COMBINE TECHNIQUE FOR EVALUATION OF RATIONAL AND POLYNOMIAL FUNCTIONS

Banyar Min Min Tun*

Abstract

In this paper the evaluation of the polynomial and rational functions in digital computer system is considered and general evaluation method (E-method) is expressed. We observed combine technique, the correspondence rule in E-method and Microsoft Excel program are combined as a new technique for the evaluation of the polynomial and rational functions.
Keywords: E-method, polynomial and rational functions

1. INTRODUCTION

In this paper introduce the evaluation of the polynomial and rational functions for a general evaluation technique, named E-method. The E-method evaluates a polynomial $P_\mu(x)$ or a rational function $R_{\mu,\nu}(x)$ by mapping it into a linear system. The system is solved using a left-to-right digit-by-digit approach, in a radix r representation system, on a regular hardware. For a result of m digits, in the range (−1, 1), the computation takes m iterations. The first component of the solution vector corresponds to the value of $P_\mu(x)$ or $R_{\mu,\nu}(x)$. Let

$$R_{\mu,\nu}(x) = \frac{P_\mu(x)}{Q_\nu(x)} = \frac{p_\mu x^\mu + p_{\mu-1} x^{\mu-1} + \ldots + p_0}{q_\nu x^\nu + q_{\nu-1} x^{\nu-1} + \ldots + q_1 x + 1}$$

where the p_i's and q_i's are real numbers. Let n = max $\{\mu, \nu\}$, $p_j = 0$ for $\mu + 1 \leq j \leq n$, and $q_j = 0$ for $\nu + 1 \leq j \leq n$. According to the E-method $R_{\mu,\nu}(x)$ is mapped to a linear system L : **A y = b**:

*Associate Professor, Department of Information and Communication Technology, University of Co-operative and Management, Thanlyin

$$\mathbf{L}\begin{bmatrix} 1 & -x & 0 & & \dots & 0 \\ q_1 & 1 & -x & 0 & \dots & 0 \\ q_2 & 0 & 1 & -x & \dots & 0 \\ & & . & . & . & . \\ . & & & & & \\ . & & & & : & \\ : & & & & . & 0 \\ q_{n-1} & & & & 1 & -x \\ q_n & & & \dots. & 0 & 1 \end{bmatrix}\begin{bmatrix} y_o \\ y_1 \\ y_2 \\ : \\ \\ . \\ : \\ y_{n-1} \\ y_n \end{bmatrix} = \begin{bmatrix} p_0 \\ p_1 \\ p_2 \\ : \\ . \\ . \\ : \\ p_{n-1} \\ p_n \end{bmatrix}$$

so that $y_0 = R_{\mu,\nu}(x)$. Likewise, $y_0 = (x)$ when all $q_i = 0$.

2. FORMULATION OF THE EVALUATION METHOD

2.1 Introduction

In this section a general evaluation technique, named E-method, is introduced. The E-method, in general terms, can be described as

(i) A correspondence rule, C_f, which associates independent variables $\mathbf{x_f}$, dependent variable $\mathbf{y_f}$, and parameters $\mathbf{p_f}$ of a given computational problem $f(\mathbf{x_f}, \mathbf{p_f})$ with a system L of simultaneous linear equations $\mathbf{A_f\, y = b_f}$ in such a way that there is a one-one correspondence between dependent variables $\mathbf{y_f}$, i.e., the results of f, and the solution **y** of the system L. The elements of the matrix $\mathbf{A_f}$ and vector $\mathbf{b_f}$ must satisfy certain conditions, as specified later. Symbolically,

$\mathbf{(}C_f, \implies \mathbf{A_f}, \mathbf{b_f)} \Rightarrow (\mathbf{y_f} \Leftrightarrow \mathbf{y = A_f^{-1} b_f)}$.

(ii) A computational algorithm for solving the system L in time linearly proportional to the desired number of correct digits of the solution **y**, and which is amenable to an efficient implementation.

A computational problem **f** is said to be L-reducible if there is a corresponding rule C_f, not necessarily unique. The E-method is applicable in all L-reducible problems: the computational algorithm remains invariant while the particular correspondence rule, no more complex than the assignment of values, characterizes the problem.

The choice of a linear system as the target of correspondence stems from an observation that the expansion of an n^{th} order determinant has the form of a sum of n! terms, each term being a product of n factors. Since the solution of a linear system L appears as the ratio of the corresponding determinants, there is an obvious potential to represent and

accordingly evaluate certain general arithmetic expressions, rational functions in particular, as the ratios of determinants in expanded form.

The exposition of the E-method in this section closely follows the order in which the fundamental ideas were developed. Thus the problem of evaluating rational functions, which alone is of sufficient importance, will be used to introduce and demonstrate the correspondence part of the E-method. Its correspondence rule, C_R, will be defined in the next section while the computational algorithm will be given in Section 2.2 after discussing in some detail what appears to be the generic problem for the E-method.

2.2 Definition of Correspondence Rule

A simple way of establishing the correspondence C_R between the coefficients and the argument of a given rational function $\mathbf{R_{\mu,\nu}(x)}$ and a system L of simultaneous linear equations, such that the value of $\mathbf{R_{\mu,\nu}}$ is computed as the first component of the solution vector **y**, is described as the correspondence problem of the E-method.

Let $\mathbf{R_{\mu,\nu}(x)}$ be a real- valued rational function:

$$\mathbf{R_{\mu,\nu}(x)} = \frac{P_\mu(x)}{Q_\nu(x)} = \frac{p_\mu x^\mu + p_{\mu-1} x^{\mu-1} + \ldots + p_0}{q_\nu x^\nu + q_{\nu-1} x^{\nu-1} + \ldots + q_1 x + 1} \qquad (1)$$

$$= \frac{\sum_{i=0}^{\mu} P_i x^i}{\sum_{i=0}^{\nu} q_i x^i} \; .$$

Without loss of generality it is assumed that $q_0 = 1$.

Let $\mathbf{A}(x)\,\mathbf{y} = \mathbf{b}$ (2)

be a nonhomogeneous system of n simultaneous linear equations,

with $\mathbf{A}(x) = (a_{ij})_{n \times n}$ - the nonsingular system coefficient matrix, (3)

$\mathbf{y} = [y_1, y_2, \ldots, y_n]$ - the solution vector and (4)

$\mathbf{b} = [b_1, b_2, \ldots, b_n]$ - the right-hand side vector. (5)

$$L: \begin{bmatrix} a_{11} & a_{12} & a_{13}\ldots\ldots a_{1j} \\ a_{21} & a_{22} & a_{23}\ldots\ldots a_{2j} \\ : & : & : \quad : \\ : & : & : \quad : \\ a_{i1} & a_{i2} & a_{i3}\ldots\ldots a_{ij} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ : \\ : \\ y_n \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ : \\ : \\ b_n \end{bmatrix} \; . \qquad (6)$$

Let D(x**)** denote the determinant of **A(**x**)**:

$$D(x) = \det \mathbf{A}(x). \tag{7}$$

Similarly,

$$D_j(x) = \det (\mathbf{a_1, a_2, ..., a_{j-1}, b, a_{j+1}, ..., a_n}), \tag{8}$$

Where: $\mathbf{a_j} = (a_{1j}, a_{2j}, \ldots, a_{ij})^t$ is the j-th column vector. (9)

2.3 Theorem

If $\max(\mu,\nu) < n-1$ and the coefficients a_{ij} 's, b_i's of the system (10) are put into correspondence with the coefficients p_i's, q_i's and the argument x according to the following rule C_R :

$$A_{ij} = \begin{cases} 1 & \text{for } i = j; \\ q_{i-1} & \text{for } j = 1 \text{ and } i = 2, 3, ..., \nu+1; \\ -x & \text{for } j = i+1 \text{ and } i = 1,2,..., n-1; \\ 0 & \text{otherwise;} \end{cases} \tag{10}$$

$$b_i = \begin{cases} p_{i-1} & \text{for } i = 1, 2, ..., \mu+1; \\ 0 & \text{otherwise .} \end{cases} \tag{11}$$

Thus

$$\begin{bmatrix} 1 & -x & 0 & & \ldots & 0 \\ q_1 & 1 & -x & 0 & \ldots & 0 \\ q_2 & 0 & 1 & -x & \ldots & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots & & \vdots \\ q_\nu & & & & \vdots & \\ \vdots & & & & . & 0 \\ \vdots & & & & 1 & -x \\ 0 & & & \ldots. & 0 & 1 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ \vdots \\ . \\ . \\ \vdots \\ y_{n-1} \\ y_n \end{bmatrix} = \begin{bmatrix} p_0 \\ p_1 \\ p_2 \\ \vdots \\ . \\ p_\mu \\ \vdots \\ \vdots \\ 0 \end{bmatrix},$$

then

$$y_1(x) = \frac{D_1(x)}{D(x)} = \frac{P_\mu(x)}{Q_\nu(x)} = R_{\mu,\nu}(x) . \tag{12}$$

Proof:

By the Laplace expansion of the determinants

$$D(x) = \sum_{i=1}^{n} a_{i1} c_{i1}(x) \tag{13}$$

and

$$D_1(x) = \sum_{i=1}^{n} b_i\, c_{i1}\,(x), \qquad (14)$$

where

$C_{i1}(x) = (-1)^{i+1}$ det $A_{i1}(x)$ is the cofactor of the element a_{i1}, and det $A_{i1}(x)$ is its corresponding minor, defined in the usual way. In general,

$$c_{i1}(x) = \begin{cases} \prod_{k=2}^{n} a_{kk} & \text{for } i = 1; \\ (-1)^{i+1} \left[\prod_{k=1}^{i-1} a_{k,k+1} \right] \left[\prod_{k=i+1}^{n} a_{kk} \right] & \text{for } i = 2, 3, \ldots, n\,. \end{cases} \qquad (15)$$

In particular,

$$c_{i1}(x) = \begin{cases} 1 & \text{for } i = 1; \\ (-x)^{i-1} & \text{for } i = 2, 3, \ldots, n\,. \end{cases} \qquad (16)$$

And, since

$$(-1)^{i+1}[-x]^{i-1} = x^{i-1}, \qquad (17)$$

it immediately follows that

$$\begin{aligned} D(x) &= \sum_{i=1}^{n} a_{i1} c_{i1}\,(x) \qquad (18) \\ &= 1 + \sum_{i=2}^{\nu+1} q_{i-1} x^{i-1} \\ &= 1 + \textstyle\sum_{i=1}^{\nu} q_i x^i \\ &= Q_\nu\,(x)\,. \end{aligned}$$

And

$$\begin{aligned} D_1(x) &= \sum_{i=1}^{n} b_i\, c_{i1}\,(x) \qquad (19) \\ &= \sum_{i=1}^{\mu+1} p_{i-1}\, x^i \end{aligned}$$

$$= \sum_{i=0}^{\mu} p_i \, x^i$$

$$= p_\mu (x).$$

Therefore,

$$y_1(x) = \frac{D_1(x)}{D(x)} = \frac{P_\mu(x)}{Q_\nu(x)} = R_{\mu,\nu}(x) .$$

Theorem 2.3 establishes the correspondence rule C_R so that the E-method can be applied to evaluate a given rational function $R_{\mu,\nu}(x)$.

Figure 1 illustrates how the system L: **A**(x)**y** = **b** appears after an initialization has been performed according to the correspondence rule C_R.

$$\begin{bmatrix} 1 & -x & 0 & & \dots & 0 \\ q_1 & 1 & -x & 0 & \dots & 0 \\ q_2 & 0 & 1 & -x & \dots & 0 \\ : & : & : & : & : & : \\ : & : & : & : & & : \\ q_\nu & & & & : & \\ : & & & & . & 0 \\ : & & & & 1 & -x \\ 0 & & & \dots. & 0 & 1 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ : \\ . \\ . \\ : \\ y_{n-1} \\ y_n \end{bmatrix} = \begin{bmatrix} p_0 \\ p_1 \\ p_2 \\ : \\ . \\ p_\mu \\ : \\ : \\ 0 \end{bmatrix} .$$

Figure 1

It can be noted that the correspondence rule C_R is degenerate in a sense that only one of the n generated components y_i, i = 1, .., n, namely, y_1 is of interest.

□

2.4 Example

Let $f(x) = R_{2,3}(x) = \frac{p_2x^2 + p_1x + p_0}{q_3x^3 + q_2x^2 + q_1x + 1}$ be a real-valued rational function. Then C_p: $R_{2,3}(x) \rightarrow$ L specifies

$$L: \begin{bmatrix} 1 & -x & & \\ q_1 & 1 & -x & \\ q_2 & & 1 & -x \\ q_3 & & & 1 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{bmatrix} = \begin{bmatrix} p_0 \\ p_1 \\ p_2 \\ 0 \end{bmatrix},$$

so that $y_1 = R_{2,3}(x)$.

3. EVALUATION OF POLYNOMIALS

The E-method introduced by M.D. Ercegovac in [4], allows efficient evaluation of polynomials and certain rational functions on simple. Here we concentrate on the evaluation of polynomials assuming radix- 2 arithmetic.

3.1 Theorem

Consider the evaluation of $p_\mu(x) = p_\mu x^\mu + p_{\mu-1} x^{\mu-1} + \ldots + p_0$. One can easily show that $p_\mu(x)$ is equal to y_0, where $[y_0, y_1, \ldots, y_n]^t$ is the solution of the following linear system.

$$\mathbf{L:} \quad \begin{bmatrix} 1 & -x & 0 & & \ldots & 0 \\ 0 & 1 & -x & 0 & \ldots & 0 \\ 0 & 0 & 1 & -x & \ldots & 0 \\ & & \cdot & \cdot & \cdot & \cdot \\ \cdot & = & \cdot & & & \\ \cdot & & & & : & \\ \vdots & & & & \cdot & 0 : \\ 0 & & & & 1 & -x \\ 0 & & & \ldots. & 0 & 1 \end{bmatrix} \begin{bmatrix} y_o \\ y_1 \\ y_2 \\ \vdots \\ \\ \cdot \\ \\ y_{n-1} \\ y_n \end{bmatrix} \quad \begin{bmatrix} p_0 \\ p_1 \\ p_2 \\ \vdots \\ \\ \cdot \\ \\ p_{n-1} \\ p_n \end{bmatrix}$$

Then

$$y_0(x) = p_\mu(x) .$$

Proof:

Seen [4].

□

3.2 Example

Evaluation of a simple polynomial $P_3(x) = 3x^3 + 4x^2 + 2x + 1$, for x = 2.

In this example we express three methods. Method (i) is simple and using substitution method. Method (ii) is combining of E-method and multiplication of matrices or Gaussian elimination backward method. Method (iii) is combining of E- Method and Microsoft Excel Computer program. Comparing the three computing method we get the same solution. We occurred that combining of E- Method and Microsoft Excel Computer program is simple and easy for evaluation of polynomial function.

Method (i).

Let $P_3(x) = 3x^3 + 4x^2 + 2x + 1$, for x = 2.

We used substitution method,

$P_3(2) = 3(2^3) + 4(2^2) + 2(1) + 1 = 45.$

Solution of polynomial $P_3(x) = 45$, when x = 2.

Method (ii).

We get linear system L: from polynomial $P_3(x) = 3x^3 + 4x^2 + 2x + 1$, by Correspondences Rule from E- method,

$$L: \begin{bmatrix} 1 & -2 & & \\ & 1 & -2 & \\ & & 1 & -2 \\ & & & 1 \end{bmatrix} \begin{bmatrix} y_0 \\ y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 4 \\ 3 \end{bmatrix}.$$

Then, we use multiplication of matrices method,

$$y_0 - 2\,y_1 = 1$$
$$y_0 = 1 + 2\,y_1$$
$$y_1 - 2\,y_2 = 2$$
$$y_1 = 2 + 2\,y_2$$
$$y_2 - 2\,y_3 = 4$$
$$y_2 = 4 + 2\,y_3$$
$$y_3 = 3$$
$$y_2 = 10$$
$$y_1 = 22$$
$$y_0 = 45$$

Solution of linear system L : $y_0 = 45$, by E- method.

Method (iii).

We apply to computing of polynomial using Microsoft Excel program.

Step 1: Polynomial function change to linear system L: **A(x) y = b** by Correspondence Rule from E- method.

Step 2: Using MINVERSE function from Microsoft Excel program to get $\mathbf{A^{-1}}(x)$.

Step 3: Using MMULT function from Microsoft Excel program to get solution of system L.

So, solution of polynomial $P_3(x) = 3x^3 + 4x^2 + 2x + 1$ is 45 when x = 2 by Correspondence Rule as shown in Figure 2.

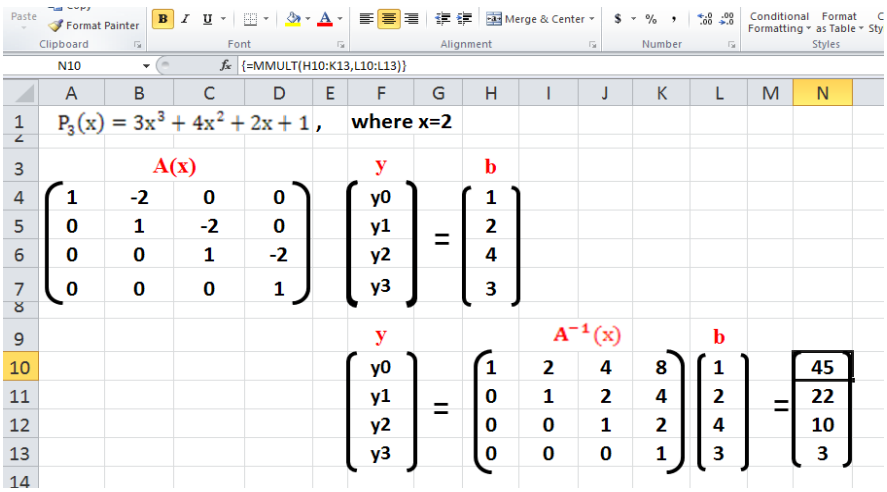


Figure 2.

3.3 Example

Evaluation of a polynomial as an approximation to 2^x, $x \in [0, 1]$, with a precision of 7 decimal digits for x = 0.5. The coefficients of $P_5(x)$ are from [6] : In this example Correspondence Rule from E- method and Microsoft Excel program are used for evaluation of 2^x with x = 0.5.

Assume, $2^x \approx P_5(x)$, for $x = 0.5$,

$$P_5(x) = P_5 x^5 + P_4 x^4 + P_3 x^3 + P_2 x^2 + P_1 x + P_0 ,$$

where.

$P_0 = 0.999999925,$

$P_1 = 0.693153073,$

$P_2 = 0.240153617,$

$P_3 = 0.558263130 \times 10^{-1},$

$P_4 = 0.898934003 \times 10^{-2}$,

$P_5 = 0.187757667 \times 10^{-2}$,

By Correspondence Rule,

$$\underset{\mathbf{A(x)}}{\begin{pmatrix} 1 & -0.5 & 0 & 0 & 0 & 0 \\ 0 & 1 & -0.5 & 0 & 0 & 0 \\ 0 & 0 & 1 & -0.5 & 0 & 0 \\ 0 & 0 & 0 & 1 & -0.5 & 0 \\ 0 & 0 & 0 & 0 & 1 & -0.5 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}} \underset{\mathbf{y}}{\begin{pmatrix} y_0 \\ y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \end{pmatrix}} = \underset{\mathbf{b}}{\begin{pmatrix} 0.99999992500 \\ 0.69315307300 \\ 0.24015361700 \\ 0.05582631300 \\ 0.00898934003 \\ 0.00187757667 \end{pmatrix}},$$

then, using MINVERSE and MMULT function from Microsoft Excel program we get solution of system as following:

$$\underset{\mathbf{y}}{\begin{pmatrix} y_0 \\ y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \end{pmatrix}} = \underset{\mathbf{A^{-1}(x)}}{\begin{pmatrix} 1 & 0.5 & 0.25 & 0.125 & 0.0625 & 0.03125 \\ 0 & 1 & 0.5 & 0.25 & 0.125 & 0.0625 \\ 0 & 0 & 1 & 0.5 & 0.25 & 0.125 \\ 0 & 0 & 0 & 1 & 0.5 & 0.25 \\ 0 & 0 & 0 & 0 & 1 & 0.5 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}} \underset{\mathbf{b}}{\begin{pmatrix} 0.99999992500 \\ 0.69315307300 \\ 0.24015361700 \\ 0.05582631300 \\ 0.00898934003 \\ 0.00187757667 \end{pmatrix}} = \begin{pmatrix} 1.41421366 \\ 0.82842747 \\ 0.27054880 \\ 0.06079037 \\ 0.00992812 \\ 0.00187757 \end{pmatrix},$$

Therefore, $2^x = y_0 = 1.41421366$, where $x = 0.5$ by Correspondence Rule from E- method.

Above Example 3.3 and other method have the same solution with 6 decimal place as shown in Table 1.

Table 1.

Sr	Method	2^x where $x = 0.5, (\sqrt{2})$
1	Combine Technique	1.41421366
2	E- Method	1.414213657

3	Newton's Respon	1.414213522
4	Calculator Machine	1.414213562

3.4 Example

In this example Correspondence Rule (E- method) and Microsoft Excel program are used for evaluation of sinh(x), x ϵ [0,$\frac{1}{8}$]. As a general example of the E-method we present the evaluation of $R_{3,4}$ as an approximation to sinh(x), x ϵ [0, $\frac{1}{8}$], with a precision of 13 decimal digits for x = 0.1019734533301 . The coefficients are taken from [6], before normalizing q_0 to 1, they appear as follows:

P_0 = 0.0 ,

P_1 = 0.53538901456087786 * 10^3,

P_2 = 0.0,

P_3 = 0.5646207450687849 * 10^2,

q_0 = 0.5353890145608794*10^3,

q_1 = 0.0,

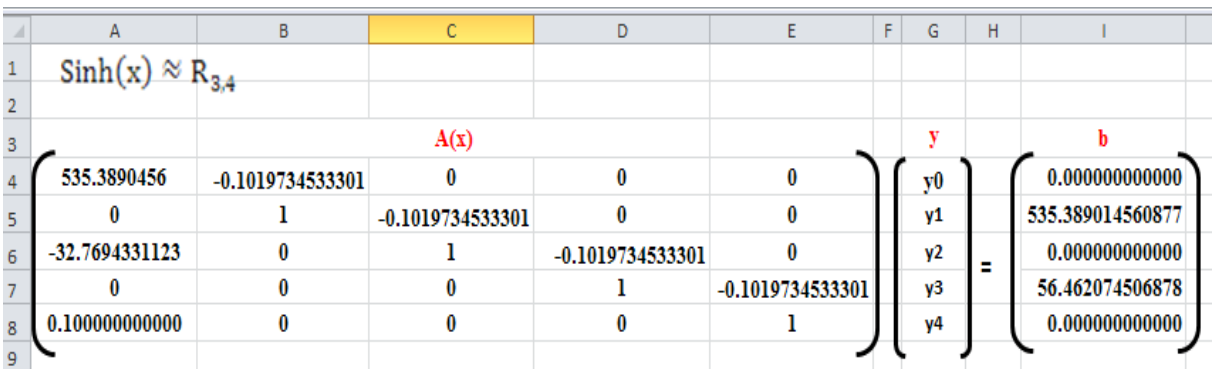
q_2 = $-0.3276943311233*10^2$,

q_3= -0.0,

q_4 = 1.0,

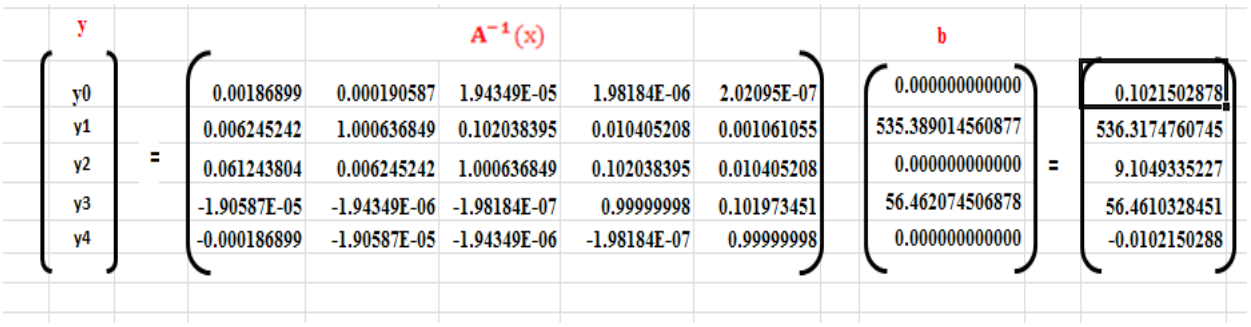
For x = 0.1019734533301,

Combination of Correspondence Rule and Microsoft Excel program are used in example. The complete evaluation is illustrated in Figure 3 and Figure 4 on Microsoft Excel program. We get the solution y_0 = 0.102150278, the solution of the system sinh(x) when x = 0.1019734533301.



	A	B	C	D	E	F	G	H	I
1	Sinh(x) ≈ $R_{3,4}$								
2									
3			A(x)				y		b
4	535.3890456	-0.1019734533301	0	0	0		y0		0.000000000000
5	0	1	-0.1019734533301	0	0		y1		535.389014560877
6	-32.7694331123	0	1	-0.1019734533301	0		y2	=	0.000000000000
7	0	0	0	1	-0.1019734533301		y3		56.462074506878
8	0.100000000000	0	0	0	1		y4		0.000000000000
9									

Figure 3.



y		$A^{-1}(x)$					b		
y0	=	0.00186899	0.000190587	1.94349E-05	1.98184E-06	2.02095E-07	0.000000000000	=	0.1021502878
y1		0.006245242	1.000636849	0.102038395	0.010405208	0.001061055	535.389014560877		536.3174760745
y2		0.061243804	0.006245242	1.000636849	0.102038395	0.010405208	0.000000000000		9.1049335227
y3		-1.90587E-05	-1.94349E-06	-1.98184E-07	0.99999998	0.101973451	56.462074506878		56.4610328451
y4		-0.000186899	-1.90587E-05	-1.94349E-06	-1.98184E-07	0.99999998	0.000000000000		-0.0102150288

Figure 4.

CONCLUSION

In Section 1 and Section 2, we expressed E-method for evaluation of rational and polynomial functions with examples. We discovered new combined technique using combination of Correspondence Rule from E-method and Microsoft Excel program for evaluation of polynomial and rational functions with approximation. Example 3.3 and Example 3.4 are used as a combined technique, these examples ware visible distinctly and simple for checking solution with other evaluation methods.

We compared the solutions of Example 3.3 in Table (1) with other evaluation method. Combine technique had the same solution with 6 decimal places. So combine technique was easy way method than other evaluation method, but this technique was semi computerize technique.

Acknowledgements

First of all, I would like to express my deeply gratitude to Dr. Yi Yi Win (Rector) Co-operative and Management University, Thanlyin , U Oo Tin Thein (Pro-Rector) Co-operative and Management University and Daw Myint Myint Sein (Pro-Rector) Co-operative and Management University, Thanlyin for their kind permission to conduct this research work. Special thanks are also due to Dr. Soe Mya Mya Aye, chairperson of paper reading seminar, (professor) head of Computer Science, Yangon University, and Dr. Ohn Mar San (professor) head of ICT Department, Co-operative and Management University, Thanlyin who gives understanding and encouragements

References

Brisebarre, N., Chevillard, S., Ercegovac, M. D., Muller, J.-M. and Torres, S.(2008). "*An Efficient Method for Evaluating Polynomial and Rational Function Approximations*,"

in 19th IEEE Conference on Application-specific Systems, Architectures and Processors. ASAP'2008, Leuven (Belgium), pp. 233–238, 2–4 July 2008.

Brisebarre, N., Constantinides, G., Ercegovac,M. D., Filip, S. and Istoan, M..(2018). "*A High Throughput Polynomial and Rational Function Approximations Evaluator*". ARITH 2018 - 25th IEEE Symposium on Computer Arithmetic, Jun 2018, Amherst, MA, United States. IEEE, pp. 99-106.

Cohen, H.(2015). "Numerical Approximation Methods", Springer, New York ,

Ercegovac, M.D.(1975). "A General Method for Evaluation of Functions And Computation In A Digital Computer", PhD thesis, Dept. of Computer Science, University of Illinois, Urbana- Champaign.

Ercegovac, M.D.(1977). "*A General Hardware-Oriented Method for Evaluation of Functions and Computations In A Digital Computer*". IEEE Trans, Comp., Vol. C-26, No. 7, pp. 667–680.

Hart, J. F.(1968). "Computer Approximations", New York, John Wiley & Sons, Inc.

FACTORS AFFECTING CONSUMERS' ONLINE BUYING BEHAVIOR DURING THE COVID-19 PANDEMIC: EMPIRICAL STUDY IN UNIVERSITY OF CO-OPERATIVE AND MANAGEMENT, THANLYIN

Aye Thone Thone Kyaw[1]

Abstract

Myanmar has been affected the worldwide COVID-19 pandemic and the second wave, started on 16 August, dramatically increased the number of positive cases compared to the first wave. At that time, the government of Myanmar announced to stay at home, keep social distancing and only allow take-away system for restaurants. Consequently, many businesses have moved online market place using Internet platforms like Facebook have doubling up due to the coronavirus disease. And Yangon region including Thanlyin Township has become a major epicenter in the second wave and deaths have tripled. Accordingly, this research paper focuses on factors affecting consumers' online buying behaviors during the second wave of COVID-19 pandemic in Co-operative and Management University, Thanlyin (UCMT). The study uses online questionnaire survey method with google form to collect data. The questionnaire is developed in the form of closed-ended questions and five point Likert scale questions. The sample size of the research is 110, that includes academic staffs in UCMT and descriptive statistics, reliability statistics and multiple regression statistics and SPSS version 24 is applied for analyzing the data. The data shows that only two out of seven factors (product factor, price factor, timesaving factor, security factor, payment factor, administrative factor and psychological factor) are significantly related to consumers' online buying behavior during the COVI-19 pandemic in UCMT. Therefore, as a suggestion, government and marketers in Myanmar should support online shops for fast delivery time, reasonable price charges, maintain consumers' privacy in transaction safe and secure, ease in e-payment transaction.

