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Contents

- 1 Farmer Protection and Sustainability of Small-scale Tobacco Production in Zimbabwe
LINDA TAPFUMANEYI, ARCHEFORD MUNYAVHI, TATENDA MAPFUMO,
PRECIOUS KUZIVA HOVE, PRAXEDIS DUBE, WONDER NGEZIMANA
- 22 Digital Economy in the Developing World: Implications on Policy and Practice
TINASHE MAGANDE, FERDINAND KABOTE, INNOCENT CHIRISA, TOBIAS NHARO, TEURAI MATEKENYA, JUSTIN MAKOTA, AND FUNGAI N MUKORA
- 43 The Nexus between Personal Life Events of Medical Students and Distress: A Case of Two Newly Established Medical Schools in Zimbabwe
MQEMANE TSHABABA, REGIS CHIRESHE, JULIA MUTAMBARA
- 61 The Herbicidal Activity of Spider Plant, *Cleome gynandra* L., Plant Tissue on Weeds in Sweet Pepper (*Capsicum Annuum*) and Tomato (*Solanum Lycopersicum*)
FARAI SHELTON CHIHOBVU, ELIZABETH NGADZE, STANFORD MABASA,
MAXWELL HANDISENI AND INNOCENT CHIRISA
- 81 Exploring the Motivations and Critical Factors of Successful Enterprise Resource Planning Implementation in Organisations in Zimbabwe
JUSTIN MAKOTA, FERDINAND KABOTE AND TOBIAS NHARO
- 103 Phenomenological Insights into Challenges and Opportunities of Learning through Social Information Communication Technology Andragogy
TOBIAS NHARO, TAUYA MANYANGA, FLORENCE BARUGAHARA, JUSTIN MAKOTA, SIBUSISIWE KANGAMBEU, TIRIVASHE MAFUHURE AND FERDINAND KABOTE

Farmer Protection and Sustainability of Small-scale Tobacco Production in Zimbabwe

LINDA TAPPUMANEY¹, ARCHEFORD MUNYAVHI², TATENDA MAPFUMO³,
PRECIOUS KUZIVA HOVE⁴, PRAXEDIS DUBE⁵, WONDER NGEZIMANA⁶

Abstract

The fast-track land reform (FTLR) programme resulted in an influx of small-scale African tobacco farmers. This was a plus for the country. This was followed by an increase in auction floors and the emergency of tobacco contract farming. Since 2000, small-scale tobacco farmers have been accounting for a significant proportion of tobacco produced and the Gross Domestic Product (GDP) in Zimbabwe. Despite the significant contribution by tobacco farmers to the economy, the issue of farmer protection in contractual arrangements is often overlooked when it comes to small-scale tobacco farming. Contract farming encourages sustainable crop production and shift towards crop specialisation, resulting in quality tobacco produced and helping in poverty alleviation among small-scale farmers. Several organisations have been formed to support farmers like, e.g. the Tobacco Industry and Marketing Board (TIMB) and the Zimbabwe Tobacco Association

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(ZTA), with a spirit to fight to protect farmers. However, small-scale farmers cried out for protection against unscrupulous business players in contract farming from the risk of low prices, fraud and general economic squalour. Several studies have been done on how to increase tobacco production and profitability of farmers, but long-standing issues of farmer protection are often left out. It is easily overlooked that tobacco production is a business and that small-scale farmers as players in the business, are driven by motivation (income, returns and protection) just as employees do. Thus, this study focused on the impact of farm protection on small-scale tobacco production in Zimbabwe.

