly in 2007, and the report about the second decade discussed the activities through the period from 2008 to 2017. A similar proposal was tabled at the seventy-third General Assembly in 2018, showcasing the plan of action for poverty eradication during the period from 2018 to 2027. In addition to this sequence of ten-year plans, the UN declared its Millennium Development Goals (MDGs) in 2000, with 'eradicating extreme poverty and hunger' as the first goal to be achieved by the year 2015. We are now living through the period of the UN's Sustainable Development Goals (SDGs) again, with 'End poverty in all its forms everywhere' as the first goal to be achieved by the year 2030. Looking at the history of all these declarations and what the world has achieved in eradicating poverty over the years, one might start wondering whether these are realistic goals for sustaining economic development without driving more and more people into poverty. A more important concept to be examined carefully is the ability to reduce poverty using the same economic concepts and political frameworks as those used to create it.

Why haven't the measures taken by governments and international organisations worked as expected so far? Can there be a fundamental flaw in the framework within which the world is trying to solve these problems? It will not be inappropriate for Sri Lankans to narrow the scope of such questions down to 'Why haven't the measures taken by governments and the IMF worked as expected so far? Can there be a fundamental flaw in the framework

within which the IMF and Sri Lankan governments have been trying to solve these problems?' After all, this is the seventeenth time the country is hoping to be rescued by the IMF. Even if the public, in general, cannot be expected to have sufficient knowledge about economics and world politics, to understand such complicated matters as the intentions and motives of world economic powers, it certainly wouldn't be unfair to expect economists and other intellectuals and the policymakers of the country to do so. The only way a country can be assured of having such knowledgeable people along the decision-making pipeline is to have a system of education designed to produce them. That is why the importance of understanding what has happened in the last hundred years, not only in economics education but also in education in general and social science education in particular, cannot be ignored.

Economics, as a subject, is being taught around the world as the field of study that analyses possible methods of managing limited resources while satisfying the unlimited needs and wants of human beings. There is enough in the world for everyone's needs, but not enough for everyone's greed. Is it possible to introduce a field of study that would analyse the most effective methods of fulfilling humans' limited needs and wants using not only the limited physical resources but also the unlimited spiritual resources humans either already have or have the potential to acquire? If the awareness of people about their responsibilities and contributions towards economic growth and poverty reduction in their own neighbourhoods, can be increased then it will make it easier for everyone to understand the expectations of contribution from: parents in establishing ethical and moral standards in their children, educators in making learners aware of economic and social concepts, religious leaders in making people aware of the importance of developing compassion into their perception of the 'path to success and happiness' and policy makers in understanding the importance of their role in creating a just society which would encourage the participation and contribution of each and every member of the society with their compassionate and innovative thinking about how to achieve a sustainable economic growth that would keep reducing poverty instead of increasing the income gap and destroying the environment. The author's description of how and why younger generations are losing interest in Economics as a subject other than learning it through Business and Management studies degree programs, and due to the introduction of higher-level mathematics in the curriculum can be an eye opener for all the stakeholders mentioned above.

Since the volume is about "One Hundred Years of Social Science Education in Sri Lankan Universities", the reader would have benefited more from the information about how some of the leading universities around the world have catered to changing socio-economic-political factors through appropriate adjustments in their educational programs if there had been an attempt to discuss what Sri Lankan universities have achieved over the last hundred years in comparison to other universities around the world. The narrow-mindedness displayed by both educationists and policymakers in the country becomes evident when considering instances like the unsuccessful collaborative efforts between the Universities of Jaffna and Colombo to establish joint degree programs in science and education. This failure primarily stems from the inability of academics and administrators to reach a consensus on a seemingly simple matter: whether to designate the program as a BSc or a BEd. Distribution of the workload among the lecturers and timetabling issues are also mentioned as some of the barriers to cross-disciplinary collaboration in the field of Education. Inability to get much needed collaborations off the ground due to petty-minded reasons such as the name of the degree or the timetabling and workload issues, while the rest of the world is moving towards cross-disciplinary teaching/learning and research, the author of the chapter provides, perhaps unintentionally, a good opportunity for the reader to think how much of the responsibility for those failures would fall back on the very same Education Faculties for creating educators with incompetence and such selfish behaviour through the education system of the country.

In conclusion, the initiative by the UGC and the efforts of producing '*Beyond Boundaries: One Hundred Years of Humanities and Social Sciences in Sri Lankan Universities; Volume II: Social Sciences'* could be appreciated by the reader mainly since it provides important information about the evolution of these disciplines over the last one-hundred-years. It certainly would help the reader understand why the country is where it is today with respect to Social Science Education.

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