Keywords: online buying behavior, consumers, influencing factors

INTRODUCTION

On 30 January 2020, WHO Director General declares COVID-19 as a public health emergency of international concern. ICTV (International Committee on Taxonomy of Viruses) announced the name of the new virus as "Severe Acute Respiratory Syndrome Coronavirus 2 (SARS- CoV-2)" on 11 February 2020. The virus that causes Covid-19 most commonly spreads between people who are in close contact with one another (within about 6 feet, or 2 arm lengths). When a person with the virus coughs, sneezes, sings, talks, or breathes, it can be spread through respiratory droplets or small particles, such as those in aerosols. On March 23, the first positive Covid-19 related case was confirmed in Myanmar and it was a person who recently had returned from the United States. The second wave

[1] Assistant Lecturer, Department of Management Studies, University of Co-operative and Management,Thanlyin

started again on 16 August in Rakhine State, after almost a month without local transmission. To date, as of 21 January, Myanmar has 136,166 confirmed cases of Covid-19 and 3,013 deaths. Covid-19 is not only a global pandemic and public health crisis; it has also severely affected the global economy and financial markets. Significant reductions in income, a rise in unemployment, and disruptions in the transportation, service, and manufacturing industries are among the consequences of the disease mitigation measures that have been implemented in many countries.

The global Covid-19 pandemic is dealing a severe blow to Myanmar's Economy. Ministry of Health and Sports (MOHS) set lockdown the infected area, quarantine those who come in contact with the virus and the traveler, social distancing rule. To prevent infection, most shops were closed and MOHS ordered restaurants to sell only take-away system. Businesses are switching from offline stores to online market and there are also more and more online only stores. During the Covid-19 pandemic, many E-commerce firms have started to experience some short-term changes. For example, Americans are adapting to e-commerce faster as sales online for groceries have increased in double the amount in the Middle of March compared to earlier in the month. This is because the virus is closing down physical stores and forcing consumers to go online for their needs (Holman, 2020). e-commerce (electronic commerce) is the activity of electronically buying or selling of products on online services or over the internet. In electronic commerce, it makes use of such technologies as mobile commerce, electronic funds transfer, supply chain management, internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems, and automated data collection systems.

From an online perspective, electronic commerce provides the capability of buying and selling products and information on the internet and other online services. Electronic commerce dabbles with the implementation of business transactions across various networks. These improvements may result in more effective performance (better quality, greater customer satisfaction, and better corporate decision-making), greater economic efficiency (lower costs), and more rapid exchange (high speed, accelerated, or real-time interaction). Electronic commerce, in particular, enables the execution of information-laden transactions using interconnected networks between two or more parties. According to statistics from Adobe Analytics (2020), e-commerce has overall increased with 25 percent. However, as with most external impacts, companies as well as e-commerce firm, should adapt to changes that emerge from the external influence, by modifying their marketing, and change their operations and business models to gain better customer satisfaction (Denger, 2020). Due to Covid-19 pandemic, Myanmar e-commerce is growing rapidly. Social commerce on Facebook is especially becoming trendy not only for people in big cities but also from anywhere of Myanmar. The convenience of asking for more information and making orders make buyers satisfied. Shopping through Facebook live also becomes a popular trend now.

About significant parts, payment and logistics, many companies are trying very hard to improve their service to support every user in Myanmar. As a brand, choosing the right media, using the easiest payment and delivery service would be a handicap to do E-commerce in Myanmar market. Based on (Ali, 2020); Eirhim and Elsayed said that unfortunately, the corona virus is a very personal threat and has spread among employees in all of the companies that were already affected by the changes of consumers habits.

When the Ministry of Health and Sports issued a region wide stay-at-home order on September 21 for Yangon Region, including Thanlyin Township, one of the responses we have seemed how people are approaching the COVID-19 pandemic period of isolation and uncertainty is in huge overnight changes to their shopping behaviors. From bulk-buying to online buying, consumers are changing what they are buying, when and how. Obviously, there has not been published research paper about factors affecting consumers' online buying behavior during Covid-19 pandemic in Myanmar. Then, the objective of this research is to investigate what factors influence consumers' online buying behavior of the respondents from UCMT during the COVID-19 pandemic. Thus, this research focuses on identifying factors affecting consumers' online buying behaviors during the Covid-19 pandemic in UCMT, one of the stay at home restriction townships in Yangon Region.

Objective of the Study

To examine the factor affecting consumers' online buying behavior during the COVID-19 pandemic.

Research Methodology

This research is designed to explore the dominant factors that affect consumers' online buying behavior during the COVID-19 pandemic at UCMT. The research paper uses mail questionnaire method to collect primary data from respondents because of COVID-19 pandemic period. In this research, Google form is applied because it supports a free platform for online data collection. The research questionnaire is developed in the form of closed-ended questions and five point Likert scale questions (1=strongly disagree to 5=strongly agree). The sample size of the research is 110, the academic staffs in UCMT. The secondary data is used in literature review and it provides to understand the stated objectives. The research paper uses descriptive statistics, reliability statistics and multiple regression statistics and applies the Statistical Package for Social Sciences (SPSS Version 24) for analyzing the data.

Scope and Limitations of the Study

In this research, scope of the study focuses only on UCMT during the second wave of COVID-19 pandemic. Therefore, the result may be not applied to other area of Yangon and Myanmar. Furthermore, the research is not related to other duration such as pre and post COVID-19 pandemic period. Moreover, only little influence of the independent variables such as product factor and psychological factor are found out in this research.

LITERATURE REVIEW

Online Buying Behavior

Consumer behavior can be defined as the decision-making process and physical activity involved in acquiring, evaluating, using and disposing of goods and services (Matin Khan, 2006). Consumers' behavior responds differently with offline and online elements. According to Subhasish Dagupta(2006), online consumers have two characteristics based on their personality: (a) manifestation of offline consumer behavior (b) unique behavioral mode. Virtual communities also play an important role on online consumer behavioral. Virtual communities are known as "Venuses for consumptions" (Dasgupta, 2006). Online Shopping behavior is a kind of individual's overall perception and evaluation for product or service, which could result in bad or good way during online shopping. Previous studies have defined that behavior is a multi-dimensional construct and has been conceptualized in different ways (Li & Zhang, 2002). The primary factor in online shopping is trust factor between consumer and online seller and it is the most important factor, which motivate consumer to process the transaction for online shopping. To increase trust factor, three elements, Safety and privacy of information, security and delivery and return on time are essential (Wan, 2009). Scholars particularly highlight the delivery, product availability, and product variety as the vital dynamics, which considerably affect consumers' internet buying decision (Hossain et al., 2018). Hossain et.al (2018) also revealed that security, personal hobby, payment method, appropriate pricing, privacy, social media and reference groups as the aspects, which significantly affect consumers' intention towards online purchase. Compared to physical stores, online stores have many advantages: they are convenient, time saving, do not need to travel and wait in lines. They are open in all time and they can be accessible anytime and anywhere. These stores provide consumers with free and rich information about products and services. They also use some online tools to help consumers compare and make purchase decisions among various products and services (Javadi et al., 2012). Smith & Rupp (2003) stated that consumers make decisions when they purchase, and they are influenced mostly by perception, attitudes motivation, personality, and emotion, which play a vital role in their online buying behavior. Czarniewski (2014) also suggested that same aspects could change customers' behavior like prices and methods of payment; customers tend to adopt a new behavior as soon as they find the financial methods are more suitable for them. Situation variables such as product display, price reduction, gifts and attractive offers also influence consumer behavior (Matin Khan, 2006).

Product Factor

The meaning of 'product' is the need-satisfying offering of a firm. The idea of "Product" as potential customer satisfaction or benefits is very important (Perreault et al., 2010). Products can include more than just tangible objects, such as cars, computers or

mobile phones. Broadly defined, products also include services, events, persons, places, organizations, ideas, or a mixture of these. Consumers see products as complex bundles of benefits that satisfy their needs. In accordance with Kotler & Armstrong (2014), in the process of developing products, firstly, marketers must identify the core customer value that consumers seek from the product. In addition, Product quality should also be determined by how customers view the product (Perreault et al, 2010). According to Satit et al.,(2012) on "The relationship between marketing mix and customer decision-making over travel agents; an empirical study product is one of the strongest predictors, there are two perceptions that will lead to high levels of purchase intention and repeat buying at the final, those perceptions are high product quality and high customer satisfaction. In the research of another researcher, Muzondo & Mutandwa (2011) found that product has a significant influence toward consumer choice of store for main grocery shopping.

Price Factor

Matin Khan (2006) stated the definition of price as the amount of money one must pay to obtain the right to use the product. From buyer's point of view, it is the cost, which he must pay to marketer for product or service. The price of the product is related with the affordable paying capacity of the consumer, the purpose and motive behind the purchase etc. (Kothari et al., 3rd ed). Price is the sum of all the values that customers give to gain the benefits of having or using a product or service. From a historical point of view, price has been a major influence on buying behavior (Kotler & Armstrong, 2018). Bucko et al., (2018) pointed out that the main factors that affect online shopping are convenience and attractive pricing/discount. Nevertheless, non-price factors became also very important in the buying decision process in the last decades (Kotler & Armstrong, 2018). Consumers patronize companies where they feel that the products have a fair price (Daskalopoulou & Petrous, 2006). A price should also never be too low for the consumer otherwise; they suspect a low quality (Monroe, 1976).

Timesaving Factor

Timesaving is prominently one of most influencing factors of online shopping. Browse or search an online catalogue can save time and patience. People can save time and can reduce effort by shopping online(Sultan & Uddin, 2015). According to Rohm & Swaminathan (2004), one possible explanation that online shopping saves time during the purchasing of goods and it can eliminate the traveling time required to go to the traditional store. Promoting online shopping as a time-saver is likely to be effective for those experiencing situational time pressure. The fact that those who experience time pressure can shop online any time and from anyplace they have internet access might be very appealing because it allows them to shop while simultaneously engaged in other activities (Richbell &

Kite 2007). Dibartolo & Siriker (2009) found that "anytime, anyplace" interpretation of online shopping convenience proved to be an important benefit for the majority of the online shopping survey respondents. Internet and catalogue shopping are often recognized as attractive because they are thought to save the buyer time. (Alreck & Settle, 2002). Based on Alreck & Settle (2002), Bhatnagar et al., (2000) pointed out that in this increasingly time–constrained world, Internet stores allow consumer to shop from the convenience of remote locations. On the other side, some respondent might think that it is also taken time for delivery of goods or services over online shopping (Sultan & Uddin, 2015).

Payment Factor

In today's marketplace, consumers have a wide range of options for making payments before, during or after purchasing services and goods. Alarooj (2019) has described payments methods that include a wide range, from the simplest way of paying by cash and cheque, to paying by debit or credit cards, paying via online bank, electronic fund transfers as well as paying via mobile applications. According to Kalia, Kaur & Singh (2016), one of the important factors is provision of alternative payment methods. Internet shoppers prefer "cash on delivery" payment method (for security reasons or non – availability for a credit card). As Cash on Delivery (COD) option, it has encouraged online purchasing (Alarooj, 2019). It gives both the buyer and the seller additional security and validates the transaction, making it similar to in-store purchasing (Bagnall et al., 2014). Debit card severs as a made for behavioral restraint among online shoppers (Hernandez et al., 2017). The nature of a credit card is compelling to the consumer because it provides the facility to consumer to purchase goods and services that are not restricted by a budget or intentions of the particular consumer. Besides, the consumer can pay this amount via credit card although he or she may not have that amount of money directly available in their bank (saving, cheque or access) account.

In the USA, almost 80% of the payments are non-cash payments, which means that people are adopting new technologies and they are using different methods of payments that involves online payment, card payments, mobile payments method and even crypto currencies (Huang, 2017). Bushry (2005) assumed that electronic payment system are proliferating in banking, retail, health care, online markets and even government, in fact, anywhere money needs to change hands. Organizations are motivated to use electronic payment systems in order to deliver products and services more cost effectively and to provide higher quality of service to the customers. Today, customers are encouraged to use the electronic payment systems because of the convenience with purchasing through them. Different e-payment methods are on the rise, particularly through mobile money, although cash on delivery remains prominent. The persistence of cash-based payments raises questions about consumer truth in e-commerce transactions as customers are only willing to pay once their orders reach their doorstep. On the same token, this is also associated with weak

financial inclusion, in a situation where contactless transactions should have been privileges (UNCTAD, 2020). Ferrao & Ansari (2015) claimed that the different modes of payments affect the buying behavior of customers and payment method has impact the profitability of the firm.

Security Factor

The conveniences of online shopping are accompanied by security threats, such as identify and fraud (Tsiakis, 2012). Security is one of the most important online shopping specificities. The more the e-shops are processing to increase the amounts of information and data about their customers, the more important the question of security seems to be than previously (Pinto et al., 2009). Huseynov & Yildirim (2014) emphasized that the lack of physical interaction tends to be the critical impediment in online retail sales followed by the privacy of individual information and security of financial transactions over the Internet (Rahman et al., 2018). Tisakis (2012) stated that consumers should have an understanding of online security and privacy risks. A result from the research of Pavlic´ et al. (2012) concluded that users of new media services often tend to worry about data manipulation, unauthorized data access and the unwanted tracking of certain services by third parties. Similarly, most consumers are particularly worried about maintaining their privacy. Shah et al. (2014) established that customers' perceptions of overall security differ depending on their perceptions of specific confidentiality related factors, such as third party seals or security/privacy statements. Bucko Vejacka (2011) discussed that one of the factors affecting the purchasing online is trust and security of the environment and connected identification of user (or communicating parties).

Administrative Factor

Based on Hai et al., (2015), Nelson & Soete (1988) revealed that government is one of the external environment but an important factor in many different ways that influence business. Government support methods include fiscal and tax policy support, government procurement, financial and foreign exchange policies to support the industry, administrative support, policy making and so on. From the earlier research, it can be stated that government support for network development plays an important role in the development of online shopping. The government needs to promote and support online business, and along with this, government needs to provide good infrastructure, sound legal regulations to flourish economic wealth in online business. From earlier literature studies on government support for science and technology infrastructure, leading to new technologies such as online network becomes easy and useful (Hai, Chi & Kazimi, 2015). In the case of electronic commerce, although there is a tendency to move from localization to globalization, the national governments of the technologically most advanced countries have announced their ‘electronic

commerce policies'.Government in Europe and US support the effort to enhance the awareness and confidence of citizens Seen, et al., (2017) and companies in electronic commerce and the development of relevant skills and network literacy (Feiropoulou & Pouloudi, 2000).

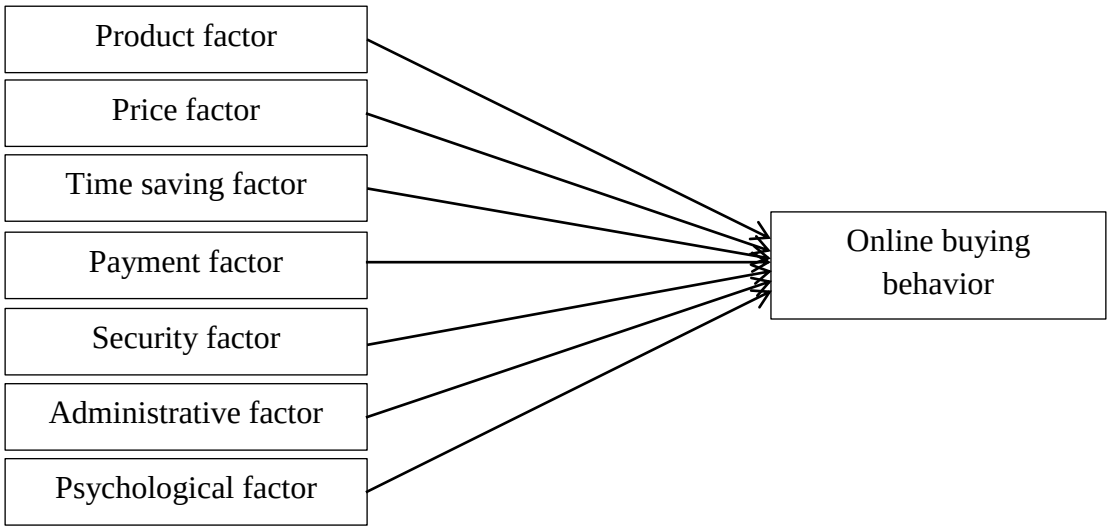
Based on, An et al., (2003); Chan & Hawamdeh (2002); King et al., (1994); Molla (1999); Dedrick (2004) stated that government initiatives are important in the adoption of e-commerce especially in developing countries. Government can encourage the private sector to adopt e-commerce by providing supportive infrastructure, legal and regulatory frameworks. In developing countries, the government is usually responsible for technology development, and it can influence e-commerce implementation decisions (Seen, et al., 2017). Therefore, based on An et al., (2003); Molla & Licker (2005) found that its level of support can encourage e-commerce adoption and the government plays an important role as an external factor affecting e-commerce adoption. On the other hand, lack of governmental support was a significant barrier to e-commerce adoption in Oman (Khalfan & Alshawaf, 2004) and Saudi Arabia (AlGhamdi et al., 2012). During the Covid 19 pandemic, the government of Myanmar urges people to stay at home as much as possible, to make social distancing and to wear the masks when going out. All government and private schools, universities and entertainment centers have to be closed. Restaurants are only available in take-away system according to the announcement on September 6, 2020. The curfew was imposed from 24:00 to 4:00 in Yangon due to the announcement of MOHS on August 25 2020. Hufnagel et al (2004) claimed that some categories of infections and simulations demonstrate that insubstantial limitations, mainly separation widespread control policies. Uddin (2020) revealed that the administrative factor impact consumers' online buying behavior during the COVID-19 pandemic.

Psychological Factor

Previous studies suggest that there are usually four major factors that play a role in the purchasing decisions of the customer. Such factors include economic, financial, medical and psychological factors (Popovc´ et al., 2015). There are four important psychological factors affecting the consumer buying behavior and they are motivation, perception, beliefs and attitudes. The level of motivation affects the buying behavior of customers. Every person has different needs such as physiological needs, biological needs and social needs. Selecting, organizing and interpreting information in a way to produce meaningful experience of the world is called perception. There are three different perceptual processes which are selective retention. Customer possesses specific beliefs and attitudes toward various products. Since such beliefs and attitudes make up brand image and affect consumer-buying behavior so that marketers are interested in them. All these factors combine to perform a comprehensive model of consumer behavior that reflects consumer decision making process. The major

factors and the process of decision-making shape the behavior and preferences of consumer behavior (Mesay, 2013). Psychological factors are these playing a crucial role in helping online customers unfamiliar with the vendor or unfamiliar with the online transactions to overcome fears of fraud and doubts as to the trustworthiness of the web site and vendor (Constantinides, 2004). According to Javadi et., (2012) revealed that has positive effect attitude toward online shopping on online shopping behavior of consumers indicate that considering attitude variables make a substantial contribution in online shopping.

Figure (1) Conceptual Framework of the study



Source: Adapted from Uddin, 2020

According to literature review and previous research studies, there are many factors, which affect online buying behavior. However, in this research, factors affecting consumers' online buying behavior are product factor, security factor, administrative factor and psychological factor.

ANALYSIS AND FINDINGS

Table (1) Demographic Characteristic of Respondents

Demographic Characteristic of Respondents (n=110)			
	Distribution	**Frequency**	**Percent**
Sex	Male	10	9.1
	Female	100	90.9
Age	20-25	6	5.5
	25-30	48	43.6
	30-35	29	26.4
	35-40	11	10

	Above 40	16	14.5
Education	Post Graduate	1	0.9
	Master	103	93.6
	Ph.D	6	5.5
	Other	0	0
Marital Status	Yes	37	33.6
	No	73	66.4
Income	Less than 100,000 Kyats	0	0
	100,001-200,000 Kyats	0	0
	200,001-300,000 Kyats	85	77.3
	300,001-400,000 Kyats	22	20
	Above 400,000 Kyats	3	2.7
Occupation	Tutor	39	35.5
	Assistant Lecturer	49	44.5
	Lecturer	9	8.2
	Associate Professor	8	7.3
	Professor	5	4.5

Source: Survey Data (January, 2021)

According to table (1), the data are described the demographic characteristics of respondents. There are female (90.9%) and male (9.1%) in the sampled respondents. During the Covid-19 pandemic, females buy products from online shops more than males. It indicates that female have more online buying habit than male respondents do. The next one is age range group and it is divided into five categories. In this research, age range between 25-30 years is (43.6%) , 30-35 years is (26.4%), above 40 years is (14.5%), between 35-40 years is (10%) and 20-25 years is (5.5%) respectively. (43.6%) of the age range between 25-30 years is largest; it means that age between 25 years to 30 years have the most online using experience in UCMT during the Covid-19 pandemic. Moreover, the research categorizes education level in four categories. These are master (93.6%), Ph.D. (5.5%) and post graduate (0.9%) separately. Therefore, the majority of the participants have completed master's degree level at UCMT. In the above table, marital status is grouped into two classifications: married and unmarried. The majority of respondents are unmarried (66.4%) whereas (33.6%) of respondents are married. The research categorizes respondents' monthly income into five statuses; (77.3%) of respondents are having income level between 200,001 kyats and 300,000 kyats, (20%) of respondents are between 300,001 kyats and 400,000 kyats and above 400,000 kyats is only (2.7%). There is no respondent at the income level of under 100,000 kyats and

between 100,001 to 200,000 kyats. Thus, academic staffs' monthly income starts at least 200,000 kyats to above 400,000 kyats at most. In this survey, majority of occupation of the participants are assistant lecturer (44.5%) as well as tutor (35.5%). For this reason, most of the buyers of online shops are assistant lecturers and tutors among the respondents at UCMT.

Table (2) Internet Using Behaviors of Respondents (n=110)

	Distribution	Frequency	Percent
Daily Internet Using Time	Less than 1 hr	7	6.4
	1-2 hrs	10	9.1
	2-3 hrs	31	28.2
	3-4 hrs	19	17.3
	Above 4 hrs	43	39.1
Online buying frequency time	very often	8	7.3
	often	44	40
	Occasionally	43	39.1
	Rarely	12	10.9
	Very rarely	3	2.7
Period	Under 1 year	57	51.8
	1-2 years	24	21.8
	2-3 years	12	10.9
	3-4 years	9	8.2
	4-5 years	3	2.7
	Above 5 years	5	4.5

Source: Survey Data (January, 2021)

In table (2), the data are related to internet using behaviors of responds in UCMT. Daily internet using time of participants above four hours is (39.1%), among two to three hours is (28.2%) , among three to four hours is (17.3%), among one to two hours is (9.1%) and less than one hour is (6.4%). According to the result, most of the respondents are frequent internet users in UCMT during the Covid-19 pandemic. Online buying frequency time of respondents means respondents' buying frequency rate of products from online shops. This data analysis shows often as (40%), occasionally as (39.1%), very often as (7.3%) and very rarely as (2.7%) respectively. It is stated that 40% of respondents often buy products from online and 39.1% of respondents occasionally buy products from online during the Covid-19 pandemic. In this research, the percentage of buyers who often buy products from internet and the percentage of buyers who occasionally buy products from internet are not much different. In table (2), online buying experience of respondents less than one year is (51.8%), between one to two years is (21.8%), two to three years is (10.9%), three to four

years is (8.2%), four to five years is (2.7%) and above five years is (4.5%) correspondingly. It is clear that most of the respondents are experienced less than one year in online buying experience. Therefore, it can be assumed that most of the respondents are practiced in online buying during the COVID-19 pandemic.

Table (3) Internet Using Behaviors of Respondents(n=110)

Items		**N**	**Percent**
	Foods	110	54.5
	Stationery	110	8.2
	Electronics	110	20
	Fashions	110	77.3
	Home appliances	110	24.5
	Books	110	30.9
	Medicine	110	21.8
	Others	110	0
Payment Methods	KBZ Pay	110	51.8
	Wave Money	110	54.5
	Credit/Debit Card	110	2.7
	Cash on Delivery	110	68.2
	Others	110	3.6
Shopping Websites	Facebook	110	99.1
	Shop.com.mm	110	20.9
	Rgo 47	110	11.8
	Spree.com.mm	110	0
	Zay Chin	110	1.8
	360.com	110	2.7
	Others	110	0.9

Source:Survey Data (January,2021)

Table (3) includes four groups of preferences and choices in online buying. In this sector, respondents have to answer one or more variables because this table is to show the results of most buying choices in item, payment methods and shopping websites.

Respondents buy fashions (77.3%) the most whereas foods (54.5%) are second most choice in online buying during the COVID-19 pandemic. Moreover, they prefer more to buy fashions and foods products from online shops during the second wave of Covid-19 pandemic. In the research paper, respondents pay cash on delivery (68.2%), wave money (54.5%), KBZ pay (51.8%), others (3.6%) and credit/debit card (2.7%). The answer of others (3.6%) in payment method choice is CB pay. By looking at this data, respondents choose cash on delivery method as the most commonly used way to purchase products from online shop during the pandemic second wave. Respondents buy products from Facebook (99.1%), Shop.com.mm (20.9%), and Rgo47 (11.8%), Zay Chin (1.8%), 360.com (2.7%) and others (0.9%). Among them, according to the above data, Facebook is the most popular e commerce site for respondents to buy the products while Shop.com.mm is the second most popular option for them during the second wave of pandemic.

Table (4) the Cronbach's Alpha for All Variables

Variables	Cronbach's Alpha	Results of Reliability	No. of Items	No. of respondents
Product Factor	0.7	Good	5	110
Price Factor	0.8	Very Good	5	110
Time Saving Factor	0.8	Very Good	2	110
Payment Factor	0.7	Good	4	110
Security Factor	0.7	Good	5	110
Administrative Factor	0.6	Fair	3	110
Psychological Factor	0.8	Very Good	5	110
Online Buying Behavior	0.9	Excellent	6	110

Source: Survey Data (January, 2021)

From the table (4), Cronbach's Alpha is engaged to analyze the reliability of this research. A general accepted rule is that alpha of 0.6-0.7 indicates an acceptable level of reliability and 0.8 or greater indicate a very good level (Hulin, Netemeyer, and Cudeck, 2001). The Cronbach's Alpha for administrative factor is 0.6; and so the level of relative internal consistency and reliability results is fair situation. However, the reliability result of this variable is the lowest among all other variables. Therefore, the survey data is reliable to measure all factors consistently and free from random error.

Table (5) Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.813[a]	.661	.638	.47968

a. Predictors: (Constant), PF, PriF, TSF, PayF, SF,AF, PsyF

b. Dependent Variable: OB

Source: Survey Data (January, 2021)

As stated in Table (5), the value of correlation coefficient, R. 0.813 (81.3%) refers to positive link between consumers' online buying behavior during the COVID-19 pandemic and product factor, price factor, timesaving factor, payment factor, security factor, administrative factor and psychological factor. R-square values of 66.1% (0.661), variation in consumers' online buying behavior during the pandemic, moves relatively in line with the product factor, price factor, timesaving factor, payment factor, security factor, administrative factor and psychological factor. The adjusted R square is 0.638 and can pointedly account for 63.8% variance in the consumers' online buying behavior during the second wave of Covid-19 pandemic.

Table (6) ANOVA[a]

Model		Sum of Square	Df	Mean Square	F	Sig
1	Regression	45.736	7	6.534	28.396	.000[b]
	Residual	23.470	102	.230		
	Total	69.206	109			

a. Dependent Variable: OB

b. Predictors: (Constant), PF, PriF, TSF, PayF, SF,AF, PsyF

Source: Survey Data (January, 2021)

According to the table (6), regression analysis is set to explore the association between product factor, price factor, timesaving factor, payment factor, security factor, administrative factor and psychological factor with consumers' online buying behavior during the second wave of COVID-19 pandemic. Seven factors are approved, and results are calculated in Table (6). F statistics generated (f= 28.396) is significant at 1 percent level (significant f <0.01) with 7 and 102 degrees of freedom, confirming the fitness for the model.

Table (7) Regression Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.174	.407		.427	.671
	Product Factor	.220	.105	.150	2.095	.039
	Price Factor	-.094	.088	-.088	-1.076	.284
	Timesaving Factor	-.100	.058	-.113	-1.710	.090
	Payment Factor	.096	.122	.068	.782	.436
	Security Factor	.050	.106	.039	.473	.637
	Administrative Factor	-.008	.061	-.008	-.127	.899
	Psychological Factor	.772	.093	.755	8.256	.000

a.Dependent Variable : Online Buying Behavior

Source : Survey Data (January,2021)

As described in Table (7), the results show that two out of seven factors are significantly related to consumers' online buying behavior during the second wave of COVID-19 pandemic. In reverse, the rest of five factors have no significant relation with consumers' online buying behavior during the second wave of COVID-19 pandemic.

Table (8) Pearson Correlations[c]

		Product Factor	Price Factor	Time Saving Factor	Pay-ment Factor	Secu-rity Factor	Admin-istrative Factor	Psych-ological Factor	Online Buying Behavior
Product Factor	Pearson Correlation	1							
	Sig.(2-tailed)								
Price Factor	Pearson Correlation	.480**	1						
	Sig.(2-tailed)	.000							
Time Saving Factor	Pearson Correlation	.205**	.324**	1					
	Sig.(2-tailed)	.032	.001						

Payment Factor	Pearson Correlation	.428**	.567**	.395**	1				
	Sig.(2-tailed)	.000	.000	.000					
Security Factor	Pearson Correlation	.392**	.568**	.241*	.655**	1			
	Sig.(2-tailed)	.000	.000	.011	.000				
Adminisra-tive Factor	Pearson Correlation	.320**	.382**	.136	.359**	.377**	1		
	Sig.(2-tailed)	.001	.000	.156	.000	.000			
Psycholo-gical Factor	Pearson Correlation	.559**	.627**	.447**	.632**	.529**	.424**	1	
	Sig.(2-tailed)	.000	.000	.000	.000	.000	.000		
Online Buying Behavior	Pearson Correlation	.548**	.479**	.262**	.537**	.461**	.350**	.793**	1
	Sig.(2-tailed)	.000	.000	.006	.000	.000	.000	.000	

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

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

c.Listwise N=110

Source : Survey Data (January,2021)

As stated by Table (8), product factor, price factor, timesaving factor, payment factor, security factor, administrative factor and psychological factor have positive relationship with online buying behavior at the 0.01 level of significant.