Keywords: contract farming, profitability, fraud, risks, unfair contract

INTRODUCTION

Zimbabwe is Africa's largest producer of flue-cured tobacco (Dube *et al.*, 2017; Chingosho *et al.*, 2020). The tobacco crop accounts for 10% of the country's GDP (Chingosho *et al.*, 2020). Tobacco is a major source of government revenue raised by levying growers and buyers. According to the Food and Agriculture Organisation (FAO) (2016), tobacco farming is an achievable strategy for mitigating rural poverty. Smallholder farmers view farming tobacco as a good livelihood strategy because they anticipate getting a good income by selling leaf tobacco (Chingosho *et al.*, 2020). Most smallholder farmers are resorting to tobacco farming since it tends to reward them well (Jerie and Ndabaningi, 2011). Tobacco smallholder farmers face the challenge of failing to access loans from banks that traditionally supported the tobacco farmers, as most of the farmers had limited experience, and no bankable collateral (Dube, 2017). The promised 99-year lease and permits have proved insufficient for banks to release agricultural credits that were accessed by the large-scale commercial farmer before the land reform program (Moyo and Nyoni, 2013; Scoones *et al.*, 2017, Mazwi *et al.*, 2020).

Support for agriculture by banks has been a recurrent challenge since the fast-track programme. This has caused a rise in contract farming as an optional source of financing for tobacco production (*ibid.*). Thus, most smallholder tobacco farmers depend on contract farming. Easey

access to inputs, employment creation, technology transfer, markets, foreign exchange generation and alleviation of poverty are incentives promised under contract farming (Ochieng, 2010).

However, from a critical point of view, contract farming leads to loss of autonomy, indebtedness, unequal power relation and converting the farmers into proletariats as agribusiness sector capitalises on free labour provided by farmers to engage in extracting value through labour taking advantage of smallholder farmers (*ibid.*). Agrarian political economists consider power asymmetries that are reflected through quality controls, unfair pricing and uneven sharing of risks (Smalley, 2013; Martiniello, 2016). High input and low output prices are techniques used by most contractors to exploit smallholder tobacco farmers by extracting and collecting surplus value. Critics of contract farming, such as Shivji (2011), note these malpractices. According to Mazwi (2019), the low prices on the market are caused by collusion of contractors at a local level in setting prices.

Although there are grower associations in the industry of tobacco recognised by the TIMB, for instant, the Zimbabwe Progressive Tobacco Farmers Union (ZPTFU) and the Zimbabwe Association of Tobacco Growers (ZATG). The influence of the grower associations in bargaining for better contracts is restricted by the power of financial capital and agrarianism (Mazwi *et al.*, 2020). Even though ZPTFU represents more than 5 000 tobacco smallholder farmers, it is a new organisation with less influential skills. To further complicate the situation for smallholder tobacco farmers, all contract forms are written in English, a language that may not be understood by all farmers, thus disadvantaging farmers with low levels of education signing contracts they do not understand (*ibid.*). Thus, this study focusses on the impact of farm protection on small-scale tobacco production in Zimbabwe.

THEORETICAL FRAMEWORK

The research is inspired by the Human Motivation Theory of 1983, developed by American psychologist Abraham Maslow. The theory is also known as Maslow's Hierarchy of Needs Theory that suggests five groups of human needs that influence an individual's behaviour

(Maslow, 1987). Maslow's Theory emphasises that human decisions are influenced mainly by the five psychological needs, presented in ascending order of groups as follows: 1. Physiological needs; 2. Safety needs; 3. Love and belonging needs; 4. Esteem needs; and 5. Self-actualisation needs (*ibid.*; Tay and Diener, 2011). The lower order physiological needs encompass the basic needs for human survival that include food, shelter, clothes, reproduction, water and rest. Once these are satisfied, then a person can move to second order needs. Safety needs focus on the protection of individuals from any form of adversities that include emotional, financial, health, well-being, violence and even theft. Safety needs are the ones mainly supporting this study of farmer protection.