DISCUSSION AND CONCLUSION

A number of businesses proceeded online and sales using digitalize system have doubled while the coronavirus outbreak, according to Myanmar's e-commerce industry body. Retail stores have been struck by COVID-19 and lockdown restrictions whilst online buying has boomed at the same time. This research paper aims to scrutinize the influencing factors on consumers' online buying behavior. In line with the data from this paper, products and psychological factors have significantly influence on online buying behavior during the second wave of COVID-19 pandemic. As the market is very competitive, most online shops should offer varieties of products, sufficient products' information and good quality products to customers. It may also have effect on customers' online buying behavior. It can be assumed that consumers have positive attitude, satisfaction and good perception toward

online buying during the pandemic based on the result of this paper. Price factor has no effect on consumers' online buying behavior so that online shops have to offer consumers plenty of discount sales and reasonable price charges in Myanmar. In this paper, timesaving factor does not affect consumers' online buying behavior during the COVID-19 pandemic because product delivery time delayed in Thanlyin Township for pandemic-related restriction during the coronavirus disease pandemic. In addition, reforming the national postal address system would make it easier for businesses to deliver products door-to-door. Online payment systems for online shops are early stage of development and most consumers still use cash on delivery method. Thus, Myanmar Payment Union should also work on strengthening its card payment offerings. Local banks should extend its ATM services deeper into the rural areas. The payment factor also affects on customers' online buying behavior for the above reasons.

As claimed by the report's result, most of the buyers purchase products from Facebook application and Facebook allows consumers to send and receive money through the messenger. However, a Facebook security breach in 2018 exposed the personal information of an estimate 87 million users and raised some doubts about Facebook's ability to protect its customers' data. Base on this fact, it can be clearly seen that there has some weakness in relation to customers' security. Hence, e-commerce operators have responsibility to educate consumers about laws related to consumer protection and unfair practices, etc. In addition, government's rules for health concerns about Covid-19 pandemic do not influence on buyers' behavior at UCMT because it is supposed that they do not strictly follow the guidance of MOHS in protection of Covid-19. In spite of experiencing some problems concerned with online shops' challenges, the e-retail shops have the opportunities to set a stunning achievement to the Nation's Gross Domestic Product and influence the e-commerce sector of Myanmar. In addition, further studies should be done on some other variables like perceived benefits, perceived risks, access to information, website quality, ease of shopping and trust, which may influence consumers' online buying behavior during the COVID-19 pandemic.

Acknowledgements

I would like to express my gratitude to Dr.Yi Yi Win (Rector of Co-operative and Management University, Thanlyin), U Oo Tin Thein and Daw Myint Myint Sein (Pro-Rectors, Co-operative and Management University, Thanlyin) for granting me to carry out the study. I special thanks to associate professor Daw Thi Thi Aung (Head of Department of Management Studies, Co-operative and Management University, Thanlyin). I also deeply thank to my family for enthusiastic support during writing the research paper. Finally, I would like to thank all people who actively participate by helping and encouraging me to the completion of the research.

References

Bucko, J., Kakalejcik, L., & Ferencova, M. (2018). Online Shopping: Factors that Affect Consumer Purchasing Behavior. Cogent Business & Management. *Marketing Research Article, 5*(1).

Czarneiwski, S. (2014). Change in Consumer Behavior in the Market and the Value of Companies. *European Journal of Research and Reflection in Management Sciences, 2*(2).

Hossain, A., Jamil, M.A.A., & rahman, M. M. (2018). Exploring the Key Factors Influencing Consumers' Intention, Satisfaction and Loyalty towards Online Purchase in Bangladesh. *International Journal of Economics and Financial Research, 4* (7), 214-225.

Javadi, M. H. M., Dolatabadi, H. R., Poursaeedi, A., & Adadollahi, A. R. (2012). An Analysis of Factors Affecting on Online Shopping Behavior of Consumers. *International Journal of Marketing Studies, 4* (5).

Khan, M. (2006). *Consumer Behavior and Advertising Management.* New Age International (P) Ltd., Publishers. New Deli- 110002.

Sultan, M. U., & Uddin, M. N. (2015). *Consumers' Attitude towards Online Shopping Factors Influencing Gotland Consumers to Shop Online*. Master Thesis in Business Administration. Department of Business Administration.

Uddin, B. (2020). Factors Affecting Consumers' Internet Shopping Behaviour During the Covid-19 Pandemic: Evidence from Bangladesh. *Chinese Business Review, 19*(3), 91-104.

A STUDY ON THE SOCIOECONOMIC SITUATIONS OF MINGOHN VILLAGE, HLEGU TOWNSHIP, YANGON REGION

Thet Min Naung[1]

Abstract

This research paper concern with the socioeconomic situations of Mingohn Village, Hlegu Township,Yangon Region. The study adopted descriptive research design to collect data from a sample survey. The 293 sample households were selected with 95% confidence interval and margin of error 5%. Simple random sampling was used in data collection. It was analyzed descriptively using percentage, mean and standard deviation, and also inferentially using regression and Pearson correlation test. The findings of the study revealed sex ratio of the Mingohn Village was 87.2% and dependency ratio was 30.5%.Child-woman ratio was 116.16%. According to education level, 53.55% of sample household members were high school level. Concerning housing condition, houses of Mingohn Village are wooden houses with zinc roofing and brick pillars. The used of fuel consumption for the households was electronic with 85.7%. The employment status for the household member were17.2% in causal workers, 12.7% were non-government services, 7.4% were government staff and 49.4% were dependents. 39.2% of the sample households' annual income were 4,000,001 kyats to 6,000,000 kyats. There is a positive linear relationship between annual income and annual expenditure and there is a moderate correlation with statistically significance of sample households.

Key words: socioeconomic situations, simple linear regression, correlation

INTRODUCTION

Socioeconomic is the important role in the development of the country. Socioeconomic status is an economic and sociological combined total measure of the person's work experience and individual or family's economic status and social position in related to others. This paper covers the social, education and economic development of Mingohn Village, Hlegu Township, Yangon Region. Mingohn Village is interesting because of the big village. It lies on Hlegu-Mingohn Road. It also occupies the center part of other villages. It is the main center of villages and government staffs with an area of about 150 acres. It is also a well-developed village in terms of social and economic aspects. The sample of these research selected by using the Yamane formula with 95% confidence level and 5% margin of error. To make an analysis of socioeconomic situations of Mingohn Village, the 293 sample households selected by using simple random sampling method. Therefore, this research paper covers the population and education status of Mingohn Village.

This research paper will help lay down development programmer for Hlegu Township as it is an analysis of socioeconomic development of Mingohn Village. In this study, primary data, secondary data and quantitative research methods were used. The government has the

[1] Lecturer, Department of Mathematics and Statistics, Co-operative College, Phaunggyi.

objective of the rural development. The government has set up the five objectives rural development tasks; (1) to be safe smooth and good transportation in the rural areas, (2) to be available of pure water in the rural areas, (3) to raise of the education standard of the rural people and growth of the economy in the rural areas, (4) to develop the socioeconomic situation of the rural areas and (5) to narrow the socioeconomic gaps between rural and urban areas by alleviating poverty in the rural areas. In performing rural development activities, the states employs its role as strategy planner, policy marker and supervisor and then rural development computes been to perform to these strategies plan has collected in selected target areas by making model village approach.

The Historical Background of Mingohn Village

In April 2014, the latest census was conducted by the Government of the Republic of the Union of Myanmar. In the post-independence period, comprehensive population and housing censuses were only successfully undertaken in 1973, 1983 and most recently in April 2014. Hlegu Township is one of 45 townships making up Yangon Region. Hlegu Township in Myanmar situated about 45 km northeast of Yangon. In this census, Hlegu Township has a population of 270,741 people. 15 percent of the population are urban, it the remaining 85 percent being rural. It has a total of 58,023 households, with the mean household size being 4.3 persons which is consistent with both the Union and Yangon Region household sizes. It is involved on 22,060 villages, and 57 village tracts**.** In Hlegu Township, there are more females than males with 98 males per 100 females. The population density in Hlegu Township constituted 181 persons per square kilometer.

The proportion of productive working population between 15 to 64 years of age in Hlegu Township is 66.3 percent. The proportions of children aged 14 and below together with the proportion of the elderly aged 65 and over are less than the proportion of the working age group population. Fewer proportions of children and elderly reduce the dependency of those age groups on the working age population.59.8 percent found by the Labour force participation rate in Hlegu Township.

Mingohn Village is existed in the Hlegu Township, Yangon Region. Mingohn Village is situated near Co-operative College, Phaunggyi and far from 20 miles in Hlegu Township. It is border with Gonminshowe village in the east, with Co-operative College, Phaunggyi in the south, with Central Institute of Civil Service (Lower Myanmar) in the west and with No.1 Basic military Training Force in the north.

Mingohn Village has an area of around 150 areas. Mingohn Village divided into 6 wards. The Mingohn Village is 1018 houses and 1105 households, total population over 5000. It has one of the B.E.P.S, one of the B.E.H.S and one monastic school, occupies in the village. It is running with a total of 1919 students and 64 teachers century also produce

outstanding citizens. It is found that there are 3 monasteries that lecturer give on Buddhism to monks. Mingohn Village has two churches.

Mingohn Village is abundance of plains and less hills. Some difference ethic groups are living in the village such as Burmese, Mon, Kayin, Chin, Shan, Rakhine and Franch.

Objective of the Study

In this study, the research objective is to analyze the socioeconomic situations of Mingohn Village.

Scope and limitation of the Study

This study focuses on the households of Mingohn Village, Hlegu Township, Yangon Region. The sample size is selected with the 293 households by using simple random sampling method.

RESEARCH METHODOLOGY

This research paper arranges a rationale for design of research, target population, sample size, data collection method and data analysis. The design of research consist a quantitative approach and primary data and secondary data. The survey method was employed to collect the data from sample people by distributing questionnaires.

In this study, primary data and quantitative research methods were used. Quantitative research method was significant to generate the measurable cause and effect of variables, and the relationship between the variables. Sample survey research design with the form of questionnaire was used to collect the data from selected sample.

By using descriptive statistics analysis to present the figures from the findings with tables and charts, the respondents were interviewed by using standard questionnaires during the research. Descriptive statistics are concerned with summarizing the properties of the sample of observations. Inference statistics apply the mathematical theory of probability to make decisions about the likely properties of populations based on sample evidence. An inference is a generalization or conclusion about some attribute of a population based on the data in a sample. If a sample is high representative of the population, as random sampling assures, then inferences about the parent population can be made with a high level of confidence.

Simple Regression and Correlation Analysis

In this research paper describe the simple linear regression and correlation analysis, in which a single numerical independent variable, X, is employ to estimate the numerical dependent variable Y, such as using annually income to estimate the annually expenditure for the sample households.

Simple Linear Regression Model

The simple linear regression model is

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

Where

β_0 = Y intercept for the population

β_1 = Slope for the population

ε_i = Random error in Y for observation i

Y_i = Dependent variable

X_i = Independent variable for observation i

Assumption

The four assumptions of regression are as follows:

- Linearity
- Independence of errors
- Normality of error
- Equal variance

Correlation Analysis

Pearson correlation was used for the strength of relationship between two variables to analyze. According to (Evans, 1996), the size of the value of Pearson correlations (r) can range from -1.00 to 1.00.

DATA ANALYSIS AND DISCUSSIONS

Demographic change can influence the underlying growth rate of the economy, structural productivity growth living standards, saving rates, consumption rates and investment. These factors can influence the long-run unemployment rate and equilibrium interest rate, housing market trend and the demand for the financial assets. Socioeconomic is generally to undertake an impact assessment and carrying about socioeconomic progress usually in terms of growth such as life expectancy, literacy people, gross domestic product and employment rate.

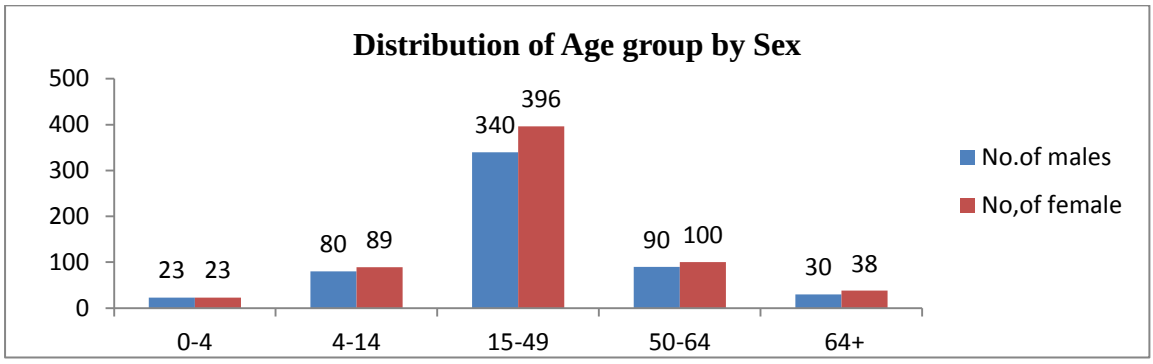
Distribution of Age Group by Sex

Table (1) Distribution of Age group by Sex

Age group	No. of males	Percent	No. of females	Percent
≤4	23	4.1	23	3.5
5-14	80	14.2	89	13.8
15-49	340	60.4	396	61.3
50-64	90	16.0	100	15.5
≥65	30	5.3	38	5.9
Total	**563**	**100.0**	**646**	**100.0**

Source: Survey Data, 2020

Figure (1) Distribution of Age group by Sex



Source: Survey Data, 2020

In this study, questionnaires were distributed to the 293 sample households. According to the table above, it is found that there are 1209 people living in 293 sample households. There are 563 males and 646 females. Most of the males are between the age of 15 and 49 years and it constitutes 60.4% of total males. Similarly most of the females are between the age of 15 and 49 years and it constitutes 61.3% of total females. Therefore, it is found that the most of the population in Mingohn Village are working people and it has good future prospect in economic development.

Distribution of Sex Ratio

Sex ratio is the demographic concept that measure the proportion of male to female in a given population.it is usually measured as the number of males per females. According to the survey data, sex ratio for Mingohn Village is as follow:

$$SR = \frac{M}{F} \times 100$$

Where, SR = Sex ratio

M = the number of males

F = the number of females

$$SR = \frac{563}{646} \times 100 = 87.2\%$$

According to the result, sex ratio of Mingohn Village is 87.2%. This means that there is 88 males for every 100 female births, which are the number of males is less than the females in Mingohn Village.

Distribution of Dependency Ratio

Dependency ratio is calculated to analyze the workforce of the working people in Mingohn Village.

There are generally two categories of dependent: young dependent and older dependent. According to the norm set by the United Nations, those who are between 15 and

64 years belong to the working people. Those under 14 are young dependents and those over 65 belong to older dependents.

Dependency ratio is the number of population at the dependent age per 100 populations at the working age.

$$D.R = \frac{P_{0-14} + P_{65+}}{P_{15-64}} \times 100$$

$$D.R = \frac{P_{0-14}}{P_{15-64}} \times 100 + \frac{P_{65+}}{P_{15-64}} \times 100$$

$$D.R = Y.D.R + O.D.R$$

Where, D.R = dependency ratio

Y.D.R = young dependency ratio

O.D.R = old dependency ratio

$P_{0\text{-}14}$ = population aged under 15

P_{65+} = population aged over 65

$P_{15\text{-}64}$ = population aged between 15 and 64

$$Y.D.R = \frac{215}{926} \times 100 = 23.22\%$$

$$O.D.R = \frac{68}{926} \times 100 = 7.34\%$$

$$D.R = 23.22\% + 7.34\% = 30.56\%$$

According to the result, there has greater young dependency ratio than old dependency ratio in Mingohn Village because of 0 to 14 ages people are greater than over 65 ages people. Dependency ratio 30.56 % and it is a fair dependency.

Distribution of Child-Woman Ratio

Child-woman rate of a particular region or a country also determines living standard and health states of that region or country. If child-woman rate is high, the living standard is low. Otherwise, the region or country enjoys development in socioeconomic situation. People living there are expected to have knowledge on health.

Child-woman ratio is the number of children per 1000 women at the reproductive ages.

$$CWR = \frac{P_{0-4}}{F_{15-49}} \times 1000$$

Where, CWR = child-woman ratio

$P_{0\text{-}4}$ =population aged 0-4

$F_{15\text{-}49}$ = female population aged 15-49

$$CWR = \frac{46}{396} \times 1000 = 116.16\%$$

Woman between 15-49 years of age is a woman at bearing age. When studying child-woman rate of people in Mingohn Village, the number of child is assumed low as child-woman rate is 116.16%.

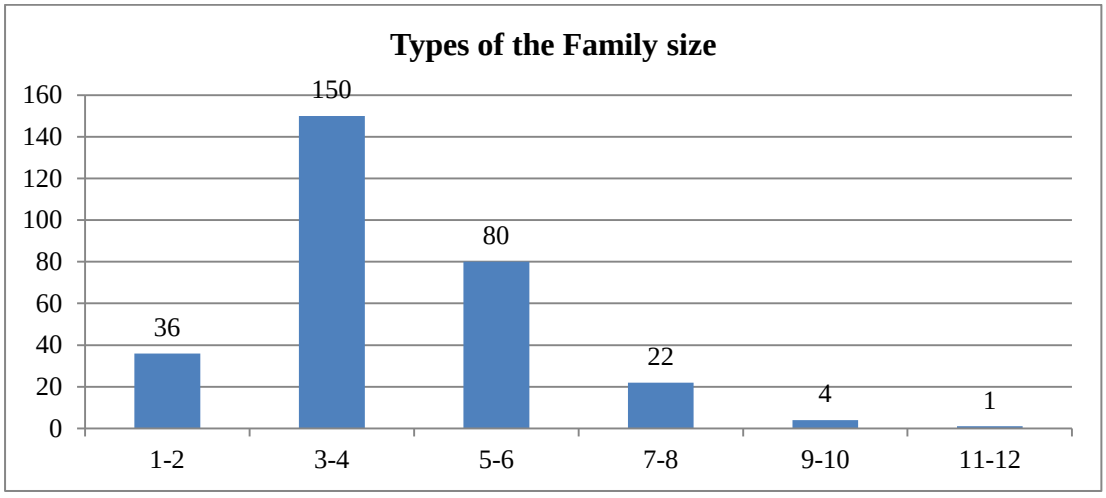
Types of the Family size

Table (2) Types of the Family size

Family Size	1-2	3-4	5-6	7-8	9-10	11-12	Total
Frequency	36	150	80	22	4	1	**293**
Percent	12.2	51.2	27.3	7.5	1.5	0.3	**100.0**

Source: Survey Data, 2020

Figure (2) Types of the Family size



Source: Survey Data, 2020

According to the findings, it is found that the most of the family size are between 3 and 4 people and it constitutes 51.2% and the second of the family size are between 5 and 6 people and it constitutes 27.3% of total family size. So, the family size of sample households in Mingohn Village is found fair.

Demographic profile of Sample Household Heads

Table (3) Demography Profile of Sample Households Heads

		Frequency	Percent
Gender	Male	237	80.9
	Female	56	19.1
Race	Burmese	270	92.2
	Mon	3	1.0
	Kayin	2	0.7
	Chin	12	4.1
	Shan	3	1.0
	Rakhine	2	0.7
	Franch	1	0.3
Religious	Buddhist	276	94.2
	Christians	17	5.8
Age	≤20	1	0.3
	21-40	75	25.6
	41-60	141	48.1
	≥61	76	26.0
Education level	Doctor of philosophy Master	1	0.3
	degree	0	0
	Ordinary degree	30	10.2
	Under graduate	5	1.7
	High school level	74	25.3
	Middle school level	95	32.4
	Primary school level	73	24.9
	KG	0	0
	Monastic education	13	4.5
	Illiterate	2	0.7
Occupation	Government Staff	22	7.5
	Merchant	59	20.1
	Non-government staff	22	7.5
	Farmer	15	5.1
	Causal worker	118	40.3
	Housework	28	9.6
	Pension	29	9.9

Source: Survey Data, 2020

According to the result, it explains the demography factor of sample household heads. Of all the participants, 80.9 % are males and 19.1% are females. 92.2% of sample size are Burmese, 94.2% of sample size are Buddhist.25.9% of sample household heads are under 40 years old and 74.1% of them are above 40 years old. So, In addition, 82.6% learnt primary, middle and high school level. However, the largest portion of sample household heads is working causal workers with 40.3%.

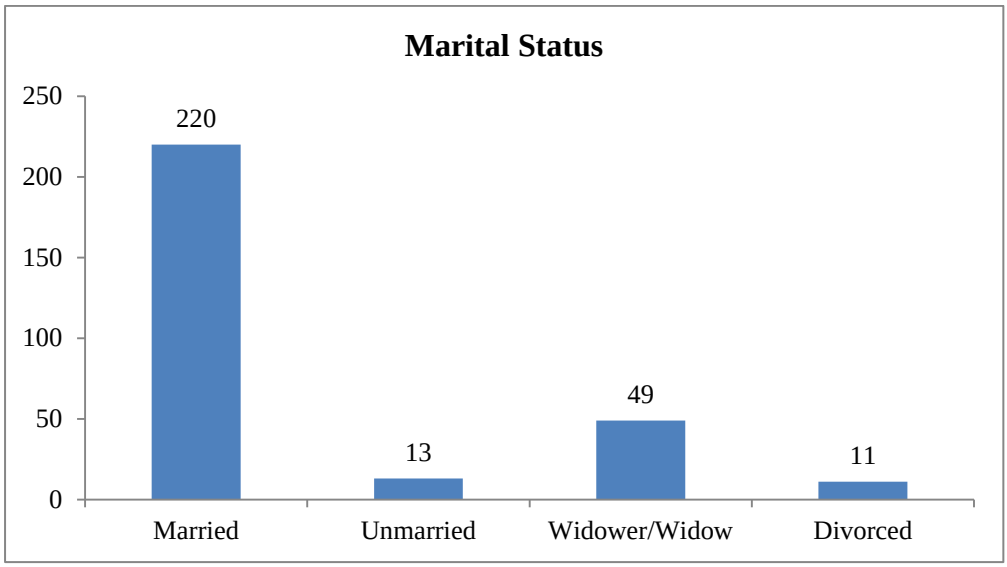
Marital Status of Sample Household Heads

Table (4) Marital Status of Sample Household Heads

Marital Status	Frequency	Percent
Married	220	75.1
Unmarried/Single	13	4.4
Widower/Widow	49	16.7
Divorced	11	3.8
Total	**293**	**100.0**

Source: Survey Data, 2020

Figure (3) Marital Status of Sample Household Heads



Source: Survey Data, 2020

When studying the married status of those who are 14 and over 14, 75.1% of the heads of household are married and widower and widow people constitutes 16.7% of sample household heads. 4.4% of the sample household heads are single and a divorced person constitutes 3.8% of the sample household heads. It is because they are Myanmar Buddhists who follow and practices Myanmar culture and tradition.

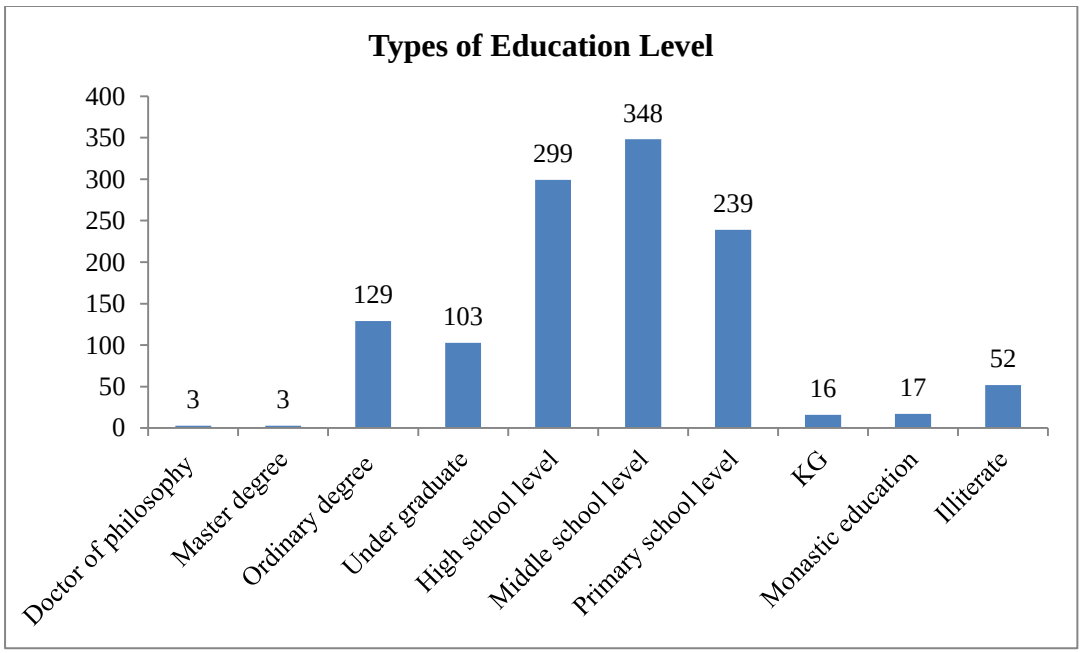
Level of Education in Sample Household Members

Table (5) Level of Education in Sample Household Members

Education level	Frequency	Percent
Doctor of philosophy	3	0.2
Master degree	3	0.2
Ordinary degree	129	10.7
Under graduate	103	8.5
High school level	299	24.7
Middle school level	348	28.8
Primary school level	239	19.8
KG	16	1.3
Monastic education	17	1.4
Illiterate	52	4.3
Total	**1209**	**100.0**

Source: Survey Data, 2020

Figure (4) level of Education in Sample Household Members



Source: Survey Data, 2020

According to the above table, it is found that 53.5% of sample household members are high school level and middle school level,19.8% of sample size is a primary education level of total people.11.1% of sample size is also graduates and their education level is a bit high

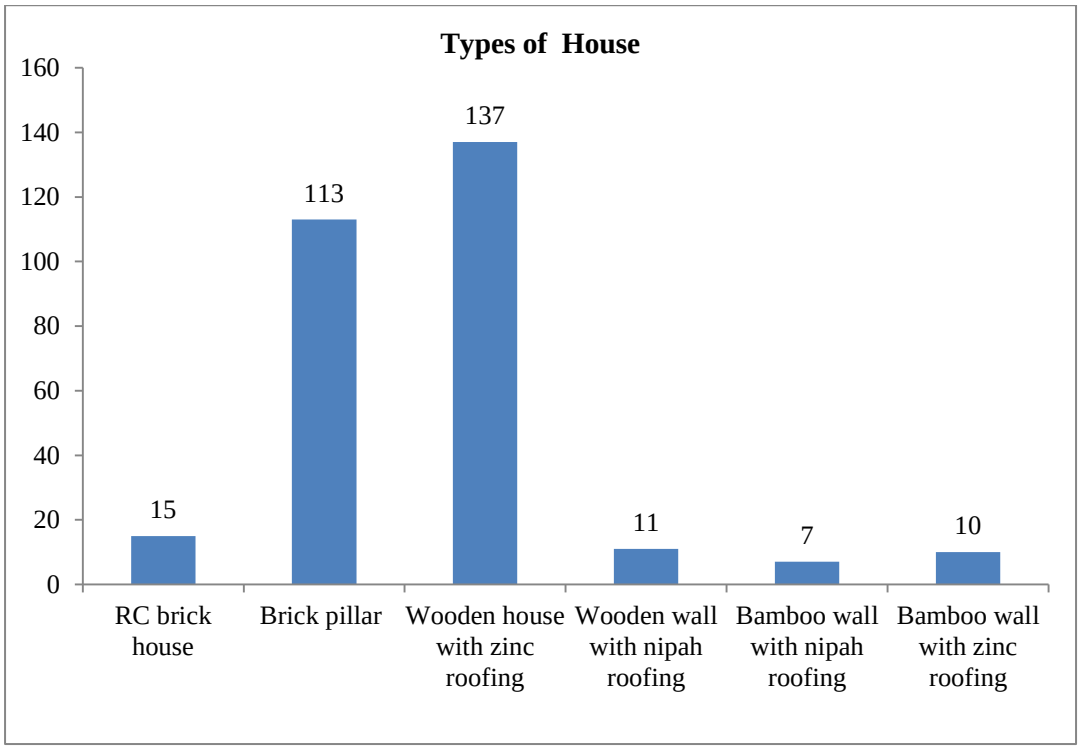
Types of House in Sample Households

Table (6) Types of House in Sample Households

Type of House	Frequency	Percent
RC brick house	15	5.1
Brick pillar	113	38.6
Wooden house with zinc roofing	137	46.8
Wooden wall with nipah roofing	11	3.8
Bamboo wall with nipah roofing	7	2.4
Bamboo wall with zinc roofing	10	3.4
Total	**293**	**100.0**

Source: Survey Data, 2020

Figure (5) Types of House in Sample Households



Source: Survey Data, 2020

The above table shown, it is found that 46.8% of houses are wooden houses with zinc roofing. It is maximum of total houses. There are 38.6% brick pillars, the second greatest number of houses. Other types of house are brick house (5.1%) , wooden wall with nipah roofing (3.8%), bamboo wall with zinc roofing (3.4%) and bamboo wall with nipah roofing (2.4%).So the living standard of sample households is found great.

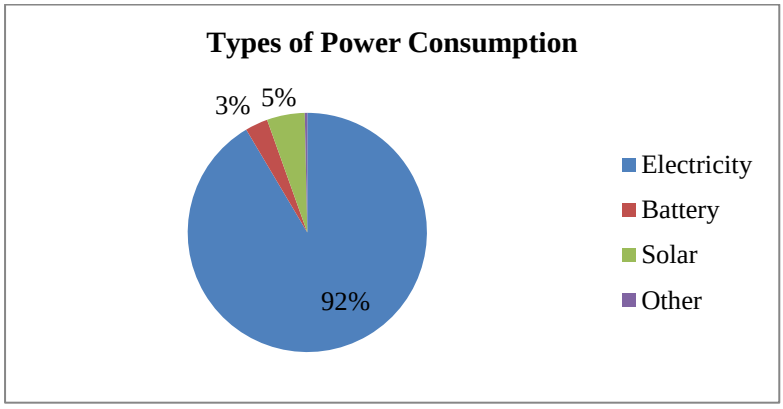
Types of Power Consumption

Table (7) Types of Power Consumption

Power consumption	Frequency	Percent
Electricity	268	91.5
Battery	9	3.1
Solar	15	5.1
Other	1	0.3
Total	**293**	**100.0**

Source: Survey Data, 2020

Figure (6) Types of Power Consumption



Source: Survey Data, 2020

As shown in the table above, it is found that 91.5% of sample households use electricity, the most of total power consumption. 5.1% use solar system, 3.1% use battery system and 0.3% use candle. It is also found that the living standard is great because they can use personal grades with electricity.

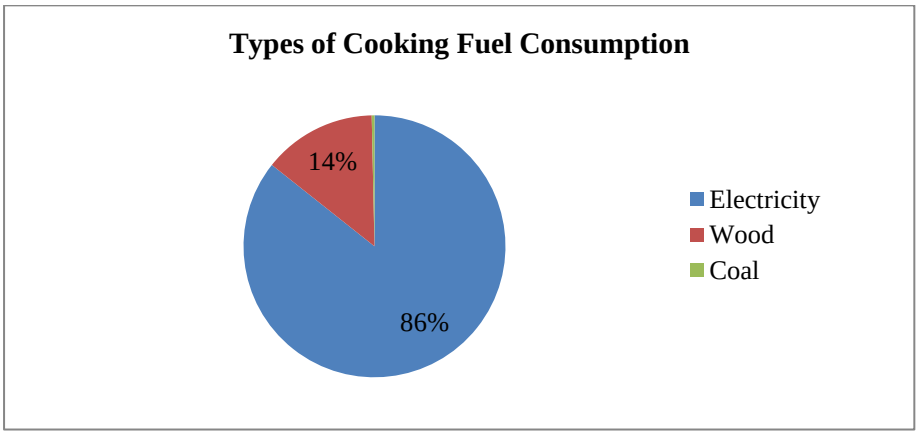
Types of Cooking Fuel Consumption

Table (8) Types of Cooking fuel consumption

Cooking fuel consumption	Frequency	Percent
Electricity	251	85.7
Wood	41	14.0
Coal	1	0.3
Total	**293**	**100.0**

Source: Survey Data, 2020

Figure (7) Types of Cooking fuel consumption



Source: Survey Data, 2020

According to the result, it is found that 85.7% of sample households use the electricity, 14% of them used the wood and 0.3% sample households used the coal for cooking.

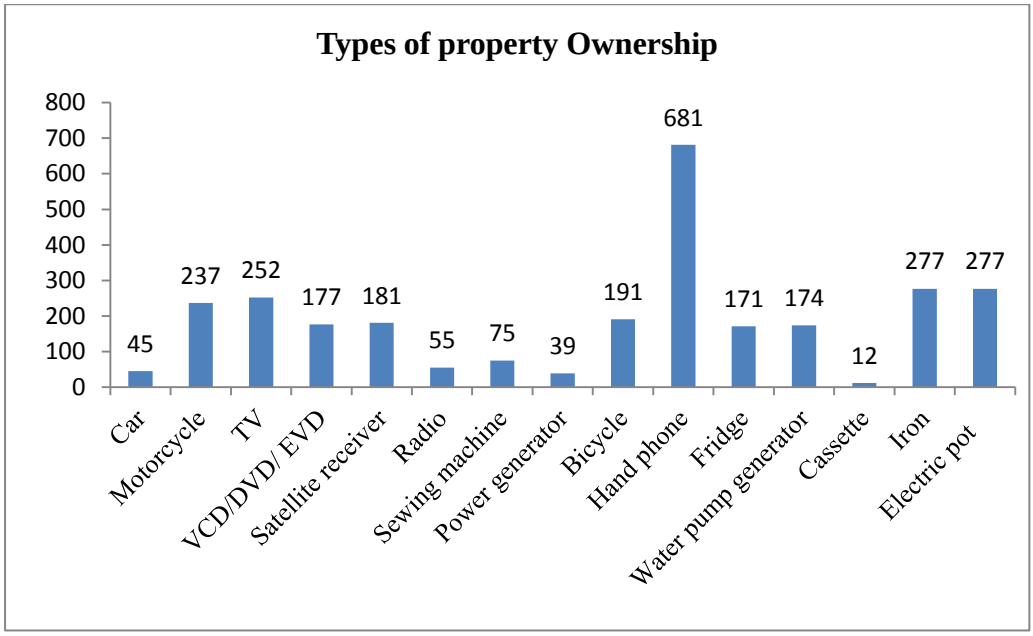
Types of Property Ownership of Sample Households

Table (9) Types of Property Ownership of Sample Households

Property Ownership	Frequency	Percent
Car	45	15.4
Motorcycle	237	80.9
TV	252	97.3
VCD/DVD/ EVD	177	60.4
Satellite receiver	181	61.8
Radio	55	18.8
Sewing machine	75	25.6
Power generator	39	13.3
Bicycle	191	65.2
Hand phone	681	232.4
Fridge	171	58.4
Water pump generator	174	59.4
Cassette	12	4.1
Iron	277	94.5
Electric pot	277	94.5

Source: Survey Data, 2020

Figure (8) Types of Property Ownership of Sample Households



Source: Survey Data, 2020

As the result, it is found that 15.4% of sample households own cars, 80.9% of sample households own motorcycles, 97.3% of sample households own televisions, 60.4% of sample sizes own VCD/DVD/EVD. 61.8% of sample sizes own Satellite receivers,18.8% of sample sizes own radios, 25.6% of sample sizes own sewing machines ,13.3% of sample sizes own power generators, 65.2% of sample sizes own bicycles, 232.4% of sample sizes own hand phones, 58.4% of sample sizes own fridges, 59.4% of sample sizes own water pump generator, 4.1% of sample sizes own cassette, 94.5% of sample sizes own irons and 94.5% of sample sizes own electric pots. It is therefore found that sample sizes own two hand phones each. According to the findings above, it is can be said that the living standard of Mingohn Village is found fair.

Transportation and Communication

Since it lies on Hlegu-Mingohn road, Mingohn Village enjoys smooth transportation and communication because YBS 45 Buses drive from 5 am to 5 pm in every day. Goods are transported to other towns and cities.

Use of fly-proof Latrine

In the survey, all sample households use fly-proof Latrine and so 100% of sample households in Mingohn Village use fly-proof Latrine.

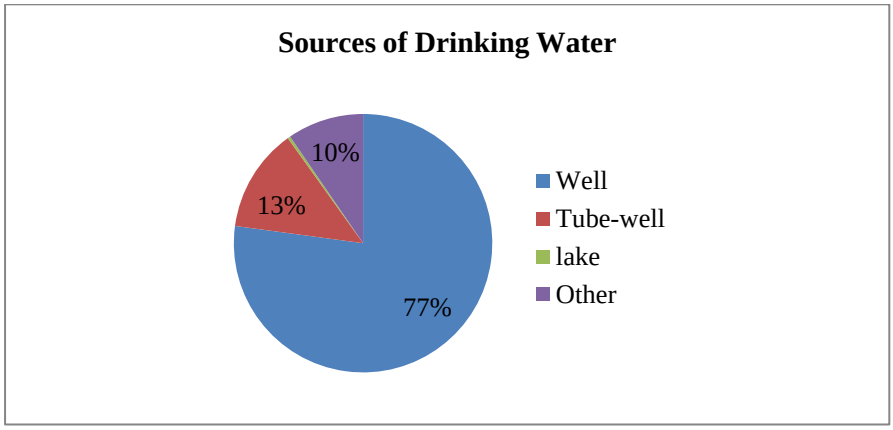
Sources of Drinking Water

Table (10) Sources of Drinking Water

Sources of Drinking water	Frequency	Percent
Well	226	77.1
Tube-well	38	13.0
lake	1	0.3
Other	28	9.6
Total	**293**	**100.0**

Source: Survey Data, 2020

Figure (9) Sources of Drinking Water



Source: Survey Data, 2020

According to the findings, it is found that 77.1 % of sample households use well, 13.0 % of sample households use tube -well ,9.6% of sample households use other and 0.3% of sample households use lake.

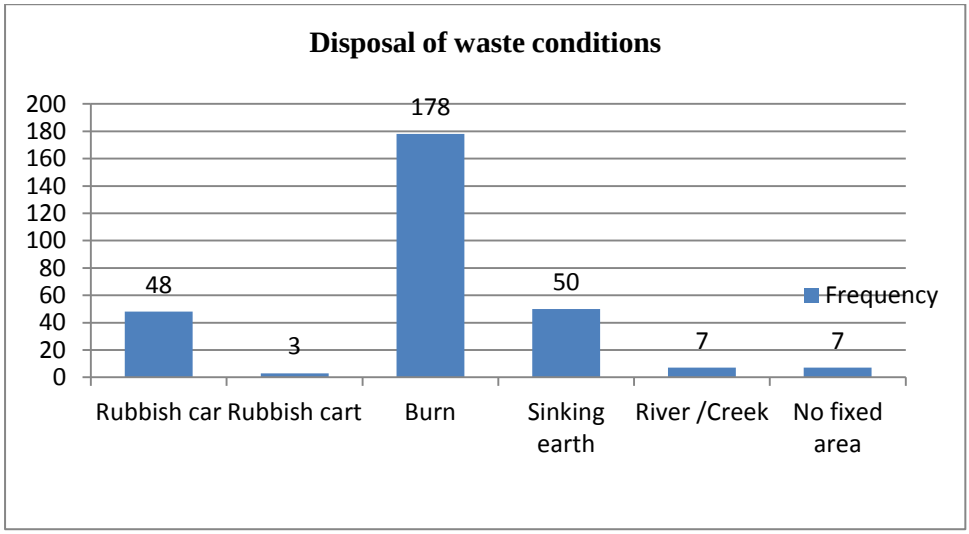
Disposal of Waste Conditions

Table (11) Disposal of Waste Conditions

Disposal of Waste Condition	Frequency	Percent
Rubbish car	48	16.4
Rubbish cart	3	1.0
Burn	178	60.8
Sinking earth	50	17.1
River /Creek	7	2.4
No fixed area	7	2.4
Total	**293**	**100.0**

Source: Survey Data, 2020

Figure (10) Disposal of Waste Conditions



Source: Survey Data, 2020

According to the survey data, it is found that 60.8% of sample households disposed by burning the waste, 17.1% of sample households disposed by sinking the waste in the ground, 16.4% of sample households are disposing the waste in rubbish car and 5.8% of the total people are disposing the waste river/creek, rubbish cart and no fixed area. Therefore it can be seem most sample households are using burn for disposing the waste.

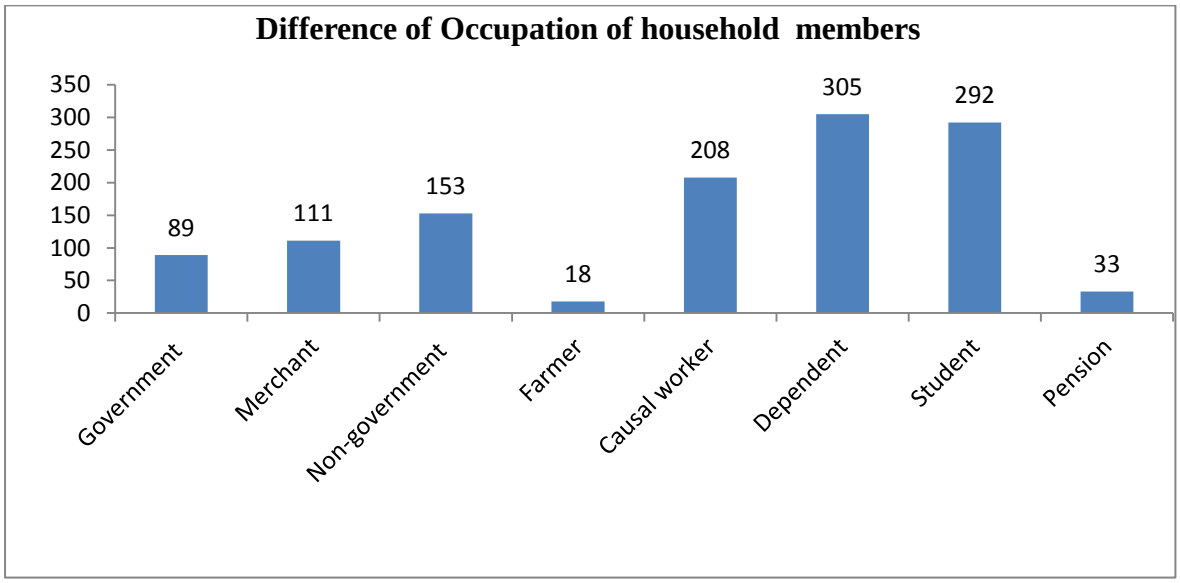
Types of Occupation in Sample Household Members

Table (12) Types of Occupation in Sample Household Members

Occupation	Frequency	Percent
Government	89	7.4
Merchant	111	9.2
Non-government	153	12.7
Farmer	18	1.5
Causal worker	208	17.2
Dependent	305	25.2
Student	292	24.2
Pension	33	2.7
Total	**1209**	**100.0**

Source: Survey Data, 2020

Figure (11) Types of Occupation in Sample Household Members



Source: Survey Data, 2020

According to the table, it is found that 17.2% or 208 of household members are causal workers, 12.7% of them or 153 household members are non-government services, 7.4% or 89 household members are government staff and there are 25.2% house workers (dependents) and 24.2% students. One significant point is that the number of dependents is greater than any other occupations.

Annually Income of Sample Household Heads

Table (13) Annually Income of Sample Household Heads

Income	Frequency	Percent
≤1000000	36	12.3
1000001-2000000	76	25.9
2000001-3000000	89	30.4
3000001-4000000	48	16.4
4000001-5000000	20	6.8
5000001-6000000	13	4.4
6000001-7000000	-	-
7000001-8000000	3	1.0
≥8000001	8	2.8
Total	**293**	**100.0**
Mean	2854870.307	
Minimum	0	
Maximum	30000000	
Standard Deviation	2987960.139	

Source: Survey Data, 2020

As the results, it is found that 30.4% of sample household heads earn between 2000001 kyats and 3000000 kyats per year, 25.9 % of them earn between 1000001 kyats and 2000000 kyats per year and 16.4% of sample size earn between 300001 kyats and 4000000 kyats per year.

Based on the survey data, the annually mean income of sample household heads was 2854870.307 kyats with a range of 0 kyats to 30000000 kyats and standard deviation of 2987960.139 kyats.

Annually Income of Sample Households

Table (14) Annually Income of Sample Households

Income	Frequency	Percent
≤2000000	17	5.8
2000001-4000000	111	37.9
4000001-6000000	115	39.2
6000001-8000000	27	9.2
8000001-10000000	10	3.4
10000001-12000000	5	1.7
≥12000001	8	2.8
Total	**293**	**100.0**
Mean	4855479.522	
Minimum	1200000	
Maximum	36000000	
Standard Deviation	3422197.699	

Source: Survey Data, 2020

In the table above, it is discovered that the majority of household or 39.2% of them earn between 4000001 kyats and 6000000 kyats per year, the second greatest annual income earn between 2000001 kyats per year and 4000000 kyats and it constitutes 37.9% of sample households, and the third greatest annual income earn between 6000001 kyats and 8000000 kyats per year and it is only 9.2%.It is found that the number of household earn annually income of over 12000001 kyats it is the greatest in Mingohn Village .

Based on the survey data, the annually mean income of sample households was 4855479.522 kyats with a range of 1200000 kyats to 36000000 kyats and standard deviation of 3422197.699kyats. It can be assessed that annually income of households in Mingohn Village it is found fair.

Types of Annually Expenditure

Table (15) Types of annually Expenditure

Expenditure	Food	%	Clothing	%	Education	%	Others	%
≤500000	-	-	221	75.4	217	74.1	152	51.7
500001-1000000	23	7.9	62	21.2	41	14.0	98	33.3
1000001-1500000	68	23.2	9	3.1	17	5.8	21	7.1
1500001-2000000	84	28.7	1	0.3	9	3.1	8	2.7
2000001-2500000	69	23.5	-	-	5	1.7	7	2.4
2500001-3000000	17	5.8	-	-	6	2.0	4	1.4
3000001-3500000	3	1.0	-	-	-	-	1	0.3
3500001-4000000	23	7.9	-	-	1	0.3	1	0.3
≥4000001	6	2.0	-	-	-	-	1	0.3
Total	**293**	**100**	**293**	**100**	**293**	**100**	**293**	**100**
Mean	3376133.11							
Minimum	850000							
Maximum	24600000							
Standard Deviation	2245166.935							

Source: Survey Data, 2020

As shown in the table, expenditure is studied in four different types of expenditure, food, clothing, education and others. Others are health, social affairs and so on. When studying the expenditure for food, it is found that 28.7% of the sample households spend between 1500001 kyats and 2000000 kyats, 23.5% of them spend between 2000001 kyats and 2500000 kyats and 23.2% of sample households spend between 1000001 kyats and 1500000 kyats. Food cover basic commodities such as rice, edible oil, salt, curry and snacks. When studying the expenditure for clothing, it is found that 75.4% of the sample sizes spend less than 5 lakh (kyats). So, it can be said that they don't spend much money on clothing. When studying the expenditure for education, it is found that 74.1 % of sample households spend less than 5 lakh (kyats). So, education expenditure of the sample households is fair. Other expenditure includes health, social affairs, maintenance cost which is less than 5 lakh (kyats). In short, health, social affairs, maintenance cost is greater than clothing and education.

Based on the survey data, the annually mean expenditure of sample households was 3376133.11 kyats with a range of 850000 kyats to 24600000 kyats and standard deviation of 2245166.935kyats.

Results of Regression Analysis

Table (16) Results of Regression Analysis

Variable	Coefficient	Std. error	T test	Significant
Constant	916195.72	115557.50	7..93	.000
Expenditure	0.52	0.01	27.25	.000
R	0.848			
Adj R Square	0.717			
R Square	0.718			
DW	1.836			
F Statistics	742.327			0.000

Source: Survey Data, 2020

a. Predictors: (Constant), income (per year)

b. Dependent Variable: Expenditure (per year)

The estimated simple linear regression model can be described as follows:

$Y = 916195.72 + 0.52\ X$

T-statistics (27.25)

R=0.848, R^2=0.718, Adj R^2=0.717, SE=115557.50, DW=1.836

According to the table (16), show that the constant is significant at the 1% level. The coefficient for X_i (0.52) is statistically significant using alpha of 0.05 because its p-value is 0.000 which is smaller than 0.05 between annually income and annually expenditure of sample households.. The Y intercept 916195.72 kyat indicates that when the sample households does not apply for the annually expenditure. The forecasted annually expenditure is 916195.72 kyats. The slope indicates that for the more of each one kyat in the annually income the estimated change in the annually expenditure is 0.52. the annually expenditure of the sample households is estimated to grow by an average of 0.52 kyat for the more of each one kyat in the annually expenditure of sample households. The value of R^2 is 0.718 that it is a strong correlation. The value of calculated Durbin Watson was 1.836. The regression coefficient between annually income and annually expenditure is 0.52 (t=27.25, p=0.000<0.01, see table (16). There is a direct relationship between annually income and annually expenditure of sample households.

And the *F*-value in the ANOVA model revealed a significant main effect for variables,

$F_{(1,291)} = 742.327$, p<0.05 that is shown in Table 3.16. The p-value associated with this *F* -value is less than 0.05. Therefore, the independent variables (annually income) can be used to reliably predict the dependent variable(annually expenditure).

Descriptive Statistics and Correlation Matrix Variable

Table (17) Descriptive Statistics and Correlation Matrix Variable

Variables	mean	Standard deviation	1	2
Annual income	4855479.522	3422197.699	1	0.557**
Annual Expenditure	3376133.11	2245166.935	0.557**	1

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

Pearson correlation was used to analyze the strength of relationship between two variables. According to (Evans, 1996), the size of the value of Pearson correlations (r) can range from -1.00 to 1.00. Therefore, r=0.00 to 0.19 assume "very weak", r=0.20 to 0.39 assume "weak", r=0.40 to 0.59 assume 'moderate", r=0.60 to 0.79" assume "strong" and r=0.80 to 1.00 assume "very strong". The data concerning research of independent variables (annually income) and dependent variable (annually expenditure) are statistically analyzed by the correlation analysis model. The correlation analysis was used to test the research hypotheses. There is a statistically significance with $p<0.01$, and R is 0.557. So, there is a moderate correlation.

CONCLUSION

The findings of socioeconomic situations of the 293 sample households of Mingohn Village, Hlegu Township, Yangon Region are expressed as below.

When studying the population of the sample households in Mingohn Village, most of the males and females are found in the middle age grouped people. As sex ratio is 87.2%, there are 88 males per 100 females. The number of the females is more than the males. As regards the dependency rate is 30.56%, there are 31 dependents each for 100 working people. The young dependency rate and elder dependency rate are 23.22% and 7.34% respectively. So, the number of working people is greater than the dependents.

Regarding child woman rate is too low, as the ratio is 116,16%.In addition the family size is neither too big nor too small because there are average 5 members in a family. When studying the married status, it is found that 75.1% sample household heads are married and domesticity is the greatest.

Concerning the education, it is found that, most of them attain higher education and a few of them are in monastic level and illiterate. Concerning the social, it is also found most of houses in Mingohn Village are wooden houses with zinc roofing and brick pillars. Electricity is used for the light and for operation electronic goods. So, the living standard is supposed to be light. In transportation and communication, it is found that sample household members in Mingohn Village enjoy smooth transportation and better communication as it is just in a convenient location. Any mean of transport such as near motor way can be used to go to other

towns and cities. So, it can be said that the village develops not only in transportation and communication but also in economic situation. In health, all sample households use fly-proof Latrine and so 100% of sample households in Mingohn Village use fly-proof Latrine.

Regarding the annual income and expenditure of the sample households, it is also found that the average annual income of sample households is 4855479.522 kyats and the average annual expenditure is 3376133.11 kyats, the maximum annual income of the sample households is about 360 lakh (kyats) and then annual expenditure is about 246 lakh (kyats). So, it can be said that sample households can save extra income.

The constant is significant at the 1% level. The coefficient for X_i (0.52) is statistically significant using alpha of 0.05 because its p-value is 0.000 which is smaller than 0.05 between annual income and annual expenditure of sample households. The estimated simple linear regression equation is $\hat{Y}_i = 916195.72 + 0.52X_i$. There is a very strong relationship between annual income and annual expenditure of sample households. The correlation analysis was used to test the research hypotheses. There is significance statistically with $p<0.01$, and R is 0.557. So, there is a moderate correlation.

Taking all these points into conclusion, it can be assessed that people of Mingohn Village enjoy fair living standard with temperature population.

Acknowledgements

First and Foremost, I would like to express my gratitude to Dr. Yi Yi Win, Rector of University of Co-operative and Management, Thanlyin for her guidance to all us. I am very grateful to Dr.Khin May Than (Professor/ Head of Department , Retired), Yangon University of Economics for her supervision on this research paper.

References

George W.B., David K.(2002). Statistics for Social Analysis (Third Edition), F.E.Peacock Publishers,INC,Itasca, illions, USA.

George W. S, Willliam G. C.,(1982). Statistical Methods (Seven Edition) , The Iowa State University Press, USA.

Jacob S.S., David A.S., (2004).The Methods and Materials of Demography,(Second Edition). Elsevier Academic Press, California, USA.

Mark L. B., David M. L., Timothy C. K., David F.(2011). Stephan-Basic Business Statistics - Concepts and Applications (Twelfth Edition) - Pearson ,San Francisco, New York.

Robert H.(2014). Handbook of Univariate and Multivariate Data Analysis with IBM SPSS (Second Edition) , Taylor & Francis Group, London, New York.

SAVING –ECONOMIC GROWTH NEXUS IN MYANMAR: CO-INTEGRATION AND CAUSALITY ANALYSIS

Zaw Htet Pine[1]

Abstract

Savings are important at both Micro and Macro level of a country. Increased Saving of people raises the economic growth and encourages investment source for the development of economy. This paper aimed at investigating causal relationship between gross domestic saving and economic growth (measuring with GDP in general sense) and identifying this relationship is unidirectional or bidirectional in Myanmar. And it is to test fitting of Solow's model and Keynes's theory for Myanmar. The study covers the period (1961- 2018). Methodology is based on the econometrics analytical approach to evaluate two -variable relationship by employing Augmented Dickey-fuller test, co-integration, Vector Error correction model and causality techniques. The study found that saving has a positive impact on economic growth in the long-term and Solow's model is consistent with Myanmar.

Key words: Saving, Economic growth, Gross Domestic Product, Vector Error Correction model, Keynes's theory, Solow's model

INTRODUCTION

Domestic savings are very crucial for the economic development of countries because investments come from savings. Savings is output of resources which have been unconsumed in current year and available for future periods. Saving is one of the important indicators of economic development where it is used to achieve economic growth in any developing country. Although there are lots of factors effecting economic growth (for example, technology, human capital, natural resource, entrepreneurship, market efficiency and international trade etc.), saving has pivotal role to play in driving engine of economic growth via direct investment according to Harrod-Domar Model . Myanmar, a developing country has a reasonable growth rate among developing countries (The World Bank,2018).

A country's economic growth is its capacity to increase production of goods and services compared to its previous period. Economic growth is a key macroeconomic concept of interest among researchers and policy makers all over the world. Macroeconomic indicators stem from its critical role in effecting other integral part of economy and livelihoods. If a country grasps long-term growth, it will have a positive impact on national income and the level of employment, which increases the standard of living.

Higher economic growth also leads to greater tax income for government spending, which the government can make a greater expenditure to develop the economy. This expansion can also be used to reduce the budget deficit. Additionally, if the population

[1] Lecturer, Department of Economics, University of Co-operative and Management, Thanlyin

growth of a country goes up, it requires growth to meet its standard of living and wealth. Because saving is very important for economic growth, this study focuses on saving and economic growth relationship in Myanmar.

RATIONALE OF STUDY

The causal relationship between saving and economic growth has caught global attention among researchers and policy makers from both developed and developing countries in the last decades. Robert Solow (1956)'s neo-classical growth model postulates an explicit link between saving and economic growth. Higher saving gives rise to higher investment, which in turn leads to higher economic growth. Therefore, this makes strong macroeconomic policy recommendations for development in many countries. And investigation of the significant relationship between saving and economic growth plays an important part due to its useful information for government and related authorities can control the targeted variables or variables in order to attain desired level of growth.

Therefore, the current paper tries to examine the causal relationship between domestic saving and economic growth for Myanmar using Augmented Dickey- Fuller test for Unit root, Co-integration technique, Vector error correction model and causality test.

Objectives of Study

1. To investigate relationship between gross domestic saving and gross domestic product of Myanmar
2. To identify direction of two variables
3. To search for theory relevant for Myanmar

Research Questions

1. Is there causal relationship between saving and economic growth?
2. Are these two variables unidirectional or bidirectional?
3. Which theory is appropriate, Keynesian theory or Solow growth model for Myanmar?

Method of Study

Annual time-series data for gross domestic product and gross domestic saving are obtained from the World Bank and Asian Development bank. The study covers periods from 1961 to 2018 (57 years). Therefore, this research is done by using secondary data. Based on econometric model Augmented Dickey-fuller test, co-integration, Vector Error correction model and causality techniques are applied.

LITERATURE REVIEW

In the econometric literature, a number of studies have been conducted to analyze the relationship between savings and economic growth in many developing countries. Increased savings stimulate economic growth through increased investment (Bebczuk 2000). This approach is recommended by Harrod (1939), Domar (1946) and Solow (1956) growth

models. Also outcomes of empirical research by Alguacil, Cuadros and Orts (2004) as well as by Singh (2009) provide support for the hypothesis that increased savings promote economic growth. Economic growth theories postulate that the dynamics of the country's economic growth increases if the investment in human or material capital or in scientific research and development (R&D) grows.

Higher domestic savings led to higher investment and therefore contributed to higher rate of economic growth in 32 countries (Krieckhaus).Abu(2010) investigated the relationship between savings and economic growth in Nigeria applying Granger causality technique and co-integration, concluding there was long-run equilibrium relationship between them. It was found that the benefits of savings have a great impact on economic growth(Harrod,1939;Solow,1956;Oladipo,2010;Roman,2005;Jappelli&Pangano,1994;Aghio n,Comin,Howitt,&Tecu,(2009) while (Sinha,1998&2008; Abu,2010; Ijeoma, Paramaiah,& Moshoshoe,2011) confirmed causality runs from economic growth to saving. But Keynesian model stressed that growth of output (income) causes increase in saving.