Farmer protection is influenced by the extent to which the second order Maslow's human needs are satisfied. Financial, health, emotional and well-being are key factors that influence farmers' decision to continue or abandon tobacco enterprise, thus having a bearing on the sustainability of tobacco production by them. In Zimbabwe, tobacco production plays a significant role in the economy, contributing approximately 10% of the country's GDP, 30% of total export earnings and 50% of agriculture exports (Ministry of Agriculture, 2018). In addition, approximately 250 000 people (almost 5% of Zimbabwe's total population) are engaged in tobacco related work, including tobacco farming (TIMB, 2018; 2019). Most of the tobacco in Zimbabwe is grown by small-scale farmers, accounting for about 57% of the land under tobacco and 95% of the total crop. However, tobacco farmers are crying over poor pricing, unfair input pricing under contract farming and fraudulent practices by some contracting companies that which a bearing on the satisfaction of the second order tobacco farmer's safety needs (Chingosho *et al.*, 2020; Ruckert *et al.*, 2022).

Given that tobacco production is labour and capital-intensive, tobacco farmers focus mainly on tobacco production on large sizes of land and allocate food crops on small land portions, or no none at all (Sakata, 2018; Clark *et al.*, 2020). As result, failure to satisfy the safety needs of tobacco farmers has the trickledown effect that extends to lower order tobacco farmer's psychological needs of food,

shelter, health, water and many others that farmers anticipated to buy from tobacco production earnings. Hence, farmers may be forced to reduce the size of tobacco enterprises or completely forego tobacco production for food crop production. Farmer protection is of paramount importance for sustainable production and economy as tobacco is the major foreign currency earner.

CONCEPTUAL FRAMEWORK

FAIR PRICING

When farmers are under a tobacco grower contractual agreement, they are obliged to sell to the contracting firm. This creates a hold-up problem and ex-post opportunistic advantage in favour of the contracting firm. Contracting firms can suppress tobacco prices to farmers to maximise their profit margin as farmers cannot sell to any other firm due to the contractual agreement. In some instances, farmers fail to clear off their debt with the contracting firm. The farmers are crying over poor pricing, unfair input pricing and fraudulent practices by some contracting companies that have a bearing on the satisfaction of the second order tobacco farmer's safety needs (Chingosho *et al.*, 2020; Ruckert *et al.*, 2022). This was further endorsed by Chifamba (2021), who states that the TIMB statistical report of 2020 revealed that the highest price paid on auction floors has remained \$4.99 per kilogram for the past six years. However, farmers have seen their tobacco sell for as little as \$0.80 per kilogramme, resulting in paltry earnings after contractors, middlemen and the auction floor commissions are paid out. Mango (2022) concurred with the same notion when discovering that 55% of the respondents in Shamva revealed that the greatest challenge faced by contract tobacco farmers was the low producer price. At such low prices, farmer protection is not guaranteed and tobacco farming for smallholder farmers is not sustainable.

UNFAIR CONTACTING TERMS

In most instances, the contractual agreement between the farmer and the firm are crafted in a manner that favours the firm. Muleya (2021) states that A Tian Ze contract for the 2019-2020 season shows how the system is rigged in the company's favour, with farmers running the

risk of shouldering debts larger than they are likely to earn from their tobacco. Loans must be paid in full before the grower makes any profit, and sometimes their property is offered as collateral in case they default. Chazovachii (2021) further alludes that centralised contract farming arrangements are manipulative. Arrangements are characterised by uncertainty and information asymmetry. With contract terms that are skewed in favour of the contracting firm, the small farmer may not even get any income if the harvest is below break-even and runs the risk of losing other assets in debt repayment.

HIGH INPUT PRICES

Under contractual agreements, the price of inputs is highly inflated by the contacting firms. In some cases, the inputs are priced at over 100% of their market value. This information is usually not disclosed to the farmer for them to make comparisons with the market values. This is coupled with the small-scale farmers' lack adequate resources to buy their own inputs hence the desperation to enter into contracts. Chazovachii (*ibid.*) discovered that interest rates on inputs and extension services they offer set by contracting firms are beyond farmers' capacity to manage, as their products are given poor market prices. Mango (2022) posits that high costs of production and uncompetitive producer prices imposed by contracting companies on tobacco farmers render the credit scheme unviable and unprofitable to the farmers. The high input costs imply that the farmer must harvest a high yield to be able to cover the high cost of production. This is the main reason behind the vicious debt cycle that small-scale farmers have with their contracting firms.