Recently, the idea of the causality has been used in many researches on relationship between savings and economic growth. Caroll and Weil (1994), relying on the data of five year average rates of economic growth in OECD member states and this causality test came to the conclusion that economic growth rate was the cause of savings in Granger sense. However, Attanasio, Picci and Scorcu (2000) questioned the reliability of the results obtained by Caroll and Weil (1994), implying that the use of annual data instead of average data from five years improves the precision and statistical importance of estimates and changes the structure of the causal relationship between variables. Mohan (2006) analyzed the relationship between economic growth and savings in four groups of countries with various levels of economic development in the 1960-2001 period, employing Granger technique. The results of this research revealed that in 13 of the analyzed countries economic growth was the cause of increased savings in Granger sense. Savings being the cause of economic growth were obtained in two countries as the opposite results. In five countries, however, the scientist confirmed the existence of a two-way relationship between economic growth and savings. The relationships between domestic savings, direct foreign investment and economic growth in Kazakhstan in the 1993-2002 Period were analyzed using the Granger causality test and co-integration methods (Katircioglu and Naraliyeva (2006). The results found one-way, positive relation between domestic savings and economic growth in Kazakhstan in a long period of time.

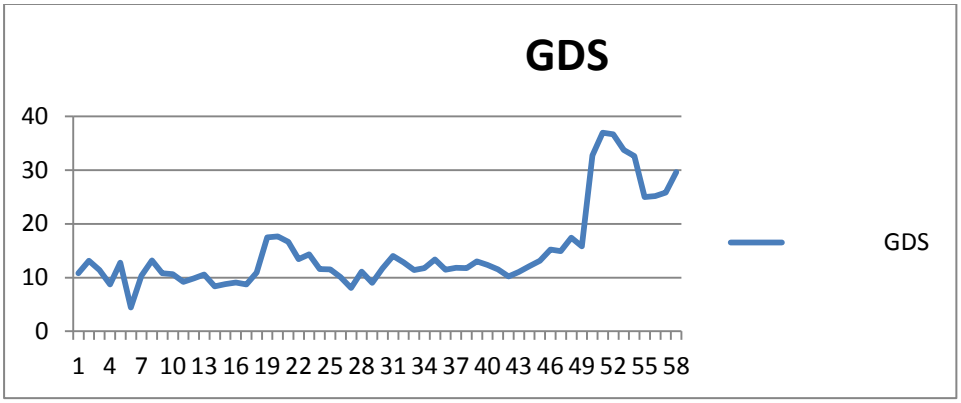
OVERVIEW OF SAVING AND ECONMIC GROWTH OF MYANMAR

Higher rate of savings is associated with higher rate of economic growth and development, while low savings lead to vicious circle and economic stagnation in the conventional wisdom. Savings is very important for Myanmar due to its stage of growth (pre-

condition for take-off). However, domestic saving rate has been low for decades in Myanmar compared to other Asian countries. The reasons are that majority of Myanmar people are low incomes with lack of education and alternative employment opportunities and a primarily rural population engaged in agriculture and related activities. Moreover, until recently Myanmar has limited access to financial services, explaining low levels of formal saving partly.

The following chart provides information about the rate of gross domestic saving from GDP in Myanmar in the periods between 1961 and 2018. Gross domestic savings are computed as GDP less final consumption expenditure (total consumption). Units are measured in percentage. Overall, the data can be seen that Myanmar gross saving rate is found to be fluctuated but gradually become higher.

Figure (1) Rate of Gross Domestic Saving in Myanmar

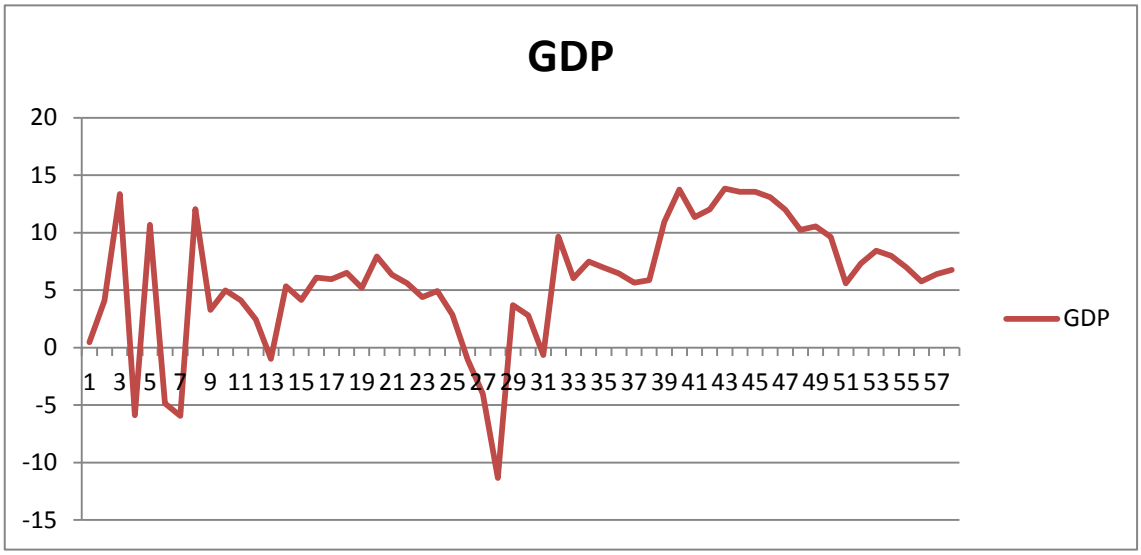


Source: World Bank

Figure (1) indicates percentage of saving. Gross saving rates were under 15% respectively during the periods between 1996 and 2004. The worst percentage amounting to below 5% was in the year 2002 and 2003. However, from the beginning of 2008, surprisingly, saving rate sharply went up up to over 15% except a little bit decline in 2009. Over the following years, the patterns of saving were noticeably different. The percentage of gross savings from GDP increased radically to 33% in 2010 and then over 35% in 2011 and 2012. Myanmar's gross savings rate was 26.7% in the year ending 31 March 2017 compared with 26.2% in the year ending 31 March 2016. Gross domestic savings (% of GDP) in Myanmar was at 29.59 % in 2018.

The figure (2) illustrates yearly GDP growth rate of Myanmar, which covers the periods from 1961 to 2018. At the start of period, the figure fluctuated heavily and this trend looked gentle in the periods between 1980 and 1985. Following years GDP growth rate fell sharply due to the political upheaval and state strike. After 1990s, the line graph shows smoother, meaning that the growth rate become stable generally. However, in 2019, the growth rate saw a sharp decline amounting to 2.9% especially due to COVID-19 effects.

Figure (2) The Rate of Gross Domestic Product of Myanmar



Source: World Bank

Owing to table (2) Myanmar's GDP represents 0.06% of world economy. Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars.

Model Estimation

This paper applies econometric model based on the Keynesian model and Solow's hypothesis. Keynesian model postulates that Saving "S" is a function of income (Y). Therefore,

$$S = \alpha_0 + \alpha_1 Y + \epsilon_1 \qquad (1)$$

Empirical Test and Discussion

After stating saving and growth equations, a unit root (stationary) test is performed in order to make sure time series are stationary or non-stationary. The reason is to abstain from spuriousness of regression outcomes. Stationary test is needed in better economic theory before estimating their relationship. Thus, the results of stationary test are expressed as follows:

Hypothesis for GDP and GDS-

Null hypothesis H_o: GDP have a unit root (Non-Stationary)

Alternative hypothesis H_1: GDP does not have a unit root (Stationary)

Null hypothesis H_o: GDS have a unit root (Non-Stationary)

Alternative hypothesis H_1: GDS does not have a unit root (Stationary)

Table (1) Results of Dickey-Fuller test for unit root

	P-value for Z(t)	Test statistic	1% critical value	5% critical value	10% critical value	Order of Integration
GDP	0.0000	-5.645	-4.135	-3.493	-3.176	Stationary at level
GDS	0.0000	-7.748	-4.137	-3.494	-3.176	Stationary at first difference

Source: Researcher's estimation using STATA Software

According to Table(1), the stationary test indicates and the variable GDP is stationary at level at 1%, 5% and 10% respectively because P-value for GDP is smaller than 0.05 (95%) and absolute value of test statistics is greater than all critical value of GDP. Therefore, null hypothesis stating GDP has a unit root is rejected. However, the variable GDS become only at first differencing at 1%, 5% and 10% respectively leading to rejection of null hypothesis, assuming GDS has a unit root. The test statistics is negative. By contrast, the more negative the value of test statistics, the stronger the evidence for rejecting the null hypothesis of a unit root.

Tests for Co-Integration

After examining unit root test for stationary, in this section, second phase is to investigate whether two variables are co-integrated using co-integration rank of Vector Error correction model (Johansen co-integration test). In this regard, there exists the following hypothesis.

H_0: there is no co-integration between two variables

$H_{1:}$ there is co-integration between two variables

Table (2) Result of Co-integration

Maximum rank	eigenvalue	Trace statistic	5% critical value
0		26.8394	15.41
1	0.31288	6.2005	3.76
2	0.10661		

Source: Researcher's estimation employing STATA Software

Table (3) Result of co-integration

Maximum rank	eigenvalue	Maximum statistics	5% critical value
0		20.6389	14.07
1	0.31288	6.2005	3.76
2	0.10661		

Source: Researcher's estimation employing STATA Software, August 2020

In this test, only trace statistics, maximum statistics and critical value are taken into consideration whether two variables are co-integrated or not. Trace statistics (26.8394) is found to be higher than the critical value (15.41) at 5% level in the maximum rank of 0 and the value of trace statistics (6.2005) is higher than critical value (3.76) in the maximum rank of 1. Likewise, maximum statistics (20.6389 and 6.2005) also shows greater than the critical values (14.07 and 3.76) at 5% level in the maximum ranks 0 and 1respectively. Thus, Null hypothesis (H_0) is rejected. It indicates 2 co-integration equations at 5% level. Because two series are co-integrated, they exhibit a long-run relationship. It can be inferred series are related and can be combined in a linear fashion. Even if they are at shocks in the short-run, which may affect movement in the individual series, they would converge over time (in the long-run). Thus it is needed to estimate long-run models. The estimation requires the use of Vector Error Correction model (VECM).

Long-run results of VECM and Causality

In this section, causal relationship between two variables is checked using Vector Error Correction model and causality test. GDP and GDS are interchangeably used as explained variables. Table 4 and 5 shows all results of relationship.

Table (4) Result of causality (Johansen normalization restriction imposed)

Beta	Coefficient	Std. Error	Z	p> | z|	95% conf. interval
Ce1					
GDP	1				
GDS	-7.212811	1.495966	-4.82	0.000	-10.14485 - 4.280772
cons	-3.339776				

Source: Researcher's estimation, employing STATA Software

In table (4) Ce1 refers to error correction term. GDP is stated as dependent variable according to Solow's model. The signs of coefficients are interpreted to be reversed in the long-run according to VECM meaning the variables are elasticity relationship. The table (4) illustrates P-value of GDS (0.000) is smaller than 0.05(95% confidence level). Thus, GDS (gross domestic saving) has a positive impact on GDP (gross domestic product) in the long-run and the coefficient (-7.212811) is statistically significant at 1% level (99% confidence). A percentage change in GDS would result in 7.21% increase in GDP.

Table (5) Result of Causality (Johansen normalization restriction imposed)

	Coef.	Std. Err.	z	P>|z|	95% Conf. Interval
_ce1					
GDS	1				
GDP	-.1386422	.107504	-1.29	0.197	-.3493461 .0720617
cons	.4630339				

Source: Researcher's estimation employing STATA Software

In table (5) GDS is stated as dependent variable according to Keynesian theory. The table (5) illustrates P- value of GDP (0.197) is bigger than 0.05 (95% confidence level). Thus, GDP (gross domestic product) has no impact on GDS (gross domestic saving) in the long-run. To sum up outcomes mentioned above, GDP and GDS have a unidirectional running from saving from economic growth, not vice versa. Therefore, Keynesian theory is rejected while Solow's hypothesis is accepted in this study. Various measures for government would be to take optimal monetary and tax policy in order promote saving.

Diagnostic Test for VECM

Diagnostic tests such as autocorrelation and test for normality are conducted to make sure whether VECM is correctly specified or not.

H_o: there is no autocorrelation at lag order

H_1: there is autocorrelation at lag order

Table (6) Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	4.6966	4	0.31987
2	9.1189	4	0.05820

Source: Researcher's estimation employing STATA Software

In table (6), at lag 1 and lag 2, p-values are insignificant and therefore null hypothesis is accepted while alternative hypothesis is rejected. This means at lag 1 and lag 2, VECM model is free from autocorrelation problem.

H_o: Residuals of variables are normally distributed

H_1: Residuals of variables are not normally distributed

Table (7) Normality test

Equation	chi2	Degree of freedom	Prob>chi2
D_GDP	5.939	2	0.05134
D_GDS	181.809	2	0.00000
All	187.747	4	0.00000

Source: Researcher's estimation

In table (7), p-values of GDP and GDS are lower than chi2 value and alternatively chi2 values are greater than P- values, indicating H_o is accepted while H1 is rejected. Hence, residuals of variables are normally distributed.

FINDINGS AND SUGGESTIONS FOR POLICY IMPLEMENTATION

This paper investigates causal relationship between saving and economic growth in Myanmar. The study found that saving and economic growth has long-term relationship while causality statistics indicates that the two variables are unidirectional running from saving to economic growth. According to researcher's model estimation, Solow's model that saving precedes economic growth is accepted while Keynesian theory with the assumption of higher economic growth leading to higher saving rate is rejected. Therefore, saving plays a major role in Myanmar' economic growth and it is recommended that government and policy makers should establish policies that will increase saving so as to accelerate economic growth which in turn leads to economic development. Because people's income is the major determinant of saving, wage policy needs to be reconsidered from central and local government point of view. For many employment opportunities, foreign direct investment policy requires amendments. Interest of people for increased saving may also be persuaded through taxation. It is recommended to introduce the reasonable model of taxation based on benefits on incomes from investments. And, fruitful results of transformation of people's saving are determined by strong financial institutions and their attractive financial instruments. Thus, the measures for government would be to take optimal monetary and tax policy. Thus, monetary authorities-concerned need to conduct as a facilitator in this regard.

NEED FOR FURTHER RESEARCH

Though saving is very important for economic growth, further researches are needed to do how other variables (FDI, electricity, trade, government expenditure, interest rate, technology capability, human capital etc.) effect economics growth

Acknowledgements

I would like to express my special thanks to Professor Dr. Yi Yi Win, Rector of University of Co-operative and Management, Thanlyin who gave me the golden opportunity to read this wonderful research. Furthermore, I would also like to show my deep gratitude to Silja Bellinger, Research Mentor from Frankfurt school of Finance and Management, who supervised my paper and ERB in Yangon University of Economics for reviewing my paper.

References

Abu, N., 2010. Saving-economic growth nexus in Nigeria, 1970-2007: Granger causality and co-integration analyses. *Review of Economic and Business Studies (REBS)*, (5), pp.93-104.

Bairamli, N. and Kostoglou, V., 2010. The role of savings in the economic development of the Republic of Azerbaijan. *International Journal of Economic Sciences and Applied Research*, *3*(2), pp.99-110.

Ciftcioglu, S. and Begovic, N., 2010. Are domestic savings and economic growth correlated? Evidence from a sample of Central and East European countries. *Problems and perspectives in management*, (8, Iss. 3), pp.30-35.

El-Seoud, M.S., 2014. Testing the Relationship between Private Savings and Economic Growth: Case of Bahrain. *Global Journal of Commerce and Management Perspective*, *1*, pp.38-44.

Farhan, M. and Akram, M., 2011. Does Income Level affect Saving Behaviour in Pakistan? ARDL approach to co-integration for empirical assessment. *Far East Journal of Psychology and Business*, *3*(3), pp.62-72.

GUJARATI, D. N., & PORTER, D. C. (2010). *Essentials of econometrics*. New York, McGraw-Hill/Irwin.

https://tradingeconomics.com/myanmar/gdp

https://tradingeconomics.com/myanmar/gross-domestic-savings-percent-of-gdp-wb-data.html

https://www.intelligenteconomist.com/economic-growth

https://www.macrotrends.net/countries/MMR/myanmar/gdp-growth-rate

https://www.mmtimes.com/news/myanmar-seeks-boost-savings.html

Jagadeesh, D., 2015. The impact of savings in economic growth: An empirical study based on Botswana. *International Journal*, *10*.

Lean, H.H. and Song, Y., 2009. The domestic savings and economic growth relationship in China. *Journal of Chinese Economic and Foreign Trade Studies*.

Misztal, P., 2011. The Relationship between Savings and Economic Growth in Countries with Different Level of Economic Development (Wspólzaleznosci miedzy oszczednosciami i wzrostem gospodarczym w krajach o róznym poziomie rozwoju gospodarczego). *Finansowy Kwartalnik Internetowy e-Finanse*, *7*(2), pp.17-29.

Mphuka, C., 2010. Are Savings Working for Zambia's Growth?. *Zambia Social Science Journal*, *1*(2), p.6.

Myanmar Insider (2018). Saving Habits of people in Myanmar

Najarzadeh, R., Reed, M. and Tasan, M., 2014. Relationship between savings and economic growth: The case for Iran. *Journal of International Business and Economics*, *2*(4), pp.107-124.

Sothan, S., 2014. Causal relationship between domestic saving and economic growth: Evidence from Cambodia. *International Journal of Economics and Finance*, *6*(9), p.213.

Turan, G. and Gjergji, O., 2014. What is the impact of savings on growth? The case of a small open economy (Albania). *Mediterranean Journal of Social Sciences*, *5*(13), pp.360-360.

Wooldridge, J. M. (2013). Introductory econometrics: A modern approach. 5th ed. Mason, OH: South-Western Cengage Learning.

www.worldbank.org, Myanmar Overview

A STUDY ON MIGRATION OF NAUNG KA YEE VILLAGE IN MON STATE

Ye Htut Aung[1]

Abstract

This paper is concerned with the migration of households in Naung Ka Yee village. Naung Ka Yee village is situated in Mawlamyine Township at Mon State. There were (8) wards in Naung Ka Yee village. This study has the objective to analysis Naung Ka Yee village migration and the effect of migrant, remittance on living standard condition of Naung Ka Yee villages. Naung Ka Yee village economy is depending on the agriculture sector. The samples of 310 head of households were collected by using simple random sampling. According to the analysis, households which have migrants increase both income and expenditure through remittance of migrants leading good living standard condition.

Key Words: Migration, Remittance of migrant, Demographic, Internal Migration, Per-Capita Income

INTRODUCTION

Myanmar people get the more salaries to migration to other countries. Myanmar peoples migration within across its long borders, which cover Thailand, Laos, China, Malaysia, Singapore, Japan and South Korea. Many people migration are i-migration and e-migration as they want to improve their living standard to back up family member, for marriage, for education or to provide their livelihoods. Moreover the income earning and education status of households with migrant workers are highly more than others households. The major shifts that the country is experiencing- industrialization, urbanization, greater connectivity, peace process, regional integration and climate change to name a few will further induce greater movements of people. The prospect of economic growth alone suggests that an additional 10 million people or nearly one-third of Myanmar's rural population of 36 million will migrate from villages to cities to take up non-farm employment in a couple of decades. Migration, whether it is internal movement or international, has increasingly become a widespread livelihood is strategy for people in Myanmar. At the same time, a closer looks at the migration of the dynamics regions clearly show that migration takes place as a result of complex local conditions, including the proximity to livelihood opportunities and established social networks.

Objectives of the Study

- To analyses Naung Ka Yee Village migration and its support to economic development and
- To analyses the effect of migrant, remittance on living standard condition of Naung Ka Yee Village in Mon State

[1] Lecturer, Department of Economics, University of Co-operative and Management , Thanlyin

Scope and Limitations of the Study

This paper focuses on the households in Naung Ka Yee Village and collected data from 310 households out of 4340 households from the four selected villages. These primary data are collected during 2020.

Method of the Study

This study used the descriptive survey method. The secondary data collected form Naung Ka Yee administrative villages documents of Mawlamyine Township, Mon State and government publication, relevant texts and previous research paper and internet websites. The primary data collected from four selected villages of Naung Ka Yee villages.

LITERATURE REVIEW

In this sector will be present of population structure and migration models, migration of labor geographically, migration and Myanmar.

Population Structure and Migration Models

Any economic policy that effect rural and urban incomes will influence migration; this, in turn, will be effect sectorial and geographic economic activity, income distribution and even population growth. About half of the world's population lives in cities; by 2025, nearly two-thirds will live in urban areas. Most of the urban growth is taking place in the developing world. The pattern of this growth and its implication are complex. Urban population growth in the developing world is far more rapid than population growth generally; migrants account about half of the urban growth for from rural areas.

The Todaro migration models postulate that observed migration is individually rational but that migrants respond to urban-rural differences in expected rather than rural earnings, which may in turn be even higher than urban traditional-sector earnings. Migration occurs until average or expected rather than actual incomes are equal across regions, generating equilibrium unemployment of underemployment in the urban traditional sector.

While migration is mostly about flows, its impact on population structure and trends is also a major issue both at national and regional levels. Migration affects population growth, age and sex structures and related dependency ratio. The migration countries, it depletes cohorts, mostly at young adult ages, and it increases the youth bulge in immigration countries. Its impact on the labor force, distribution of income, women empowerment and families can have positive as well as negative effects on poverty and consequently on MDGs. Poverty is acknowledged to be a comer stone of MDGs attainment. Migration, through its impact on population can have effect on access to quality services and contribute to poverty reduction that are both necessary to achieve the MDGs.

Migration of Labor Geographically

The migration of labor geographically, out of rural areas and occupationally out of farm jobs, is one of the most pervasive features of agricultural transformations and economic growth. This is true both historically in developed countries (DCs) and currently in less-developed countries (LDCs). Among nations, the share of rural population declines sharply as per-capita incomes increase, from 70 to 80 percent in countries with the lowest per-capita GNPs to less than 15 percent in the highest-income countries. The share of the national workforce in agriculture plunges even more sharply from 90 percent or higher in low-income countries to less than 10 percent in high-income countries.

As internal migration redistributes populations and workforces from rural to urban areas many countries including those with the world's most dynamic fruit, vegetable and horticultural crop production turn to foreign-boom migrants frequently of rural origin for labor.

The world's great migrations out of rural areas are accelerating making internal and international migration potentially one of the most important development and policy issues of the 21st Century. The greatest migration potential is in China, where 71 percent of the population is rural and an estimated one-third of the rural labor force of 450 million is either unemployed or underemployed.

Migration and Myanmar

Due to the economic crisis in 1997, manufacturing and other industries in most advanced economies were closed down and many employees were retrenched. Asian countries including Japan, Korea and Singapore are also facing with lay-off problems as a result of recession. Therefore, many migrant workers in these countries lost their jobs. Although this situation can affect Myanmar nationals who are working in foreign countries, it depends on the type and nature of jobs and qualification and education required by respective industries.

However, Myanmar is able and ready to job opportunities to them in the sectors of agriculture, oil palm plantation and fishery. And measures are being undertaken by distributing leaflets regarding job vacancy announcement as well as advertising job vacancies announcement as well as advertising job vacancies on notice boards at entrances and airports for jobseekers. At present, Myanmar employees have been still working in engineering, services, managerial and other skilled related sectors in many foreign countries. The movement of skilled and educated professional workers has predominantly been toward the developed countries while the movement of unskilled or relatively less skilled workers has been more around intra-regional and cross border areas. It is also found that more skilled and professional Myanmar migrates to Singapore and other developed countries while more of the unskilled Myanmar have been working in Thailand and Malaysia. In Myanmar there are more than 110 private overseas employment agencies registered under the overseas mployment legislation and thousands of Myanmar workers are assigned to overseas employment month.

BACKGROUND HISTORY OF THE VILLAGE

In this section will be present location and selected villages and economic conditions of Naung Ka Yee villages.

Location and Selected Villages

Naung Ka Yee village is situated at 25 miles far from Mawlamyine Township. It is bounded by Hpan-an township and Paung Township on the North, Kyaikmaraw Township on the East, Mudon Township on the south and Chaungzone Township on the west. Although it is a coastal township and which consists of 19 villages and 18wards. Kawhmet Village and Kawhlar Village are Located in North side and Pa auk and Yogo Villages are south sided in the Township of Mawlamyine.

The shape of the four villages is elongated with north-south extent of 36,8km (23 miles) and east-west breadth of 14.4km (9 miles). The Yankin Ridge, the central portion of that township divided the major and minor urban areas of the Township. It also divides Mawlamyine River side and Ataran River side. Arable lands on both sides are contiguous with urban center.

Economic Conditions of Naung Ka Yee Village

The main economic activity of the Naung Ka Yee villages is agriculture sector. The cultivation in this village main crop is paddy and then multi-crop. Multiple cropping and double cropping are typical for the area because single cropping is not sate for the farms facing the meager and unreliable rainfall. Double cropping is partied in the paddy lands. Livestock and fishery plays a crucial role in household food security as it provides a source of income and nutrition as well being a key asset especially during times of extreme crisis. Common livestock include pigs, poultry and cattle. The cattle are most important for livestock of households.

DATA ANALYSIS

1. Survey Profile

A survey profile for a study on migration of workers from Mawlamyine Township of Myanmar it includes four villages Ya Khine Kone, Kawhlar, Pa auk and Yogo. The survey was carried out 5 weeks in April, May 2020 when 300 households were surveyed. The respondents were household heads the sample size was calculated using the sampling survey method to cover the population.

2. Population

Unlike other region, the majority of the national races residing in these four villages are Mon and Bahmars. Total households, population and sex ratios of surveyed villages are shown Table (1).

Table (1) Household and Population Number of Selected Villages

Village	Household	Population				Total
		Male	%	Female	%	
Ya Khine Kone	380	1347	36.02	2393	63.98	3740
Kawhlar	153	4019	43.78	5160	56.22	9179
Paout	384	2450	47.02	2761	52.98	5211
Yogo	563	761	20.55	2942	79.45	3707
Total	4340	8577	39.28	13256	61.72	21833

Source: Survey Data, 2020

In these villages, it is found that every household owns a house. The total number of households in 20202 is 4348 and total population is 21833 in four villages. The average family size is 4.96 persons per household. Kawhlar Village has the largest number of households with 153 households and population 9179 persons and it also has the largest average family size with 5.06 persons per household. Yo go village has the smallest number of household, 563 and population is 3707.

3. Household Sample Size

The following table (2) shows that households sample by four selected villages of Naung Ka Yee Villages in Mon State.

Table (2) Household Sample Size by Selected Villages

Particular	Ya Khine Kone	Kawhlar	Paout	Yogo	Total
Sample Household	75	150	45	40	310

Source: Survey Data, 2020

The data collection in household level interviews includes health, education, economy, biography, house size, numbers of children, occupation, food supply, income, sources of income, educational qualification of family members and migrant workers. In the survey, total sample household is 310 head of Naung Ka Yee village.

4. Age, Education and Marital Status of Reported Migrant Workers

There were a total of 310 migrant workers reported by respondents in this study. Frequency and percentage distribution of number of reported migrant workers is presented in table (3).

Table (3) Percentage Distribution of Reported Migrants Workers by Their Age Group

Age	Ya Khine Kone		Kawhlar		Paout		Yogo		Total	
	No	%	No	%	No	%	No	%	No	%
01-15	-	-	2	1.33	1	2.22	-	-	3	0.97
16-20	6	8.00	16	10.67	4	8.89	2	5.00	28	9.03
21-25	17	22.67	24	16.00	12	26.67	16	40.00	69	22.26
26-30	27	36.00	28	18.67	16	35.56	6	15.00	77	24.84
31-35	4	5.33	28	10.67	5	11.11	7	13.50	44	14.19
36-40	6	8.00	22	14.66	2	11.14	3	7.50	33	10.65
41-45	8	10.67	21	14.00	5	11.11	-	-	34	10.96
46-50	3	4.00	9	6.00	-	-	4	10.00	16	5.16
51-55	4	5.33	-	-	-	-	2	5.00	6	1.94
Total	75	100	150	100	45	100	40	100	310	100

Source: Survey Data, 2020

From this table, it is found that 77 migratnt worker 24.24% age bracket 26-30 years, having the largest percentage and second largest percentage is 22.26% is 69 migrant workers between 21 and 25 years.

5. Education Level of Reported Migrant Workers by Their Education Level

Frequency and percentage distribution of reported migrant workers in this study is presented in table (4).

Table (4) Education Level of Reported Migrant Workers by Their Education Level

Villages Educational Level	Ya Khine Kone		Kawhlar		Paout		Yogo		Total	
	No	%	No	%	No	%	No	%	No	%
Monastery Education	-	-	8	5.33	1	2.22	-	-	9	2.91
Primary Level	21	28.00	26	17.33	9	20.00	4	10.00	60	19.35
Secondary Level	22	29.33	35	46.67	18	40.00	21	52.50	96	30.91
High Level	14	18.67	42	56.00	10	22.22	7	17.50	73	23.55
University Level	10	13.33	13	17.33	2	4.44	3	7.50	28	9.03
Post Diploma	2	2.67	16	10.67	2	4.44	-	-	20	6.45
Graduate	6	8.00	4	2.67	2	4.44	4	10.00	16	5.16
Master	-	-	6	4.00	1	2.22	1	250	8	2.58
Total	75	100	150	100	45	100	40	100	310	100

Source: Survey Data, 2020

According to this table, it is found that monastery education have 2.91%, primary level have 19.35%, secondary level has larger percentage have 30.91% and second largest percentage is high level have 23.55%. And then university level is 9.03%, post diploma level have 6.45%, graduate level have 5.16% and less level is master have 2.58.

6. Marital Status of Migrant Workers

Frequency and percentage distribution of reported migrant workers by their marital status and native village is presented in table (5).

Table (5) Percentage Distribution of Reported Migrant Workers by Their Marital Status

Status	Ya Khine Kone		Kawhlar		Paout		Yogo		Total	
	No	%	No	%	No	%	No	%	No	%
Marriage	30	40.00	42	28.00	17	37.78	19	47.50	108	34.84
Single	45	60.00	108	72.00	28	62.22	21	52.50	202	65.16
Total	75	100	150	100	45	100	40	100	310	100

Source: Survey Data, 2020

Frequency and percentage distribution of reported migrant workers by their marital status and native village is presented in table 5. According to the surveyed data, 65.16 (202 workers) are singe and it can be easier decision to migrate, 34.84% (108 workers) of total migrant workers are marriage.

7. Reasons for Migrating from Native Villages

In this section four selected village of Naung Ka Yee villages will be reasons for migrating from migration are shown in the following table (6).

Table (6) Reasons for Migrating from Migration

Villages/ Reason	Ya Khine Kone		Kawhlar		Paout		Yogo		Total	
	No	%	No	%	No	%	No	%	No	%
Higher income	7	9.33	16	10.67	2	4.45	1	2.50	26	8.39
Lower income	42	56.00	93	62.00	28	62.22	28	70.00	191	61.61
Educated	14	18.67	36	24.00	14	31.11	9	22.50	73	23.55
Marriage	7	9.33	5	3.33	1	2.22	2	5.00	15	4.84
Opportunities	5	6.67	0	-	0	-	0	-	5	1.61
Total	75	100	150	100	45	100	40	100	310	100

Source: Survey Data, 2020

According to this table results of 310 migrant workers in the study exits 191have migrated from their villages to other regions or countries because of lower income and scarcity of the opportunity in their villages at maximum percent of (61.61%), 73 migrant

workers (23.55%) migrated to other regions or countries because they thought that (i) they become educated after receiving a diploma or a bachelor degree at least from an academic institution or university and (ii) there were no sufficient jobs in their native region and job opportunities which were not commensurate with their educational qualifications. Some 15(4.84%) migrant workers migrated from their villages because they were married to their spouses living in other regions apart from their villages while there were nine migrant workers who migrated from their villages because of higher income in the region or countries to which they migrated. There were only the workers who migrated in anticipation of good overall long run opportunities in the regions or countries. It was also found that most of the migrant workers, who migrated to other region for the reasons of higher income, were the ones who were currently living and working in other countries.

8. Migration Regions of Reported Migrant Workers

The four selected villages of Naung Ka Yee villages of households have migrant workers to work in other countries and internal migrant are shown in the table (7).

Table (7) Migration Regions of Reported Migrant Workers

Countries/ Region	Ya Khine Kone		Kawhlar		Paout		Yogo		Total	
	No	%	No	%	No	%	No	%	No	%
Malaysia	34	49.27	33	30.28	9	24.32	16	4.44	92	36.65
Thailand	26	37.68	68	62.36	20	54.05	20	55.56	134	53.39
Singapore	8	11.59	6	5.52	8	21.63	-	-	22	8.76
Japan	-	-	1	0.92	-	-	-	-	1	0.40
USA	1	145	-	-	-	-	-	-	1	0.40
Australia	-	-	1	0.92	-	-	-	-	1	0.40
Other	-	-	-	-	-	-	-	-	-	-
Foreign Total	69	100	109	100	37	100	36	100	251	100
Yangon	-	-	-	-	-	-	-	-	-	-
Madalay	-	-	7	17.07	-	-	-	-	7	11.86
Pharkant	6	100	14	34.15	6	75.00	4	100	30	50.85
Shweli	-	-	20	48.78	2	25.00	-	-	22	37.29
Other	-	-	-	-	-	-	-	-	-	-
Internal Migrant	6	100	41	100	8	100	4	100	59	100
Grand Total	755	100	150	100	45	100	40	100	310	100

Source: Survey Data, 2020

9. Type of Job in Foreign and Internal-Migration

Types of job in foreign migrant workers are shown in the table (8)(a) and 8(b).

Table (8) (a) Types of Job in Foreign

Types of Job	Ya Khine Kone		Kawhlar		Paout		Yogo		Total	
	No	%	No	%	No	%	No	%	No	%
General Worker	15	21.39	5	14.85	4	9.76	8	22.22	32	12.75
Factories	23	32.39	26	25.24	14	34.15	10	27.78	73	29.08
Contraction	15	21.13	14	13.59	13	31.70	8	22.22	22	20.73
Agriculture	1	1.41	24	23.30	4	9.76	8	22.22	37	14.74
Nurse	3	4.23	3	2.62	-	-	-	-	6	2.39
Engineer	1	2.82	3	2.92	-	-	-	-	5	1.99
Sailors	12	16.90	28	27.18	6	14.63	2	5.56	48	19.12
Total	71	100	103	100	41	100	36	100	251	100

Source: Survey Data, 2020

As shown in table (8) (a), there are 251 migrant workers in the foreign countries to get type of job in factories sector is largest percentage have 29.08% and second largest is contraction percentage have 20.73%. The less type of job in the foreign countries is engineer sector have 1.99%.

Table (8) (b) Types of Job in Internal-Migration

Types of Job	Ya Khine Kone		Kawhlar		Paout		Yogo		Total	
	No	%	No	%	No	%	No	%	No	%
Unmanly Staff	2	50.0	24	51.06	-	-	-	-	26	44.07
General worker	-	-	10	21.27	4	100	4	100	18	30.51
Restaurant	-	-	6	12.77	-	-	-	-	6	10.07
Grocery	2	50.00	7	14.90	-	-	-	-	18	15.25
Sale person	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
Total	4	100	47	100	4	100	4	100	59	100

Source: Survey Data, 2020

As show in table (8) (b), there are 59 migrant workers in the internal migration countries to get type of job in unmanly staff sector has largest percentage of 44.07% and second largest percentage is general worker has 3051% in this four selected of Naung Ka Yee villages in Mon State.

10. Comparison of the Household Income and Expenditure (par/day) After Migration

After the migration, these selected four village households numbers are the migration to more income and expenditure in the following table (9).

Table (9) Comparison of the Household income and Expenditure (par/day) after migration

In Kyats	Past Income		Presents Income		Past Expenditure		Presents Expenditure	
	Frequ ency	%	Frequ ency	%	Frequency	%	Frequ ency	%
Under- 5000	34	10.96	-	-	123	39-68	63	20.32
5000-7500	60	19.35	32	10.23	92	29-68	128	41.29
7500-10000	76	24.52	68	21.94	73	23-55	94	30.32
10000-15000	67	21.61	108	34.84	22	7.09	25	8.07
Over-15000	73	23.56	102	32.90	-	-	-	-

Source: Survey Data, 2020

According to this table comparison of the household before and after migration to get more income that is socio-economic development for these four villages.

CONCLUSION

Findings and Recommendations

In this research paper, 310 respondents of Mawlamyine Township are selected as a sample. The sample includes influent's 75 respondents in Ya Khine Kone, 150 respondents in kawhlar, 45 respondents in Pa auk and 40 respondents in Yogo Village of Mawlamyine Township. A total 310 households were interviewed using semi-structured questionnaires. They are most likely to be affected by migration and also contribute the most adequate areas for the study area.

According survey data, average family sizes is still large but it can be seen that the education level and average family sizes of each village have been inversely related. A village with higher education level has a small average family sizes. Migrant workers completed age in surveyed villages 61.25% of migrant workers are in age group between 21-35 years. At this indicated that most of the migrant workers were young persons in the prime of their lives.

In status of marital worker can be concluded that that is why singles persons are easier to make a decision to migrate. The main causes of migration in survey four villages is lower earning in their native village and in some villages and education level is also the influence factor of migration decision. Most of the migrant workers in internal and international are general workers in different job such as factories, construction sites, factories, restaurants and etc.

Myanmar faces great challenges in balancing poverty-reducing agricultural and rural economic growth with sustainable natural resource use needed for such growth. In order to stimulate migrant returnees contributions to the economic development of Myanmar, Myanmar policy makers should provide proper international banking channels and banking infrastructure such as ATM networks and electronic money order systems: relax restrictions on foreign currency accounts for migrant workers; provide pre-departure training regarding financial education and offer saving and investments options and services to get the best benefit out of financial remittances. Moreover, the government should grant a friendlier environment for migrant returnees, such as providing more reliable and transparent immigration information: allow the returnees to buy and possess property regardless of their present status of nationality; grant them exemption from various visa regulations review double taxation policy and exemptions in different spheres including tax exemptions.

Acknowledgements

Firstly, I would like to express my sincere thanks to Dr. Yi Yi Win, Rector of University of Co-operative and Management, Thanlyin for her kind permission to write and report this research paper. I wish express my special thanks our Pro Rector Daw Myint Myint Sein. And my words of thanks go to Chair Person of Daw Thin Thin Yu (Associate Professor, Head of the Department of Economics) and her various kinds of support and guidance. At least but not least, I heartily thank to my research survey of Naung Ka Yee Villages Administrative and its research questioner of four selected villages of Ya Kine Kone, Kawhlar, Paout and Yogo of Mon State.

Reference

Naung Ka Yee administrative villages document of Mawlamyine Township, Mon State.

Robert O'Connor, Urban-Migration in Myanmar an Analysis of Migration patterns and migrant well-being p.df.

Micheael ,P.T. and Smith,S.C.(2015). Economic Development 12 edition, Pearson Education, Inc.

www.Charlotte McConaghy, Migration.

https://www.irrawaddy.com

https://www.ilo.org

https://Lac.unfpa.org

https://themimu.info

THE SOCIAL IMPACT ON THE PERFORMANCE OF SOCIAL ENTERPRISES IN YANGON

Lin Thidar Khaing [1]

Abstract

Social enterprises have been emerged for over a decade and the sector has rapid development in Myanmar. Social enterprises are registered as private company or co-operatives and aim to balance their social mission and core business to achieve financially sustainable social impact. The objectives of the study are to examine the social impact of social enterprises. The data are collected by using secondary data obtained from respective social enterprises, offices and organizations, reference books and literature reviews to obtain important information of 30 social enterprises in Yangon. The results of the study show a positive social impact of organization resources on organizational performance. As a result, also highlight that organization performance has significant effect on social impact of social enterprises in Yangon. This study suggests that socioeconomic activities of social enterprises can improve their organizational performance by continuously improving institutional information and organizational resources. Based on the findings, social enterprises in Yangon can benefit the social sectors such as education, health, culture, social welfare, etc.

Key Words: social impact, social enterprises, social sectors, organizational performance

INTRODUCTION

As the environmental changes constantly, innovation and entrepreneurship are critical elements for success and sustainability of any type of organizations including social enterprises. Running on social enterprises entails the achievement of the double line, that is, social missions and the business sustainability. The mode things are more difficult to social enterprises. Entrepreneurship in competitive business often refers to the capturing of new opportunities through innovation. In Myanmar, where social enterprise is not newly starting to emerge, mapping movement and surrounding landscape at an early stage systematically.

Social enterprises have the potential to make Myanmar's growth work better for citizens. There are several reasons for that Myanmar has to manage social enterprises to alleviate the poverty, including non-uniform infrastructure, low quality public goods provision by the government (especially in health and education) and resource limitations. By employing innovative business models, social enterprises are addressing Myanmar's development needs, while maintain sustainability though viable revenue models. Simultaneously, this space is and increasing number of impact investors who are interested in supporting businesses with triple bottom line returns that is, profit (or financial sustainability at the least) social impact and environmental impact. And, social enterprises may be registered as private limited companies, co-operatives, not for profit or other type of entities. The study provides an overview of the social enterprises in Yangon.

[1]Lecturer, Department of Co-operative Studies, University of Co-operative and Management, Thanlyin

Objectives of the Study

The objectives of the study are:

(1) To explore the business and social activities of social enterprises.

(2) To identify the social factors impacting on the performance of social enterprises in Yangon.

Methodology of the Study

The research is mainly used descriptive research method in qualitative approach. The secondary data were used to study the case of performance on social enterprises in Yangon. Other needed information obtained data collection method from respective social enterprises, offices and organizations, reference books and literature reviews.

Scope and Limitation of the Study

This study was conducted to determine the social impact of social enterprises. The data of the study is 30 social enterprises in Yangon that is obtained from Social Enterprise Development Association Myanmar (SeDAM). The limitation of the study cannot cover all the social enterprises that have social impact in Myanmar.

LITERATURE REVIEW

Literature Review

"Social Enterprises are a new type of business, characterized by an entrepreneurial approach to delivering activities that are aligned with an explicit social mission" (Haugh & Tracey, 2004). As the analysis of the academic literature demonstrates, "there is neither a commonly agreed definition of social impact measurement nor a shared understanding of the overall aim of social impact measurement". Monetti, 2014; Nicholls, 2009; Palmer and Vinten, 1998 are defined as "accounting and measuring for social enterprises relies on three main approaches". "Positivist accounting builds a picture of the real world .by adopting rational and objective value measurements" (Whittington, 1986, Watts and Zimmerman, 1979), "Critical accounting is grounded in the principles of democracy and accountability and plays a role between organization and society" (Lehman, 1992). In this perspective, organizations are accountable to a wide range of stake holders affected by their activities" (Gray, 1996). "Interpretive accounting serves as a symbolic mediator between social group and a tool for dialogue between companies and their stakeholders to simulate social change" (Ryan, 1992, Gray, 2002).

It follows that arriving at a universal definition of social impact measurement is difficult since these three conceptualizations correspond to different strategic objectives for social entrepreneurs; "positivist reporting practices aim to enhance operational performance and drive innovation; critical theorist practices support resource acquisition; interpretive reporting builds and maintains organizational legitimacy" (Nicholls, 2009). Moreover, the

academic literature highlights "a number of different methods adopted by public actors, social enterprises and private funders to measure their social impact". Among the debate regarding social impact measurement, the fact that it is measured by based on economic and social indicators such as living standard, social activities, social welfare etc.

While complementary definitions about social impact, it is important to note the conceptual different aspects of social entrepreneurs. According to Thompson, Alvy & Lees (2000), "social entrepreneurs are people who realize where there is an opportunity to satisfy some unmet need that the state welfare system will not or cannot meet and who gather together the necessary resources (generally people, often volunteers, money and premises) and use these to make a difference".

The Need for Communicating Social Value

The aim of social enterprise that the social entrepreneur run is to deliver goods and services in order to address social needs while operating in the markets, which do not always recognize the social vale that they create. "Social Value is when resources, inputs, processes or policies are combined to generate improvements in the lives of individuals or society as a whole" (Richmond, 2008; Acharya, 2010). Based on definitions provided in literature, it can be assumed that social enterprises broadly operate on this principle. Social enterprises also depend on a whole range of resources: human and financial just like any other business. Barraket & Anderson are defined as "among financial and physical resources, they depend on a variety of sources such as individual contributions, philanthropic grants and debt or equity finance depending on the maturity of the organization".

Social Impact of Social Enterprises

"Social enterprises are required to demonstrate their delivery of 'social value' to create the social impact" (Barraket & Anderson, 2010). "The term "social impact" is often replaced by terms such as social value creation and social return with the differences arising out of the entrepreneur's and social scientist's definitions of the words impact, output, outcome, and social return"(Maas, 2008).

While perspectives on social impact can differ from on the basis of divergent philosophies, "impact can be differentiated in terms of internal impact (employees' health and economic security, the environmental effects of the company's supply chain and operations, and impact on issues of access, fairness and trust in company policy and management practices) and external impact (health, economic, environmental, and other effects on parties outside the company such as customers and communities)" (Golden, Hewitt, & Mc Bane, 2010). Although not currently recognized as formal social enterprises, there are number of informal social enterprises like NGO, INGO, Foundation and Cooperatives that emphasis the social mission or social impact as a part of their business model.

THEORETICAL FRAMEWORK

The Social Enterprise Frameworks

There are seven general social enterprise frameworks. Here we would like to think of them as frameworks to show how the IMPACT MODEL and BUSINESS MODEL of a social enterprise fit together.

These frameworks are by no means exhaustive, and of course they can mix and match or blend together. A successful social enterprise could possess qualities from several of these frameworks.

What they have in common is that they are jumping off points for envisioning how your social enterprise could generate income while delivering on its social impact goals. The frameworks are:

1. Free for Service
2. Cross Compensation
3. Employment and Skills Training
4. Market Intermediary
5. Market Connector
6. Independent Support
7. Cooperative

These 7 frameworks are not typically seen in traditional for-profit business, because traditional business tends to optimize only for revenue, with less (or no) emphasis on social and environmental considerations. The reason these frameworks work well for social enterprise is that they are not only optimized for social and/or environmental considerations, but they present innovative ways to create value in unexpected places! And where value is created, there is an opportunity to generate revenue.

The components those are common to each framework:

Impact Activities refer to the purpose-driven goals and driving mission of the social enterprise to serve Beneficiaries in some way.

The role of generating Impact Activities is sometimes fulfilled by a Social Mission Organization (a non-profit, charity or NGO).

Beneficiaries are the underserved populations that are benefiting from the social impact programs provided by the socially entrepreneurial initiative.

Commercial Activities are representing earning money through the sale of goods or services. Profits earned then serve to offset all or part of initiative's expenses that are incurred while fulfilling the social and/or environmental mission.

The role of generating Commercial Activities is sometimes fulfilled by an independent Social Business (a separate for-profit legal entity).

Lastly, the **Customers** are the individuals who are buying something they desire or need.

Each of the social enterprise frameworks takes the components above and connects them in a unique way, with the following interactions.

PAYMENT - who pays who?
GOODS - the product or service being delivered and who it is delivered to.
DEMAND - the desire for a product or service by a players in the framework.
SUPPLY - the desire to provide a solution for the demand.
FUNDING - the way in which money is flowing to further the social/ environmental mission.
IMPACT - where the social mission is being achieved.

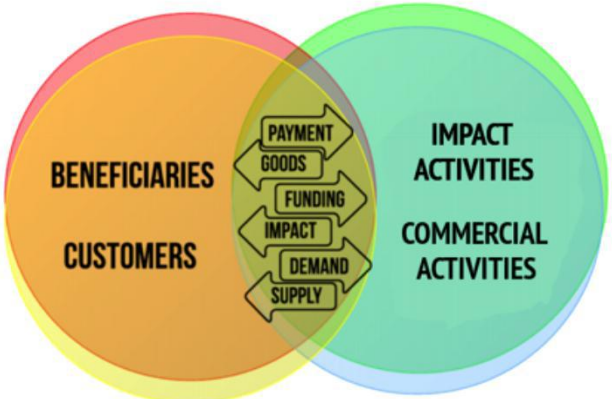
Independent or Blended

In the frameworks, in some cases the Impact Activities the Commercial Activities are distinct. This would most often be the case when an existing non-profit, charity or NGO that is funded in large part by grants and philanthropic donations diversifies their revenue with a new venture for the purpose of generating an additional stream of cash flow. However, there are also many examples where there is less (or no) distinction between a social enterprise's Impact Activities and Commercial Activities. For example, this could be the case for a brand new venture that is being designed and built from the ground up as a triple bottom line social business. In these cases, social or environmental impact is very much fully intertwined with the financial sustainability and revenue-generation.

1. Free for Service

Perhaps the simplest and most common social enterprise framework is Fee for Service.

In this framework, the beneficiaries pay directly for the goods or services provided by the social enterprise. This is most similar to a traditional for-profit business, where those receiving product or benefit pay for the services directly to the business supplying it.



As shown in the diagram, the beneficiaries and customers are the same, and they provide the demand and pay for goods and services provided by the social enterprise. The impact and commercial activities of the social enterprise are again the same.

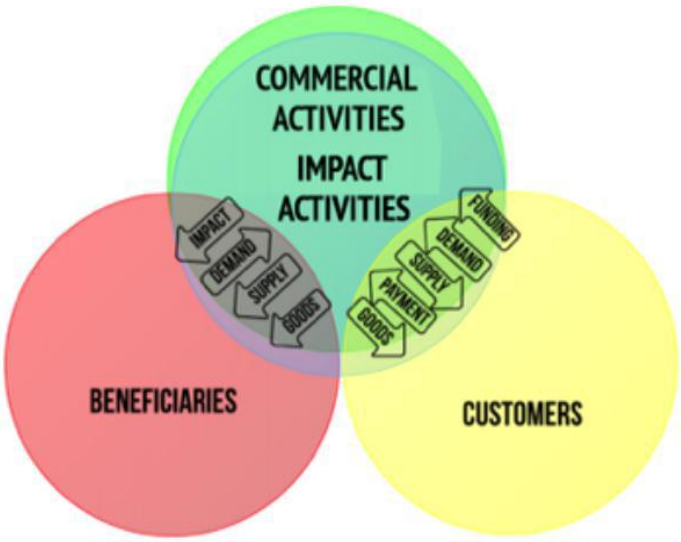
As a result, the beneficiaries' lives are improved, and the social enterprise funded in a financially sustainable way.

2. Cross Compensation

Cross compensation is a variation of Fee-for-Service for low income clients. This framework is able to serve the beneficiaries by taking advantage of another market that has higher purchasing power.

The product or service produced by the social enterprise is delivered to the beneficiaries at an affordable price or at no cost. This is made possible by clients or customers in another market paying market rates (higher rates).

In this framework, the product or service offered to both the underserved market and the higher purchasing power market is generally the same or very similar. For this reason, the social enterprise is able to use its core business capabilities, resources, supply chains, and sometimes distribution, to reach both markets – essentially doubling up its strength.



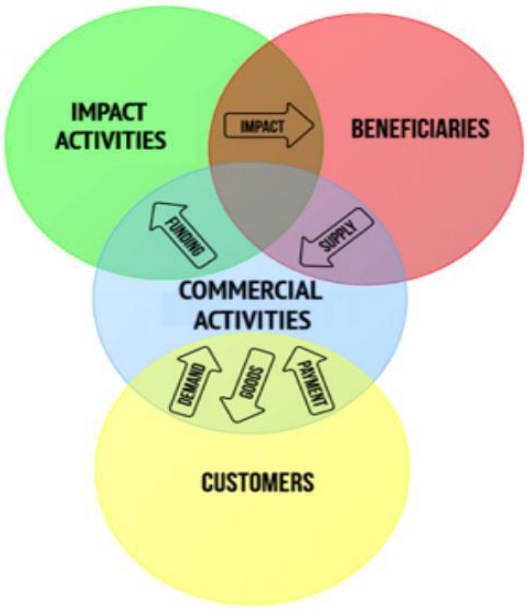
The diagram presents the commercial and impact activities of the social enterprise are essentially one in the same, sharing the same strengths and resources. A similar offering is provided to two different markets, beneficiaries and customers, with customers paying full price and funding the social impact provided to the beneficiaries.

3. Employment and Skills Training

With this third common framework, the beneficiaries are an essential component of the supply of the social enterprise's product or service. In these cases, the beneficiaries are the same group that is involved in the creation or provision of the product or service. The core purpose of the social enterprise is to provide living wages, skills development and job training to the beneficiaries. The beneficiaries are typically part of a marginalized group that may not have the same employment opportunity if the social enterprise was not in place.

In this framework, the commercial activities of the social enterprise are crucial to delivering on the social mission. They allow the venture to provide access to jobs, training, and other development for the beneficiaries.

This relationship not only creates social value, but it creates economic value through the production of a good or service. This economic value is secondary to the social mission, but is still essential to generate sustainable income to cover costs. These costs are incurred to generate not only the economic value through the creation and supply of a good or service, but also include the cost of delivering the social value through added training, liveable wages, slower production, etc.

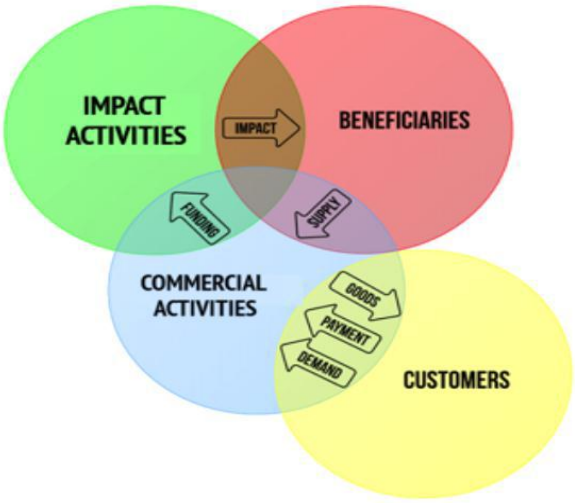


4. Market Intermediary

In this framework, the social enterprise acts as an intermediary, or distributor, to an expanded market. The beneficiaries are the suppliers of the product and/or service that are being distributed to an international market. The new market benefits from added selection and choice presented by the social enterprise market intermediary. But this group is not dependent on the service or product.

In addition to added distribution, the social enterprise can also provide additional services to support their supplier, who in this business framework is also the beneficiary. This allows the supplier to improve their offering and increase their competitive advantage and success in the new marketplace.

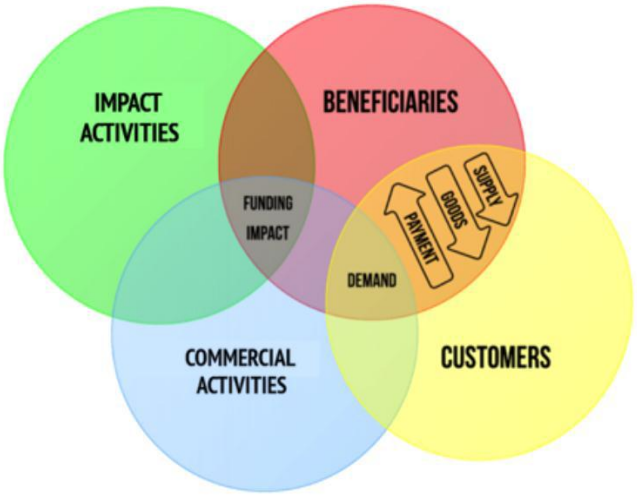
According to the diagram, the customers are not directly interacting with the beneficiaries who are supplying the product. The social enterprise acts as the intermediary to connect supply to this new market. The social enterprise generates funding to further the mission of supporting beneficiaries while also helping create more demand which expands the beneficiaries businesses.



5. Market Connector

This framework sees the commercial activities of the social enterprise connecting two co-dependent parties together by facilitating relationships between beneficiaries and new markets. This could involve aiding the players in the process of importing or exporting, or it could mean providing other information or resources that are essential for players to connect with each other.

The main difference between this framework and the Market Intermediary framework is that the Intermediary is opening up an expanded market and widening the choices for customers and clients. In contrast, the Market Connector is not selling goods but is facilitating trade relationships.

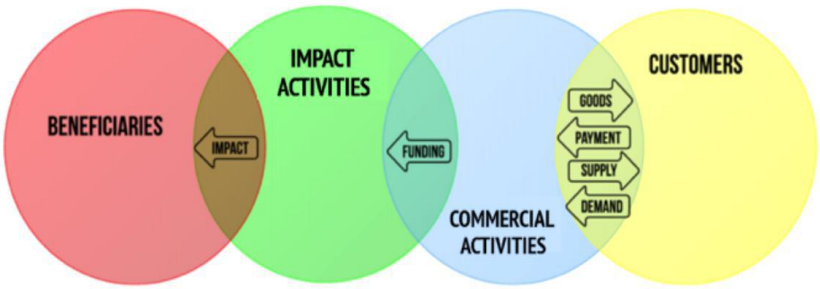


6. Independent Support

In this case, the commercial activities of the social enterprise deliver products or services to an external market that is separate from the beneficiary and social impact generated.

Then, funds generated from the independent social business are funnelled back into social programs that support the beneficiaries.

There are cases where the social enterprise is somewhat integrated in with the social programs, but more often in these cases, the tie between the beneficiaries and the business is only loosely related.



7. Cooperative

The discussion of social enterprise frameworks wouldn't be complete without talking about a very unique model - arguably the oldest established social enterprise framework - which has existed for hundreds of years throughout history.

7th and final business framework is a Cooperative. A cooperative is a profit or non-profit business (providing virtually any type of goods or services) that is owned by its members who also use its services.

There are many examples of co-operatives ranging from food producers, financial services providers, workers co-ops, and others. Cooperatives are unique, in that they are wholly member-owned, with each member having an equal and democratic voice into the operations of the business. With values of honesty, social responsibility, and caring for others - integral within the cooperative framework, it is a business model truly built for social enterprise.

Typology of Myanmar Social Enterprises

In spite of the awareness of the social enterprise concept is starting to emerge and the space in Myanmar has begun to take shape, there is already a number of social enterprises in

Myanmar engaging in different industries. Because of the concept is still new and of the limited data available, there is a lack of clarity how many entities provide socially and environmentally beneficial services through revenue generating activities (British Council, 2013).

While lack of strong legal definition in Myanmar, social enterprises in this region are separated by two “Formal social enterprises” and "Informal social enterprises”. ‘Formal’ social enterprises are entities that identify themselves as social enterprises and have understanding of the social enterprises concept. ‘Informal’ social enterprises comprises entities that have positive social impact and are exploring revenue generating activities as a way of financing social impact. These include NGOs with characteristics of a market-driven organization and SMEs with positive social impact (British Council, Burma Report 2013).

There is a wide spectrum of development organizations in Myanmar with different legal forms, different degrees of market orientation and financial viability, and different social missions, however Myanmar social enterprises and social organizations are mainly operating in five types of socially beneficial services to create a positive impact on the society. According to a report conducted by the British Council Skills for Social Entrepreneurs (SfSE) programme, the services include:

(1) Provision of basic services (basic education and health care, disaster relief)
(2) Civic engagement and civil society promotion
(3) Targeted livelihood enhancement programs (including vocational training)
(4) Access to finance
(5) Provision of socially beneficial products and services.

The majority of social enterprises in Myanmar are currently engaging in livelihood enhancement, vocational training and micro finance, where in this sector, they are the strongest in financial sustainability. Civil society organizations like NGOs and associations primarily focused on focused on dissemination of specific knowledge and behavioral change. Civic engagement organizations often supplement their activities with basic health and education services, as well as disaster relief activities.