RISK MANAGEMENT

Farming, as an enterprise, is plagued by a plethora of risks and tobacco farming is not spared from these unexpected circumstances. These risks and their severity have been greatly increased by climate change. Most small-scale farmers who venture into tobacco farming do not employ risk mitigation measures. The risks they face include, but are not limited to, price risk, inputs cost risk, adverse weather conditions and human resources (*ibid.*). The contracts that smallholder farmers get into do not have insurance or any risk mitigation tool incorporated in them. Any smallholder farmer under a contract is totally exposed to

these risks and due to their low net worth; they cannot purchase insurance on their own. In the event of adverse conditions, smallholder farmers bear the full brunt and, in some instances, make total losses (Muleya, 2021). However, the contracting firm must be paid for the inputs that were provided and other costs associated with the contracts. In most instances, smallholder farmers are compelled to sell other assets on the farm to pay off the debt to the contacting firm in the event of risks.

LACK OF INFORMATION ON TOBACCO TRADE

To most smallholder farmers, tobacco trade is a 'black box system'. The farmers do not understand how the auction system works, how their crop is graded and the prices that are commensurate with each grade. This information asymmetry allows for opportunistic behaviour in that contracting firms lower the grades of smallholder farmers' tobacco, thus lower prices (Mango, 2022). Low prices mean lower revenues for the farmer. In addition, the smallholder farmers are not aware of their right to appeal against low prices that are not a true reflection of the quality of their crop.

TRAINING

Lack of comprehensive training on tobacco agronomic practices and trade has been an impediment to farmer protection. Mango (*ibid.*) argues that smallholder farmers lack the knowledge to identify pests and diseases on time. In instances where they identify the pests, they lack the knowledge on proper usage of pesticides. Thus, they suffer losses on yield. This lack of training is further worsened by usage of rudimentary technology and substandard facilities. In most instances, smallholder farmers use substandard flue-curing barns, hence producing low quality output that fetches low prices on the market.

METHODOLOGY

STUDY AREA

The research was conducted in Wards 21 and 22, Marondera District in Mashonaland East Province of Zimbabwe. The research area falls in agricultural ecological natural Region IIb. The district has an average

annual rainfall of between 750mm and 1 000mm (ZIMSTAT, 2019). Its altitude varies from 900m to 1 000m above sea level (Ruckert *et al.*, 2022). The study area is endowed with heavy sandy and clay soils that are favourable for the production of cereal crops (maize, sorghum and rice) and horticultural crops (potatoes, paprika, tomatoes, cabbages) and cash crops (tobacco) and is characterised by both urban and communal farming (Mafuse *et al.*, 2021). People in Marondera District are engaged mainly in farming activities of tobacco and livestock production, such as cattle, sheep, goats and poultry.

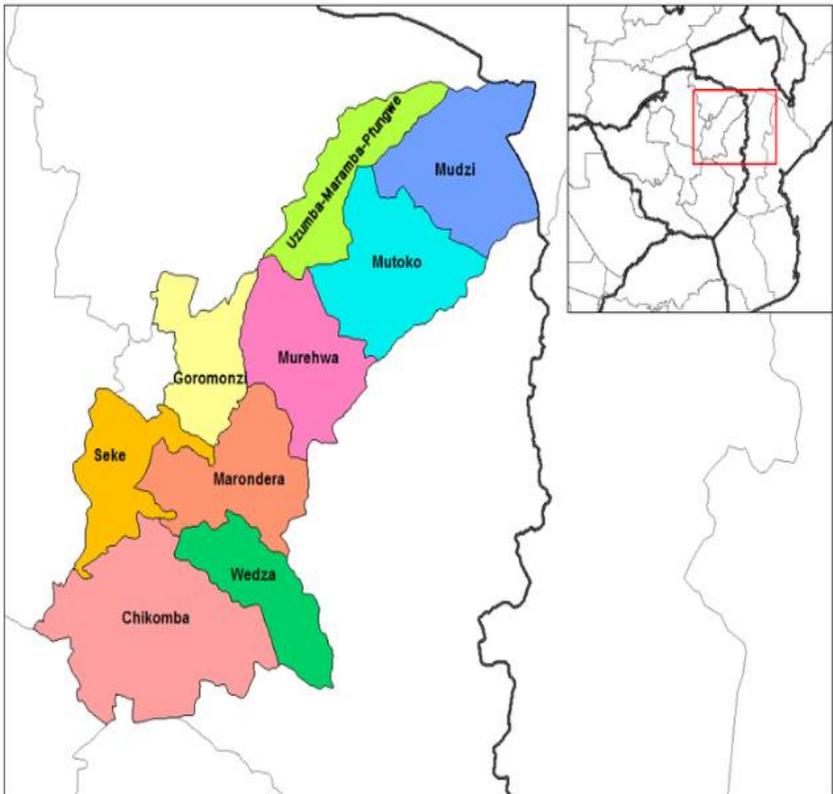


Figure 1: Map of Mashonaland and the specific study site, Marondera district (ZIMSTAT, 2019).

SAMPLE AND SAMPLING PROCEDURE

The research used the non-probability sampling technique, particularly snowball sampling, since not all farmers in the study area were small-scale tobacco farmers. Therefore, to reach the tobacco farmers, the research made use of local extension officers. Other participants were reached through referral by the first participant. A sample of 172 small-scale tobacco farmers was sampled and interviewed for the research.

SOURCE DATA AND COLLECTION PROCEDURE

The study was conducted using semi-structured interviews and structured questionnaires. Semi-structured interviews were held with key stakeholders such as tobacco companies (contractors), agriculture extension workers, councillors and village heads. These stakeholders were interviewed on their perceptions of the contract scheme. Issues that were asked concerning the tobacco contract credit scheme were the provision of inputs on time, timely payment of tobacco leaf on the market, problems faced by the smallholder farmers in the contract credit scheme and challenges faced by contractors. The Statistical Package for Social Sciences (SPSS) was used to analyse data to assess challenges and benefits of tobacco growing under contract farming.

DATA ANALYSIS

The research utilised descriptive statistics such as frequencies and percentages to describe the tobacco contract related issues such as those asked concerning the tobacco contract credit scheme in the study area. A Multiple Linear Regression Model (MRM) was used to determine the factors influencing the profitability of small-scale tobacco production in the study area. Research data were used to come up with a multinomial regression expressed as:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

Table 1: Variables of small-scale farmer's tobacco profitability.

Independent variables	Variable description
X ₁ Gender	Gender of household head (1=male, 0=female)
X ₂ Age	Age of the respondent
X ₃ Experience	Number of farming years of household head
X ₄ Educaation	Level of education attained (0=primary, 1=secondary, 2=tertiary)
X ₆ Farmer Membership	Are you a member of a farmer group/cooperative? (1=yes, 0=no)
X ₇ Land Size	Total land size of farms in hectares
X ₈ Contract Farming	How long have you been in tobacco contract/agreement with the current partner?
X ₉ Divert Inputs	Did you use any of these inputs for non-tobacco crops? (1=yes, 0=no)
X ₁₀ Selling Inputs	Did you sell some of the inputs provided? (1=yes, 0=no)
X ₁₁ Outstanding Arrears	Do you still owe any money/balance from the previous year's contract/ production loan? (1=yes, 0=no)
X ₁₂ Balance Arrear	How much did you owe to the contracting company in USD\$?
X ₁₄ Hired Labour	How much did you pay for hired tobacco-related labour?
X ₁₅ Non-Tobacco Crop	Did you plant any non-tobacco crop during the most recent tobacco farming season?
X ₁₆ Tobacco Levy	What amount of government tax was deducted from tobacco sales as Tobacco Levy?
X ₁₇ Warehouse Levy	How much did you pay for the warehouse?
X ₁₈ Tobacco Income	How much income did your household receive from tobacco
Dependent variable	
Y ₁ Tobacco Profit	Total household tobacco profit