In creating positive impact on livelihood enhancement, social enterprises emphasize on core activities, such as sustainable forestry or vocational training. In some operations, organizations provide micro finance services to their beneficiaries. These generate revenue and become fully or partially sustainable (British Council, 2013). The major ways of creating a social impact in livelihood enhancement programs includes women empowerment activities, creating job opportunities for underprivileged people who include victims of nature disaster, human trafficking and victims of HIV/AIDS, and some vocational training programs for local youths, and some groups of people.

Both private entities and cooperatives and NGOs create socially beneficial products which they tend to produce favorable results on fair trade, providing affordable and socially conscious products. The most successful example might be Proximity Designs which provide

water pumps and water filters to local farmers in the same time they give training services about agriculture.

THE SOCIAL IMPACT ON THE PERFORMANCE OF SOCIAL ENTERPRISES IN YANGON

Social Impact of Social Enterprises in Yangon

Myanmar social enterprises and social organizations are mainly operating in five types of socially beneficial services to create a positive impact on the society. Social enterprises are operating business functions with their social mission creating positive impact on the community. The social impacts created by social enterprises are socially beneficial services to create a positive impact on the society. According to the table (1), most of the social enterprises provide the basic needs of the community and closely related with other beneficial impact by creating social value. It can be assumed that social enterprises create positive impact on the society.

Table (1) Social Impact of Social Enterprises in Yangon

Social Impact	Number of Social Enterprise
Provision of basic services (basic education, healthcare, disaster relief)	10
Civic engagement and civil society promotion	5
Targeted livelihood enhancement programs (including vocational training)	7
Access to finance	-
Provision of socially beneficial products and services	8
Total	30

Source: Social Enterprise Development Association Myanmar (SeDAM), 2019

Provision of Basic Services (basic education, healthcare, disaster relief)

There are 10 social enterprises in the provision of basic services that build and donate fully equipped primary, middle and high schools in remote areas as required and appoint staff and teachers. Moreover, fully equipped dispensaries, clinics and hospitals were built in remote areas as necessary and staff, nurses and doctors will be appointed to run the facilities. It is common case that the access to basic services such as education, healthcare is a daily struggle facing people living in conditions of poverty.

Table (2) Provision of basic services (basic education, healthcare, disaster relief)

Sr. No.	Name of Social Enterprises	Performance of Social Enterprises	Social Impact
1	Trust Oo M-Health Social Enterprise	❖ E-health has been proposed to help improve healthcare services as a nationwide-accessible tool by overcoming geographical boundaries, and fulfil the health needs of Myanmar inhabitants.	Provision of basic services (basic education, healthcare, disaster relief)
2	FXB Myanmar Social Enterprise	❖ FXB Myanmar is an NGO active in the context of the nationwide anti-human trafficking, anti-HIV/AIDS programs and poverty reduction.	
3	SoyAi Myanmar	❖ Donate to monasteries and orphanages and support for the elderly.	
4	Phoenix Social Enterprise	❖ The scope of work from humanitarian assistance to development work not only for the HIV community but also for the general community.	
5	CC Educare Social Enterprise	❖ This project aims to educate youth in ICT literacy, using the internet as a tool for education and information. The goal is for the community to practice safe and legal use of information and technology, to become critical thinkers.	
6	360ed Universe Social Enterprise	❖ 360ed is an Edu Tech venture based out of Silicon Valley with major operations in Myanmar.	
7	Mote Oo Education	❖ Mote Oo Education is provide Curriculum Development for teachers.	
8	CVT Myanmar Social Enterprise	❖ The aim of poverty reduction through skills development and vocational training school for community.	
9	Lamtib Social Enterprise Myanmar	❖ Lamtib Social Enterprise is dedicated to address the rural poverty of Myanmar through leapfrogged technologies, education, job creations and SMEs development.	
10	Third Story Project Social Enter	❖ Donate story books to children who will start teaching basic education.	

Source: Social Enterprise Development Association Myanmar (SeDAM), 2019

The social enterprise framework is Fee for Service, the beneficiaries pay directly for the goods or services provided by the social enterprise. This is most similar to a traditional for-profit business, where those receiving product or benefit pay for the services directly to the business supplying it.

Civic Engagement and Civil Society Promotion

The involvement of 5 social enterprises in civil society organizations like NGOs and associations primarily focused on dissemination of specific knowledge and behavioral change. Civic engagement organizations often provide their activities with basic health and education services, as well as disaster relief activities.

Table (3) Civic engagement and civil society promotion

Sr. No.	Name of Social Enterprises	Performance of Social Enterprises	Social Impact
1	Orient Travel Social Enterprise	❖ Social Enterprise is Community-based Tourism (CBT). CBT creates opportunities for training and technical assistance and develop the community's capability to manage marketing, sales and financial income.	Civic engagement and civil society promotion
2	Greenovator Social Enterprise	❖ Social Enterprise model is inclusive, sustainable and have good impact on the improvement of farming sector.	
3	Kiwi Go Social Enterprise	❖ It is contributing to local communities by promoting community-based, responsible and Eco-Tourism.	
4	Tun Yat Farm Equipment Service Social Enterprise	❖ Social Enterprise is to facilitate the small and marginal farmers in Myanmar who have doubled their net farm income through their engagement.	
5	Genius Social Enterprise	❖ Teaching coffee farmers how to grow organic to improve their lives. ❖ Providing natural mountains, natural forests and coffee plantations for eco-tourists.	

Source: Social Enterprise Development Association Myanmar (SeDAM), 2019

This social society as cross compensation is a variation of Fee-for-Service for low income clients. This framework is able to serve the beneficiaries by taking advantage of another market that has higher purchasing power.

The product or service produced by the social enterprise is delivered to the beneficiaries at an affordable price or at no cost. This is made possible by clients or customers in another market paying market rates (higher rates).

Targeted Livelihood Enhancement Programs (including vocational training)

The 7 social enterprises in targeted livelihood enhancement programs (including vocational training) are currently engaging in livelihood enhancement, vocational training and micro finance, where in this sector, they are the strongest in financial sustainability. In addition to regular school education, and will establish training centers to support vocational education.

Table (4) Targeted livelihood enhancement programs (including vocational training)

Sr. No.	Name of Social Enterprises	Performance of Social Enterprises	Social Impact
1	Pan Nan Ein Social Enterprise	❖ Providing employment opportunities for people with disabilities and providing a secure future.	Targeted livelihood enhancement programs (including vocational training)
2	LinkAge Restaurant & Art Gallery Social Enterprise and Hospitality Training School	❖ Delicious Myanmar Food prepared by Myanmar Youth with full of hope.	
3	Sunflower Social Enterprise	❖ Support genuine local products and educating uneducated young women to become weavers and provide employment.	
4	Yangon Bake House Social Enterprise	❖ To make a difference in the lives of women and their families, communities, and the greater economy.	
5	YK Collections Social Enterprise	❖ Offer the Myanmar traditional souvenirs with unique designs.	
6	Three Good Spoons Social Enterprise	❖ Promoting decent work for domestic workers in Myanmar.	
7	Amazing Grace Social Enterprise	❖ Supporting people with disabilities (PWD) specifically woman.	

Source: Social Enterprise Development Association Myanmar (SeDAM), 2019

These social enterprises beneficiaries are an essential component of the supply of the social enterprise's product or service. In these cases, the beneficiaries are the same group that is involved in the creation or provision of the product or service. The core purpose of the

social enterprise is to provide living wages, skills development and job training to the beneficiaries. The beneficiaries are typically part of a marginalized group that may not have the same employment opportunity if the social enterprise was not in place.

In employment and skills training framework, the commercial activities of the social enterprise are crucial to delivering on the social mission. They allow the venture to provide access to jobs, training, and other development for the beneficiaries.

Provision of Socially Beneficial Products and Services

Involvement of 8 social enterprises in provision of socially beneficial products impact are private entities and cooperatives and NGOs create socially beneficial products which they tend to produce favorable results on fair trade, providing affordable and socially conscious products. The most successful example might be proximity designs which provide water pumps and water filters to local farmers in the same time they give training services about agriculture.

Table (5) Provision of socially beneficial products and services

Sr. No.	Name of Social Enterprises	Performance of Social Enterprises	Social Impact
1	Hla Day Social Enterprise	❖ Work with Myanmar artisans, disadvantaged groups and small businesses and support the livelihoods of producers to overcome disability, exclusion and poverty.	Provision of socially beneficial products and services
2	Gaia Green Social Enterprise	❖ Provide customers with the highest quality of organic fertilizers and natural soil amendments.	
3	Chu Chu Social Enterprise	❖ Provide training in handicraft with waste material and can customize techniques and designs depending on the context and provide for the setup of general solid waste management system.	
4	Pomelo Social Enterprise	❖ It is a creative outlet in Yangon for artisans to hone their design and business skills.	
5	Tree Food Social Enterprise	❖ The new version of Myanmar traditional palm jiggery with new design and different tastes.	
6	Shwe Taung Nyo Gyi Organic Grogery Store	❖ Free Range Egg to help for farmers.	

7	Zero Plastic Social Enterprise	❖ Eco friendly products for household use to reduce plastic usages for green environment.	Provision of socially beneficial products and services
8	Super Solar Social Enterprise	❖ Through a social enterprise, creating products that provide jobs and improve the quality of life for families living in poverty.	

Source: Social Enterprise Development Association Myanmar (SeDAM), 2019

This social enterprises framework is a Cooperative. A cooperative is a profit or non-profit business (providing virtually any type of goods or services) that is owned by its members who also use its services.

There are many examples of co-operatives ranging from food producers, financial services providers, workers co-ops, and others. Cooperatives are unique, in that they are wholly member-owned, with each member having an equal and democratic voice into the operations of the business. With values of honesty, social responsibility, and caring for others integral within the cooperative framework, it is a business model truly built for social enterprise.

CONCLUSION

Findings and Discussion

The first objective of the study is to explore the business and social activities of social enterprises. Therefore it is indicated that their activities based on the respective framework to state the social impact of social enterprises. Among organization resources, financial and physical resources have positive effect on social impact of social enterprises. The second objective of the study is to identify the social factors impacting on the performance of social enterprises in Yangon. According to the study, organizational performance of social enterprises have positive effect when generating social impact. Measuring the effectiveness or impact of social enterprises' efforts continues to be a major challenge for both researchers and practitioners. New insights that raise awareness about the importance of social impact and social responsibility, and would possibly improve methods for understanding and assessing social performance.

Recommendations

The nascent social enterprise movement in Myanmar is grappling with the many divergent views on almost every aspect of what it means to be a social enterprise. Thus suggest the following factors to develop the social sector of the social enterprise in Yangon.

- Social Enterprise is wide promotion in the social media; in particular, success stories need to be captured to help encourage other people to get involved with social enterprise.

- Building social enterprise into the education system; there needs to be a focus on empowering young people to address the social issues either within their communities through more entrepreneurial approaches.
- More research; there is a real lack of evidence on how social enterprise is really developing, particularly interpretations of what the concept means.
- Transparency; there will be benefits to encouraging greater transparency in the functioning of organizations working in the social enterprise space.

Acknowledgements

Firstly,I would like to express my gratitude to Dr. Yi Yi Win, Rector of the University of Co-operative and Management, Thanlyin for her encouragement to write this research paper. Secondly, I am grateful to Daw Khin Aye Mar, Professor and Head of the Department of Co-operative Studies for her various kinds of support and guidance. I wish to express my special thanks all of respective social enterprises and Social Enterprise Development Association Myanmar (SeDAM). I heartily thank to my colleagues, especially for their kindness, ideas and contribution to the completion of this paper.

References

British Council, (2013). *Social Enterprise Landscape in Myanmar*.

Center for Entrepreneurship, (2014). *Research Study on the Social Enterprise Sector in Hong Kong*.

Clifford, J, Markey, K, and N, Malpani, (2013). *Measuring Social Impact in Social Enterprise.*

Hlaing, T. H. (2016). *A Study on The Impact of Social Enterprises on Social Development*. Master Thesis, P 4-10.

OEDC, (2015). *Policy Brief on Social Impact Measurement for Social Enterprises*.

Social Enterprise UK (2014). *A Report on The Social Enterprise Landscape in Morocco*.

Zaw, K. T. (2017). *Analysis on Factors Affecting Success of Social Enterprises in Myanmar*. MBA Thesis, P 22-28.

http://www.britishcouncil.org.mm/programmes/society/skills-social-entrepreneurs

GEOGRAPHICAL ASSESSMENT ON SPATIAL VARIATION OF LAND SURFACE TEMPERATURE USING LANDSAT (8) DATA

Win Thet Myint[1]

Abstract

The land surface temperature "LST" is an important parameter in the study of the physical processes of the land surface; such as urban land use and land cover changes, global climate change, hydrological, geophysical, biophysical, heat balance study, and also a key input for climate models. Recently, land surface temperature obtained by satellite technology can furnish an effective assessment of surface temperatures variation than thermometer network-based assessments. The major objectives of this research are the estimation of surface temperature variation and areas of high temperature and to evaluate the use of Thermal Infrared Remote Sensing for assessing temperature differences in Thirty-Two Townships of Yangon area. The present study focuses on ArcGIS Raster functions and Raster calculation using the Landsat 7 and Landsat 8 March and December, thermal Bands (10 & 11). The results are feasible to Calculate NDVI, LSE, and LST with appropriate accuracy. The thermal energy responses of different structures of the City indicate the variations in surface temperature. Ground-based observations reflect only thermal conditions around the station. However, using remote sensing thermal bands in this study enables us to get the thermal condition for each pixel and assess the spatial variation of temperatures on the whole study area.

Keywords: LST, NDVI, Thermal Infrared Remote Sensing data (TIR), Spatial Variation

INTRODUCTION

The earth's surface and all substances on it emit the temperature while urban centers are releasing much more heat than other places according to the industries, the use of automobiles, dense settlement, uses of air conditioners, and the lack of trees and other vegetation there. Urban areas are increasing demand for residential, commercial, and industrial purposes. In currently, the agricultural land is mainly in the periphery of the cities into the built-up area. It is also seen that the change in land use or land cover leads to loss of agricultural lands, loss of forest lands, increase of barren areas, an increase of impermeable surface cover because of the build-up area, etc. With these physical changes mainly decrease in green cover and increase in the built-up area, land surface temperature (LST) mostly likely increases.

The land surface temperature of the earth's crust, LST absorbs heat and radiation from the sun and then reflected and refracted. Characteristics of Urban Heat Island (UHI) are typically based on LST that varies spatially, due to the non-homogeneity of land surface cover and other atmospheric factors. LST is the key factor for calculating the highest and lowest temperature of a particular location.

[1]Lecturer, Department of Economic Geography, University of Cooperative and Management, Thanlyin

In the urban area, a green area is a basic need for the physical environment because it contributes to a healthy city environment as well as healthy living and also maintains the aesthetic and ecological attractiveness in the urban area. Physical, chemical, and biological properties of the earth are controlled by the energy balance of the surface, characteristics of the atmosphere surface thermal property, and surface media, which affect the land surface temperature. Landsat 8 holds two sensors, the Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS). This paper analyzes the variation of land surface temperature in terms of both temporal and spatial extent with the application of remote sensing data.

Objectives

This paper aims to estimate the Land Surface Temperature by the following facts:

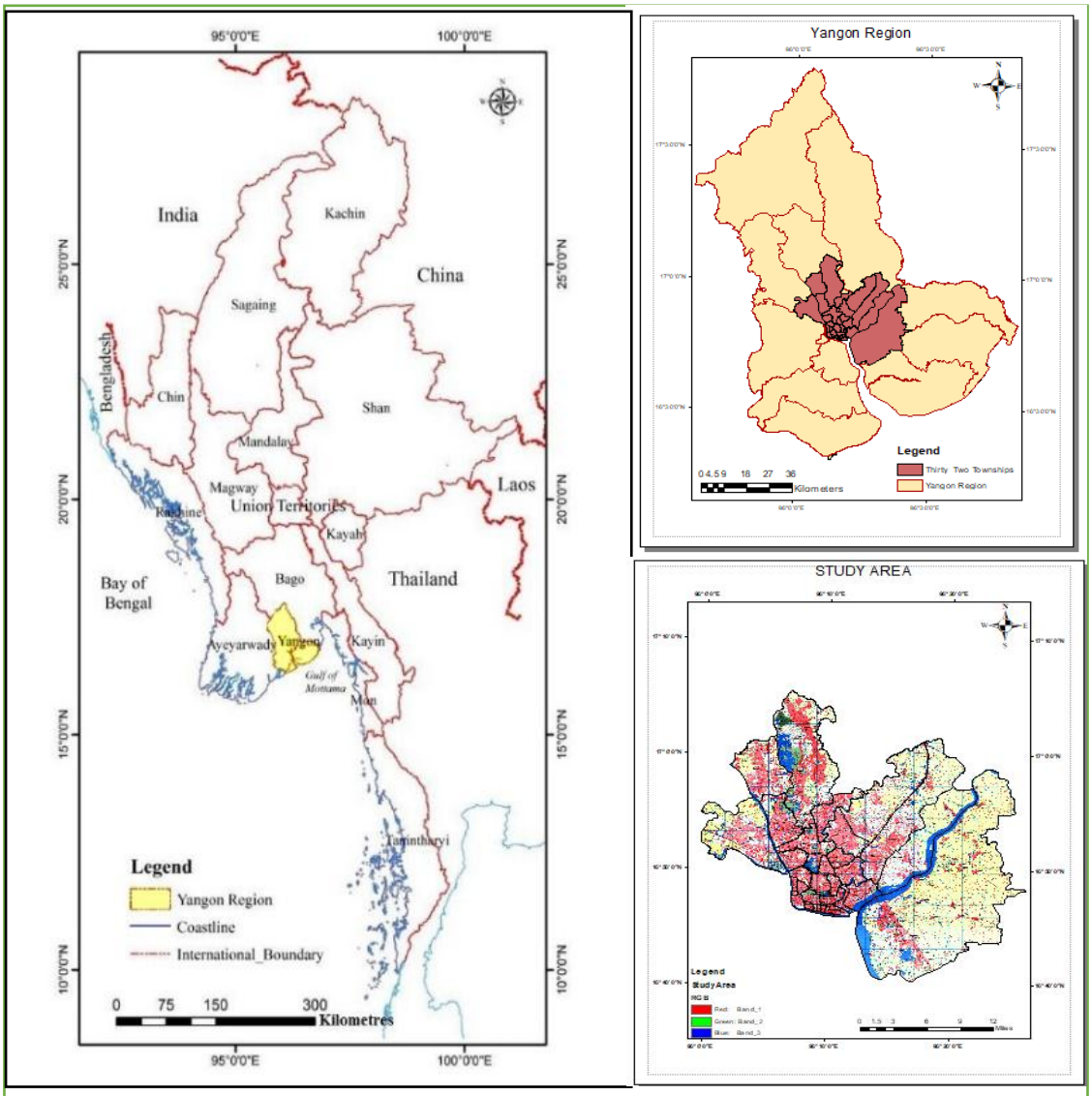
1. Convert TIRS band data to TOA spectral radiance
2. Calculate Atmospheric Brightness Temperature
3. Estimate variation of Land Surface Temperature and compute the area percentage

STUDY AREA

Yangon Region is situated in Lower Myanmar bordered by the Gulf of Martaban. The study area of this research, Thirty-Two Townships of Yangon Region covers (1122.65) square Kilometers (433.46) square miles. It is located in the central part of the Yangon Region and lying between 16° 40' North latitude to 17° 31' North latitude and 95° 59' 30" East longitude to 96° 27' 30" east longitude. Yangon is the Region that is densely populated with the urban area. The metro area population of Yangon in 2020 was 5,332,000, (1.68%) increase from 2019 and 2019 was 5,244,000, (1.69%) increase from 2018.

Figure (1) Location Map of Study Area

MYANMAR NAING NGAN



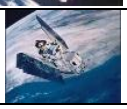
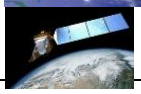
Source: Based on MIMU & UTM Map

MATERILS AND AMETHODOLOGY

Program and Characteristics of Landsat Images

The National Aeronautics and Space Administration entered on an initiative to develop and launch the first Earth monitoring satellite to meet the needs of resource managers and earth scientists in the mid of 1960s. The U.S. Geological Survey came into a partnership with NASA in the early 1970s to assume responsibility for archiving data and distributing data products.

Table (1) Landsat Program from USGS

No.	Satellite Name	Lunch Date	Landsat Image	Functions
1	Landsat 1	July 24, 1972		provide repetitive global coverage of the Earths land masses
2	Landsat 2	July 22, 1975		Earth resources satellites (Multispectral Scanner System) (MSS)
3	Landsat 3	March 5,1978		civil operational land remote sensing activities
4	Landsat 4	July 16,1982		Multispectral Scanner (MSS) and Thematic Mapper (TM) scenes
5	Landsat 5	March 1,1984		delivered Earth imaging data, available to download from Earth Explorer
6	Landsat 6	October5,1993		development of the spacecraft and ground system
7	Landsat 7	April15,1999		Thematic Mapper Plus (ETM+) scenes are available to download from Earth Explorer
8	Landsat 8	February11,2013		OLI/TIRS scenes are available to download from Earth Explorer
9	Landsat 9	September,2021		global observations for monitoring, understanding, and manag-ing Earth's natural resources

Source: United State of Geological Survey

Pixels can be call as satellite images are made up of little dots and the width of each pixel is the satellite's spatial resolution. All bands have a special resolution of 30 meters per pixel, although the thermal bands B10 and B11 are generated from sensor data with a native resolution of 100 meters per pixel. Band can be defined as each satellite has several sensors and each sensor captures the data on the specific wavelength of the electromagnetic spectrum. The following are the characteristics of Landsat (8).

Table (2) Characteristics of Landsat

Name of Band (Landsat -8)	Wavelength (micrometers) (µ m)	Resolution (meters)(m)
Band 1 Ultra Blue (coastal/aerosol)	0.43-0.45 µ m	30
Band 2 Blue	0.45-0.51 µ m	30
Band 3 Green	0.53-0.59 µ m	30
Band 4 Red	0.64-0.67 µ m	30
Band 5 Near Infrared (NIR)	0.85-0.88 µ m	30
Band 6 Shortwave Infrared (SWIR) 1	1.57-1.65 µ m	30
Band 7 Shortwave Infrared (SWIR) 2	2.11-2.29 µ m	30
Band 8 Panchromatic	0.50-0.68 µ m	30
Band 9 Cirrus	1.36-1.38 µ m	30
Band 10 Thermal Infrared (TIRS) 1	10.6-11.19 µ m	100
Band 11 Thermal Infrared (TIRS) 2	11.5-12.51 µ m	100

Software and Data Usage

In this research, Arc GIS software was used with Landsat data for the estimation of spatial variation in land surface temperature. To get the pixel-wise surface temperature in this study, satellite images are used as the main materials and checked with station temperature and the main source of data was four Landsat images.

Landsat 8 (OLI-TIRS) image for Path 132 and Row 48 WGS 1984, Zone 47 downloaded from USGS earth explorer website with free cost and images the entire earth once in (16) days. Thermal Infrared (OLI-TIR) of bands (10 and 11) used to estimate brightness temperature and bands (4 and 5) used to generate (NDVI) of the study area. Satellite data over Thirty-Two Townships of Yangon Region of March and December of (2015 to 2020) have been used in this paper.

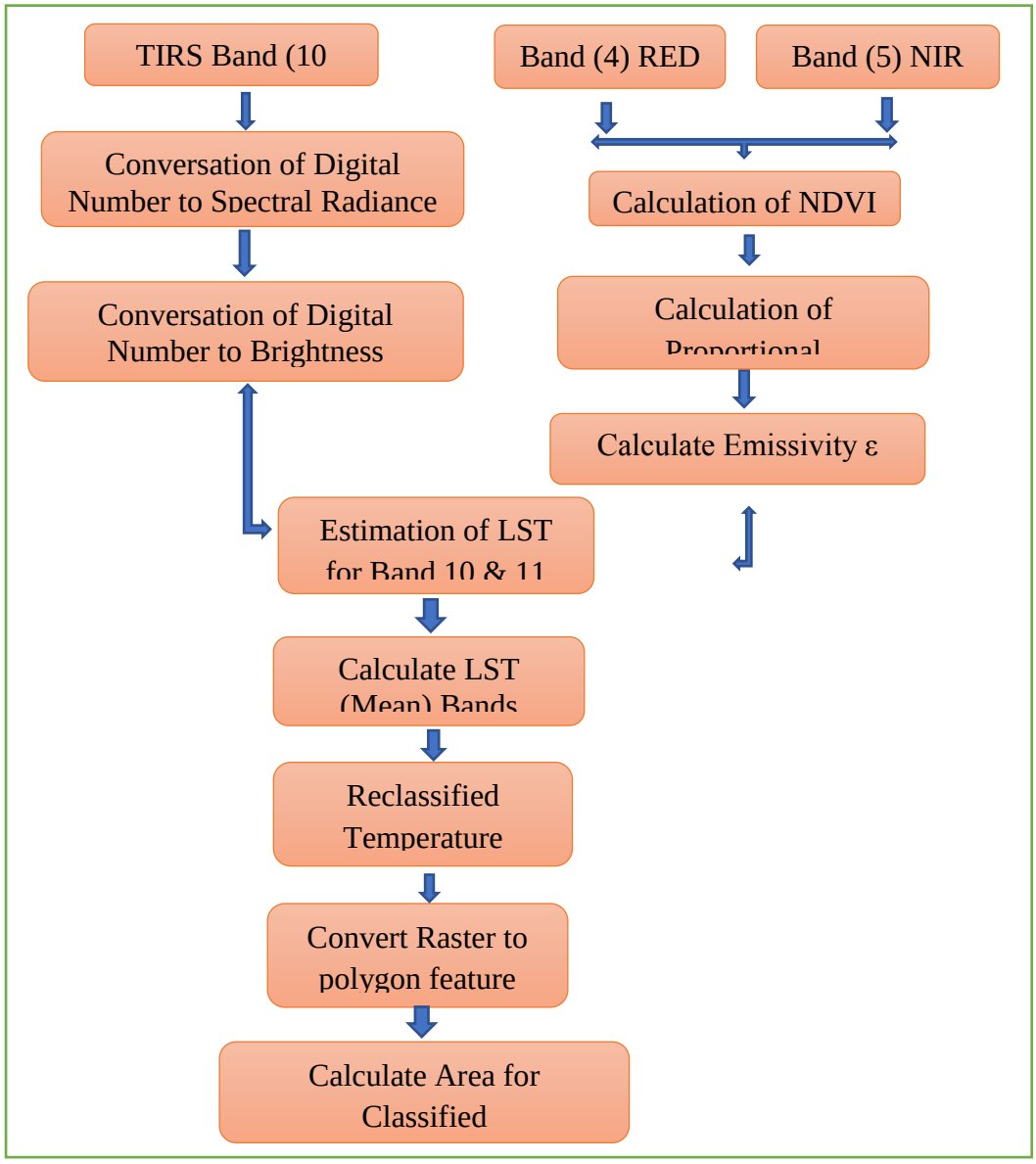
Table (3) Landsat Series

No	Types of Landsat Sensor	Reference System (Path, Row)	Band Used in the Study	Date of Image Acquisition	Spatial Resolution
1	Landsat-8	WRS-II/132/48	Band-4,5,10,11	2015(March& Dec;)	30 m
2	Landsat-8	WRS-II/132/48	Band-4,5,10,11	2020(March & Dec:)	30 m

Source: United State of Geological Survey

Methodology

Figure (2) Estimation Flow Chat of Land Surface Temperature



Source: Researcher View

Image Processing

1. Top of Atmosphere (TOA) Radiance

By using the radiance rescaling factor, can be converted Thermal Infra-Red Digital Numbers to TOA spectral radiance. "Radiance most often has units of (watt/ steradian/square meter). Reflectance is the ratio of the amount of light leaving a target to the amount of light striking the target. It has no units".

$$L\lambda = ML * Qcal + AL$$

Where:

1. Lλ = TOA spectral radiance (Watts/ (m2 * sr * μm))
2. ML = Radiance multiplicative Band (No.)
3.AL = Radiance Add Band (No.)
4.Qcal = Quantized and calibrated standard product pixel values (DN)

2.Top of Atmosphere (TOA) Brightness Temperature:

The brightness temperature can be measured by the radiance of the microwave radiation traveling upward from the top of the atmosphere to the satellite. Spectral radiance data can be converted to top of atmosphere brightness temperature using the thermal constant Values in the Metadata file.

$$BT = K2 / \ln (k1 / L\lambda + 1) - 272.15$$

Where:

1. BT = Top of atmosphere brightness temperature (°C)
2. Lλ = TOA spectral radiance (Watts/ (m2 * sr * μm))
3. K1 = K1 Constant Band (No.)
4. K2 = K2 Constant Band (No.)

3. Normalized Differential Vegetation Index (NDVI):

"The NDVI index that describes the difference between visible and near-infrared reflectance of vegetation cover and can be used to estimate the density of green area of land and which calculated using Near Infra-red (Band 5) and Red (Band 4). NDVI is a simple graphical indicator to analyze remote sensing measurement".

$$NDVI = (NIR – RED) / (NIR + RED)$$

Where:

1. RED= DN values from the RED Band
2. NIR= DN values from Near-Infrared Band

4. Land Surface Emissivity (LSE):

"Land surface emissivity (LSE) is the average emissivity of an element of the surface of the Earth calculated from NDVI values".

$$PV = [(NDVI – NDVI\ min) / (NDVI\ max + NDVI\ min)]^2$$

Where:

1. PV = Proportion of Vegetation

2. NDVI = DN values from NDVI Image

3. NDVI min = Minimum DN values from NDVI Image

4. NDVI max = Maximum DN values from NDVI Image

5. Emissivity

"Average **emissivity** of an element of the **surface** of the **Earth** calculated from measured radiance and **land surface** temperature".

$$E = 0.004 * PV + 0.986$$

Where:

1. E = Land Surface Emissivity

2. PV = Proportion of Vegetation

Table (4) Value of Band Specific Thermal Constant Conversion

Land sat	Value of Band Specific Thermal Constant Conversion	
	K1 (watt/(m2 *ster*µm)	K2 (watt/(m2 *ster*µm)
Land sat -8	Band 10 = 774.8853	Band 10 =1321.0789
	Band 11 =480.8883	Band 11 = 1201.1442

Source: Satellite Data

6. Land Surface Temperature (LST):

"The Land Surface Temperature (LST) is the radiative temperature Which calculated using Top of atmosphere brightness temperature, Wavelength of emitted radiance, Land Surface Emissivity".

$$LST = (BT / 1) + W * (BT / 14380) * \ln (E$$

Where:

1. BT = Top of atmosphere brightness temperature (°C)

2. W = Wavelength of emitted radiance

3. E = Land Surface Emissivity

IMAGE ANALYSIS

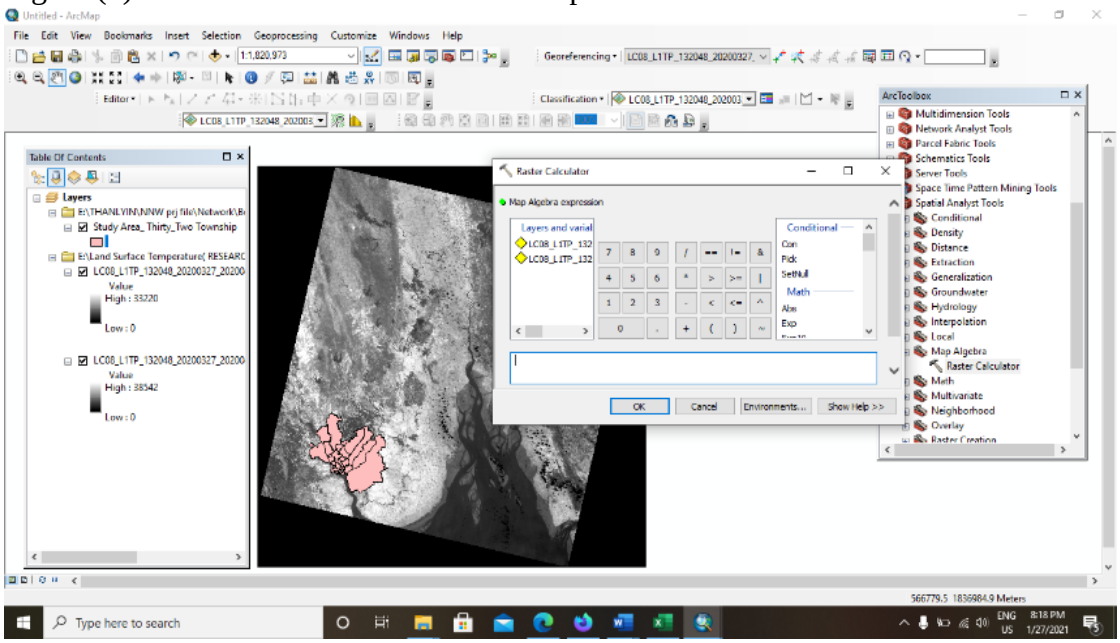
Estimation of Land Surface Temperature

The required data is collected and then calculated step by step in Arc GIS software. The main tool used is Map Algebra > Raster calculator for Landsat 8 data. Firstly, open Arc Map software and add band (10) and band (11) from Landsat 8 and conversion of Digital Number to Spectral Radiance and then calculate Spectral Radiance to Brightness Temperature.

Secondly, add band (4) and (5) to calculate Normalized Difference Vegetation Index. Thirdly, Proportional Vegetation is calculated from NDVI values and the land surface emissivity is then calculated using the PV value.

Fourthly, the radiative temperature of Land Surface Temperature (LST) which computed using the Wavelength of emitted radiance, Top of Atmosphere brightness temperature, and land surface emissivity. Moreover, the Mean LST of the band (10) and band (11) is calculated using the cell statistics tool.

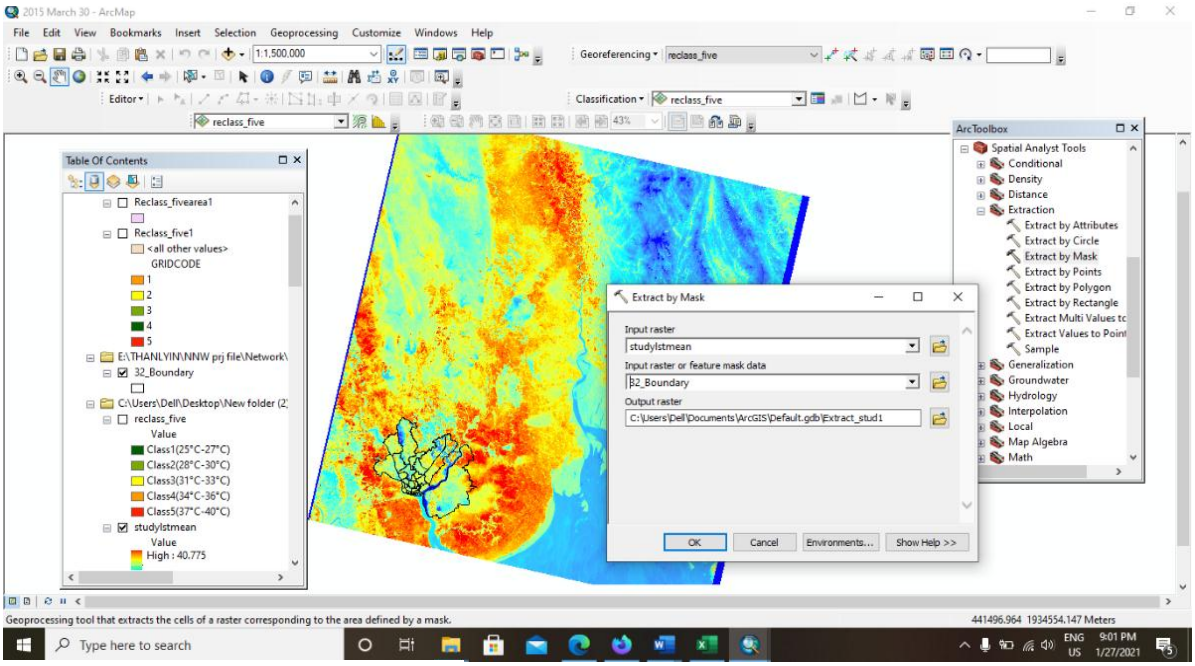
Figure (3) Calculation of Land Surface Temperature



Source: Researcher View

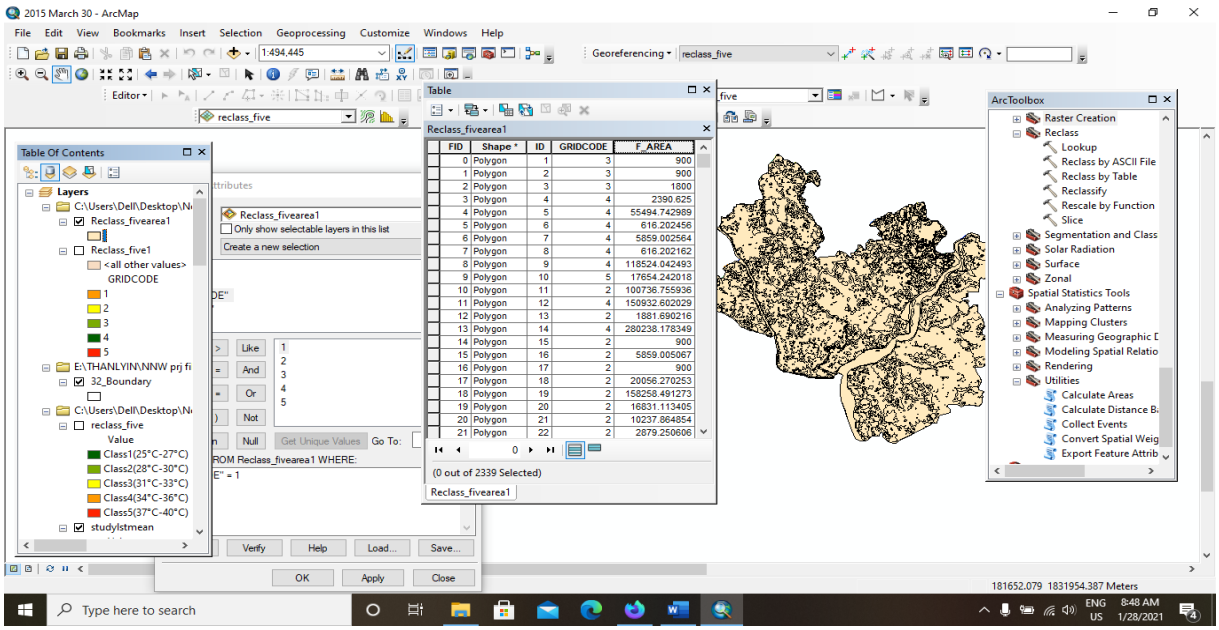
And then study area polygon is extracted by extraction > extract by mask from the Landsat image, and reclass temperature is calculated for the study area. The raster is then converted to a polygon feature to separate the study are into the area of land surface temperature. Finally, the resulting area is expressed as a percentage of the reclass temperature and area.

Figure (4) Land Surface Classification



Source: Researcher View

Figure (4) Polygon Area Classification



Source: Researcher View

FINDING AND CONCLUSION

In this paper, 2015and 2020 were analyzed using Landsat-8 data for (5) years apart. 2015(March and December) and 2020 (March and December) were calculated to clearly show the Land Surface Temperature (LST) calculation. According to the LST study, it was (40) °C in March 2015 and (44) °C in March 2020.

According to the table (5), the mean value of LST become increased from (32.05) °C in 2015(march) to (33.89) °C in 2020(March). The results are compared with the temperature data provided by the ground station to ensure reliability. Sometimes in LST calculation, due to the difference between the satellite-based and the ground-based, the resulting temperature may vary slightly.

Table (5) LST Results from Landsat-8 Images

	2015		2020	
	March	December	March	December
Count	1247486	1247486	1247486	1247486
Minimum	25.46	23.43	21.52	18.16
Maximum	40.78	36.68	44.69	33.09
Mean	32.048	28.5	33.89	25.03
SD	2.42	2.23	3.5	2.29

Source: Calculation from LST with Arc GIS

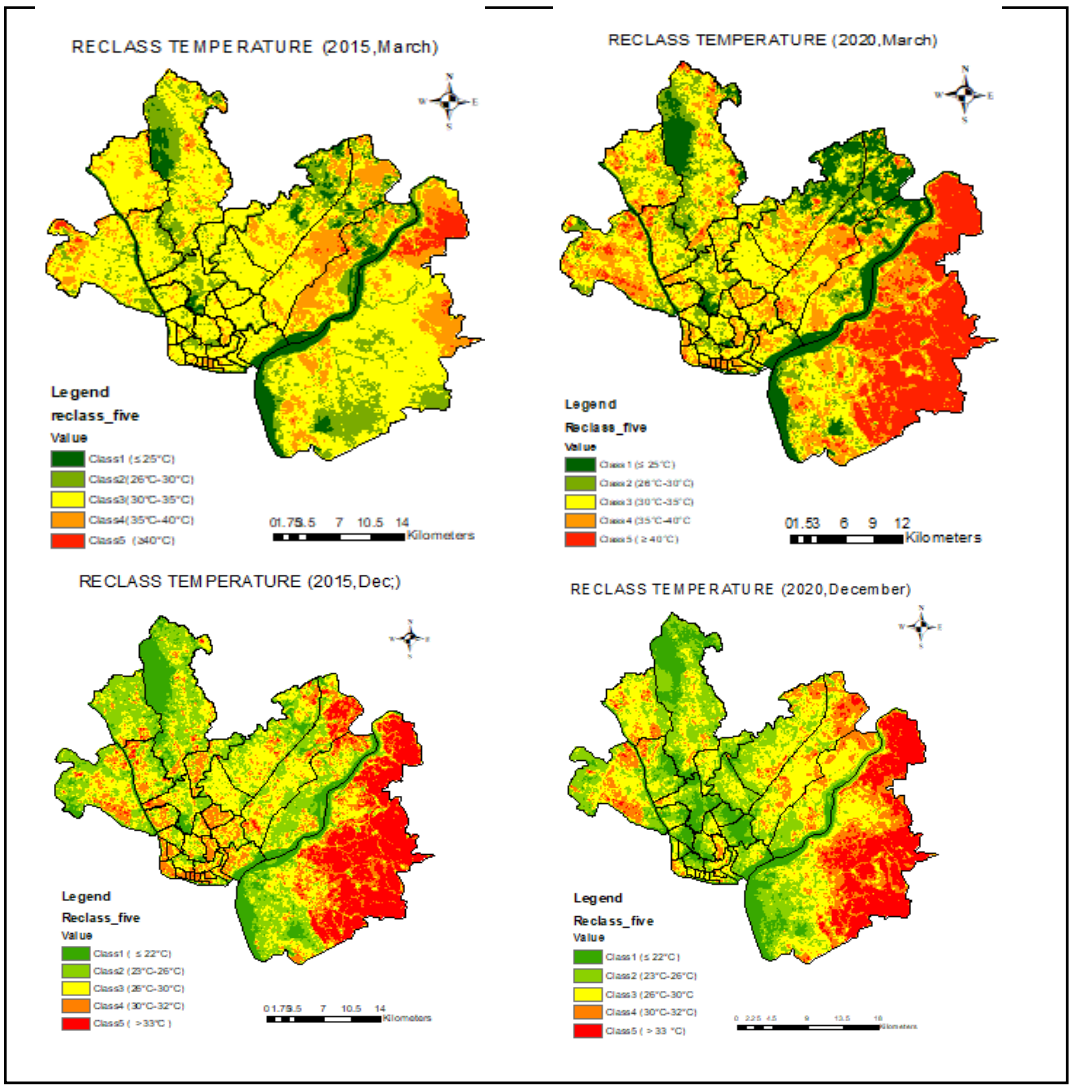
In the study area, temperatures are rising due to densely populated, with increasing use of air conditioners, increasing traffic, paving the concrete road, development of industry zone and This reason for an increase in temperature include an increase in population density, increasing usage of automobiles, paving a lot of concrete roads, increase use of air conditioners, expansion of urban areas and these leads to increase the temperature in urban areas.

1. Result of LST:

The output result raster image of LST values is reclassed into (5) groups from lowest to highest value of during 2015 to 2020, such as Class 1 (25°C), Class 2 (26°C-30°), Class 3 (30°C- 35°C), Class 4 (35°C-40°C) and Class 5 (40 °C) in Summer and Class 1 (22°C), Class 2 (23°C-28°C), Class 3 (28°C- 30°C), Class 4 (30°C-32°C) and Class 5 (32°C) in winter. In figure (5.1), each class of spatial extent is also calculated using Arc GIS software.

From the interpretation of the resulted maps, it was very clear that the area covered by green areas (water bodies& vegetation) have the lowest temperature and bare land, harvested land, and built-up areas having the highest temperature of study area of townships in Yangon Region.

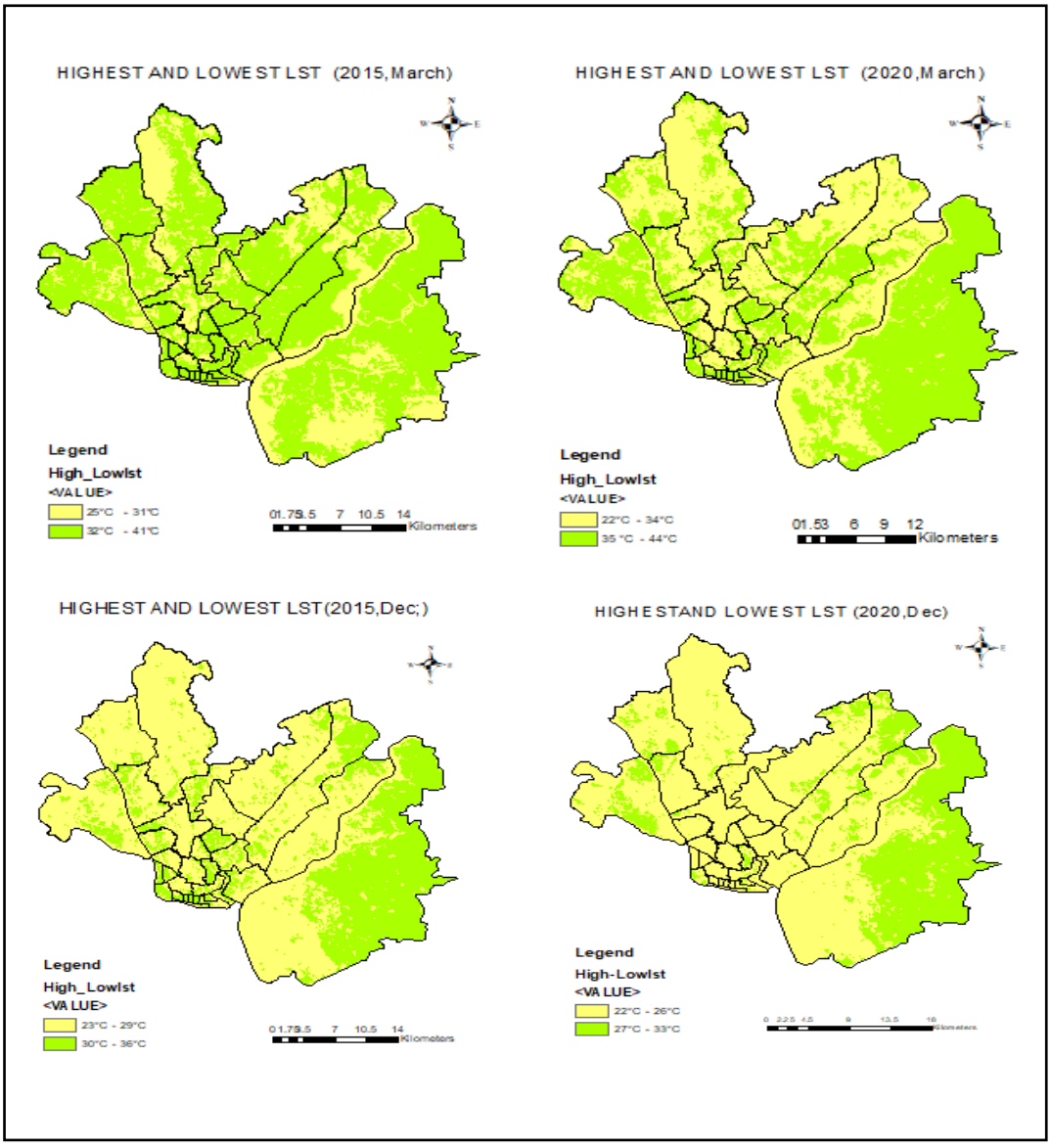
Figure (6) Spatial Variation of Land Surface Temperature in Study Area



Source: Calculation from LST with Arc GIS

The highest and lowest areas are shown in figure (7) to clearly show the spatial and temporal variation of LST in the study area. According to the following data, temperatures rose from (41°C) in March 2015 to (44°C) in march 2020, (36°C) in December 2015 and decreased (33°C) in 2020.

Figure (7) Highest and Lowest Temperature in Study



Source: Calculation from LST with Arc GIS

2. Percentage of Total Area of Different Class:

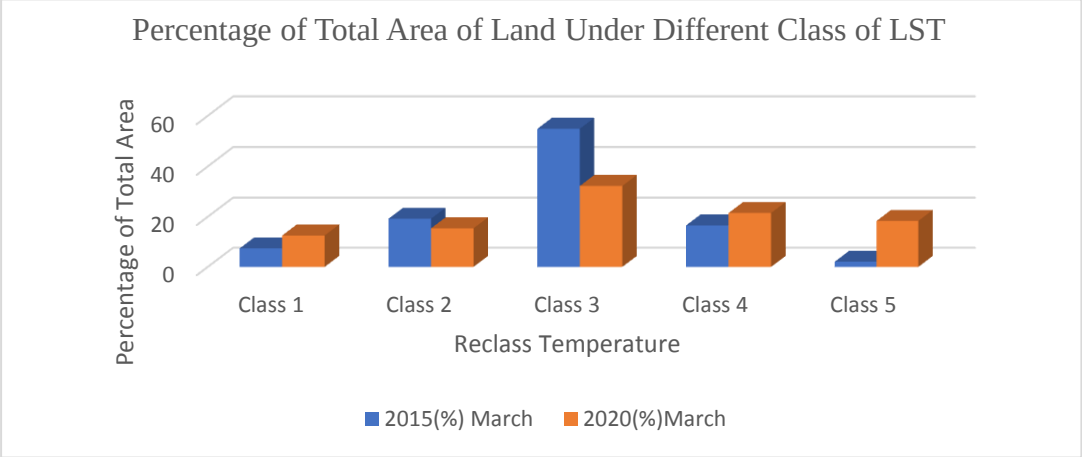
Re-class temperature (Geocode) was calculated from the area polygon with Arc GIS software and also the area percentages were calculated. It is divided into (5) classes for 2015 and 2020 (March). In2015 (March), the area underclass (1) accounted for (7.37%) of the total area but increased to (12.52%) by 2020. Class (5), the highest temperature, accounted for (2.05 %) of the total area in 2015 and increased to (18.32%) in 2020. Similarly, in 2015 (December), the area underclass (1) accounted for (11.89%) of the total area but increased to (14.3%) by 2020(December). In Class (5) the area under percentage was (16.12%) in 2015(December) but decreased to (12.74%) in 2020.

Table (6) Percentage of Total Area of Different Class (March)

Class	Class Temperature	2015(March)		2020(March)	
		Area (Sq-km)	(%)	Area (Sq-km)	(%)
Class 1	≤ 25°C	82.78	7.37	140.54	12.52
Class 2	26°C-30°C	215.47	19.19	172.72	15.38
Class 3	30°C- 35°C	615.58	54.83	362.27	32.27
Class 4	35°C-40°C	185.84	16.55	241.42	21.50
Class 5	≥40 °C	22.99	2.05	205.70	18.32
Total		1122.66	100	1122.66	100

Source: Researcher View

Figure (8) Percentage of Total Area of Land under Different Class of LST



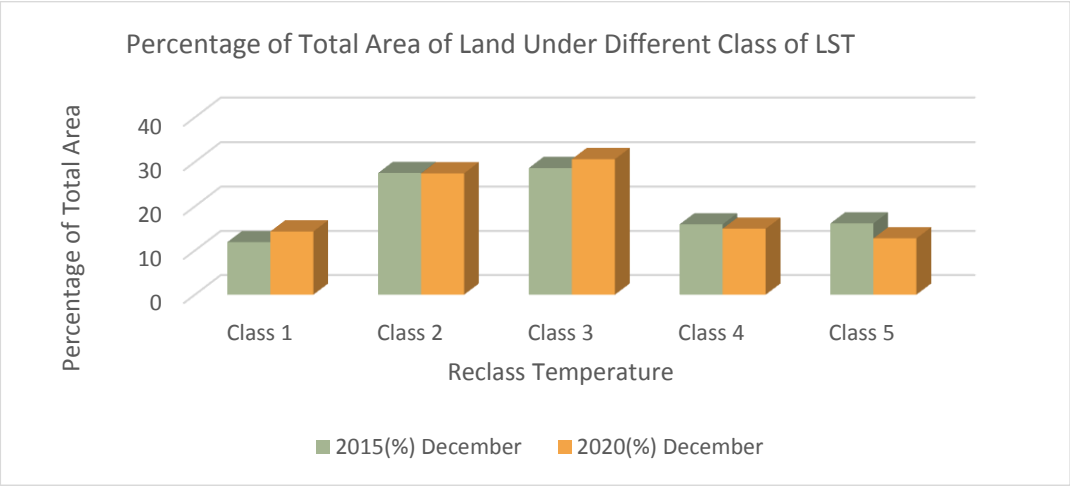
Source: Researcher View

Table (7) Percentage of Total Area of Different Class (December)

Class	Class Temperature	2015(December)		2020(December)	
		Area (Sq-km)	(%)	Area (Sq-km)	(%)
Class 1	≤ 22°C	133.51	11.89	160.85	14.3
Class 2	23°C-26°C	308.54	27.48	307.87	27.42
Class 3	26°C- 29°C	320.97	28.59	343.45	30.59
Class 4	29°C-32°C	178.68	15.92	167.46	14.92
Class 5	≥33 °C	180.96	16.12	143.02	12.74
Total		1122.66	100	1122.66	100

Source: Researcher View

Figure (9) Percentage of Total Area of Land under Different Class of LST



Source: Researcher View

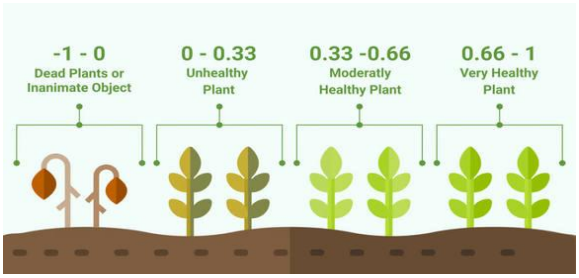
Figure (9) clearly shows the increasing changes of LST from one class to another during the period from 2015 to 2020. The main reasons for this change are changes in land use, warming weather, and the construction of concrete buildings. These Land use changes and the processes are interesting to learn more about.

3. Normalized difference vegetation index:

A simple graphical indicator is the normalized difference vegetation index {NDVI}, which is calculated by the visible and near-infrared light reflected for vegetation. Healthy vegetation absorbs most of the visible light and reflects a large portion of the near-infrared light. The following table shows the NDVI Values for the study area from 2015 to 2020. According to the following figure, the NDVI value (0.66 -1) grows well to plants, and the Index value plants may die within (-1 -0).

Figure (10) NDVI Value of Study Area

year	NDVI Value (March)	NDVI Value (December)
	Low - High	Low - High
2015	-0.274 0.560	-0.2689 0.560
2020	-0.215 0.603	-0.2022 0.545

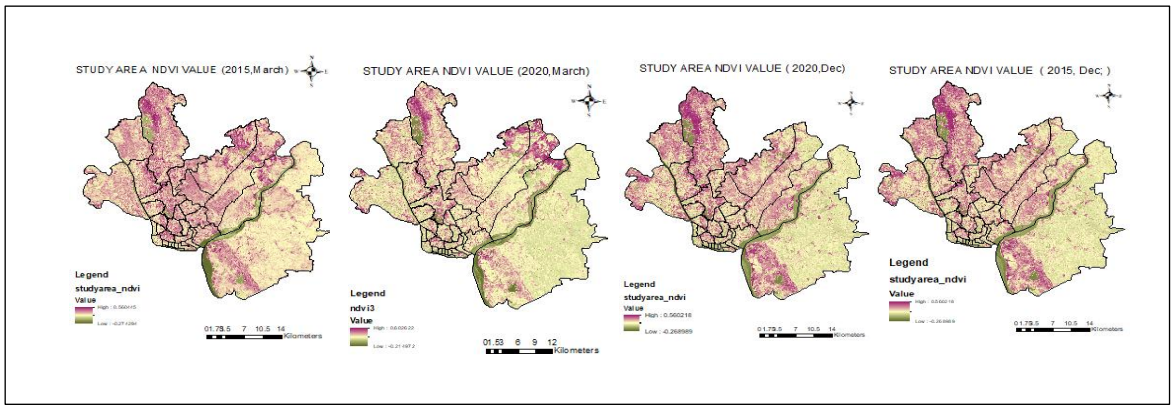


Source: Researcher View

Figure (10) shows the NDVI value of the study area. In it, the temperature of NDVI (0.56) in March 2015 was (40°C) and in March 2020 it was (44) ° C when it was NDVI (0.60). Therefore, as the temperature rises, so does the value of NDVI.

The Index of NDVI value (0.66 -1) grows well to plants and the Index value plants may die within (-1 -0). Figure (11) is a visual map calculated by Landsat 8 (Band 4 & Band 5) using Arc GIS software.

Figure (11) Map of NDVI Value in Study Area



Source: Calculation from LST with Arc GIS

CONCLUSION

In this research, Landsat-8 Data was used by Arc GIS software to analyze temperature changes. Because of the rapid growth of population, urban extension, buildings were becoming taller and denser, and industries were increasing temperature in the study area. Surface temperature is higher in the urban area and bare land than vegetation and water body areas.

This study can clearly show the usefulness of remotely sensed thermal infrared (TIR) data in retrieving land surface temperature (LST) that can estimate land surface temperature variation for both temporal and spatial, and the detection of an area of high and low temperatures over the study area.

Acknowledgements

First of all, I would like to express my gratitude to Dr. Yi Yi Win, Rector of University of Co-operative and Management, Thanlyin for allowing this geographical research. I would like to thank Dr. Nyein Nyein Win, Professor, and Head of the Department of Geography, East Yangon University, who help me as the Chairperson and for his guidance and valuable advice on this paper. I wish to thank Daw Aye Aye Maw, Professor and Head of Economic Geography Department, and Co-operative University Thanlyin for her encouragement. Finally, I also wish to thank all my teachers and respective departmental concerns for giving me the necessary assistances and encouragement which enables me to successfully carry out this work.

References

Anandababu. D. et al. (2018) Estimation of Land Surface Temperature using LANDSAT 8 Data. *International Jouranl of Advance Research, Ideas and Innovations in Technology*, 4(2), pp. 177-185.

Khaing, K. K. (2017) Geographic Assessment on Spatial Variation of Land suface Temperatures in Yangon City. *Research Gate.*

Khin, M. Y. et al. (2019) Land Surface Temperature Changes of Two Economic Cities in Myanmar: (Case Study on Yangon and Mandalay Cities' Environment). *International Journal of Scientific and Research Publications* , 9(9).

Ugur, A. and Gordana, J. (2016) Algorithm for Automated Mapping of Land Surface Temperature Using LANDSAT 8 Satellite Data. *Hindawi,* Volume 2016.