RESULTS

DEMOGRAPHIC OF THE RESPONDENTS

Results of this study show that most of the respondents (72%) were male, suggesting that tobacco production in Marondera District is dominated by male farmers. On the contrary, female smallholder tobacco farmers constituted only 28%. This evidenced that tobacco

farming is male-dominated, a sign of gender inequalities in smallholder tobacco production. These results agree with the notion that tobacco farming is common amongst males who are more technically talented, physically fitter, and do not bother staying in the fields for long hours to optimise the yields (FAO, 2012). In addition, the results reveal the decision-making structure of most households in Zimbabwe, where men are considered household heads since the study only considered the leaders of these households. So, based on this, it is wise to enact public agricultural policies to encourage gender equality in maize production (the staple food), given that women constitute a significant proportion of the population in Zimbabwe.

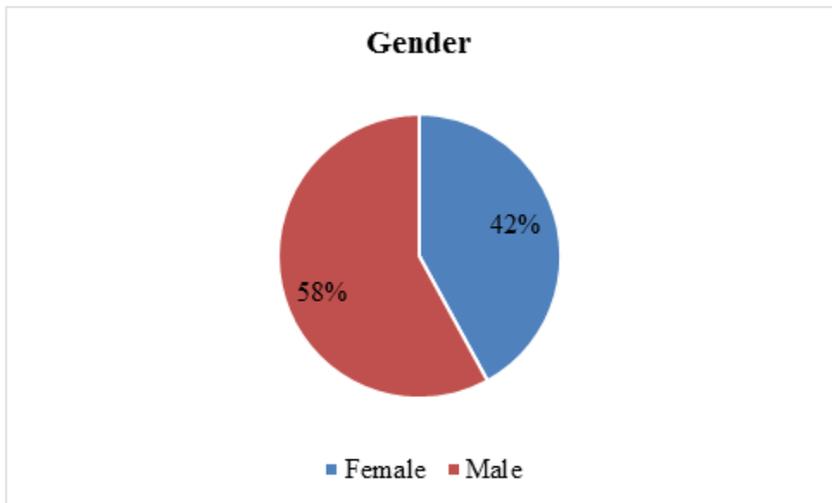


Figure 2: Respondents distribution by Gender (Research Data, 2022)

DISTRIBUTION OF RESPONDENTS BY AGE

To determine the impact of farmer protection and sustainability on small-scale tobacco production and profitability, the researchers considered the exploration of the ages of the respondents who worked under the contractual arrangements. This assisted in establishing the ages of small-scale farmers and take a broad view if the age effect is important in the research (Table 2).

Table 2: Distribution of Respondents by Age (Survey, 2021)

Age	Count	Percentage
< 30 years	5	2.9%
30-39 years	32	18.6%
40-49 years	42	24.4%
50-59 years	49	28.5%
60-69 years	29	16.9%
70-79 years	13	7.6%
80 years +	2	1.1%
Sub Total	172	100.0%

Table 2 reveals that the respondents' ages range from 21 years to 82 years with an average age of 47.5 years. The respondents' age groups were categorised into seven groups. The results show that tobacco production in Marondera District was dominated by farmers aged from 50 years to 59 years and 40 years to 49 years, constituting 28.5% and 24.4%, respectively. Furthermore, the results revealed that small-scale farming is not common among the young (aged below 30 years) and the elderly who are at least 80 years old, as they contributed only 2.9% and 1.1%, respectively. This is attributed to the fact that young people are concentrated mostly in towns and urban centres doing other jobs for a living, while the elderly have since retired from the farming business as it required able-bodied energetic people to carry out farm duties. As a result, the age groups that dominate tobacco production are people with energy, though most of them are resource constrained to support their production, implying poor production as tobacco farming is very capital intensive (Ruckert *et al.*, 2022).

DISTRIBUTION OF RESPONDENTS BY THEIR HIGHEST LEVEL OF EDUCATION

Small-scale tobacco farmers in Marondera District under contract farming were also examined to determine their abilities to make comprehensive responses based on their highest level of education (Table 3).

Table 3: Respondents Distribution by their Highest Level of Education (Survey, 2022)

Education Level	Count	Percentage
Primary	14	8%
Secondary	127	74%
Tertiary	31	18%
Sub-total	172	100%

Table 3 reveals that that respondents in Marondera District attained primary, secondary and tertiary education level as their highest level of education. The findings revealed that the bulk of the respondents (74%) had attained secondary level education; with the least (8%) having attended only primary level education and 18% of them had attained tertiary education in different areas. Considering the respondents' literacy rate, the study expected a better understanding of the tobacco contract terms as most of the respondents could read and write. Those semi-literates were able to understand the contract agreement terms with some assistance.

USE TOBACCO INPUTS TO NON-TOBACCO CROPS

The study results shown in Figure 3 revealed that small-scale tobacco farmers in Marondera District used some of their tobacco inputs in non-tobacco crops as evidenced by the minority (18.6%) of the respondents who submitted that they have used some of the contract inputs in non-tobacco crops. However, only 140 small-scale farmers, 81.4% of the total respondents, used their contract inputs solely for tobacco production. This, therefore, means that the minority had to underfeed the crop according to its nutritional requirements, hence small-scale tobacco production is characterised by reduced tobacco production and profitability. This emanates from using tobacco

contract inputs on other non-tobacco crops, hence improving tobacco production remains difficult as small-scale farmers are resource constrained. This is supported by Ruckert *et al.* (2022), who posits that tobacco production is capital intensive mainly the purchase of the much-needed plant nutrients in the form of fertilizers. As a result, small-scale tobacco farmers could not fully utilise inputs or attain optimum production and profits as well.

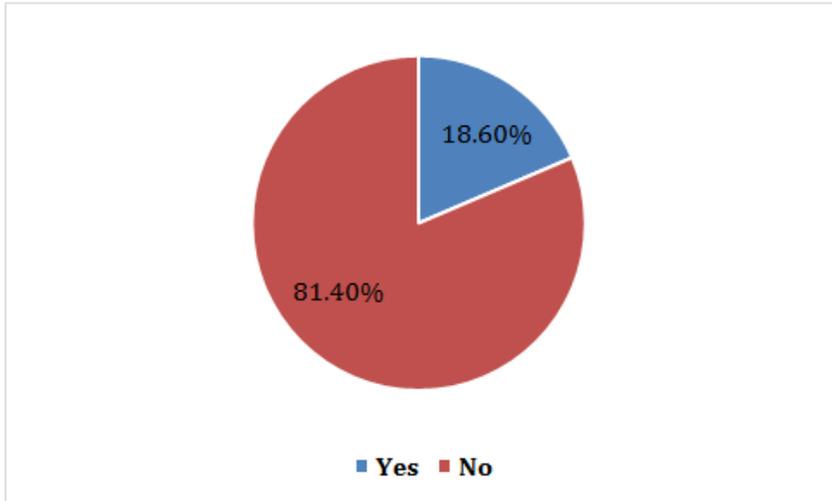


Figure 3: Use tobacco inputs to non-tobacco crops (Survey, 2022)

SELLING OF TOBACCO INPUTS

The study findings shown in Figure 4 reveal that some of the small-scale tobacco farmers in Marondera District sold some of the contract inputs as evidenced by the minority (21.5%) of the respondents who submitted that they sold some of the tobacco inputs. However, about 135 small-scale (78.5%) of the total respondents had not sold any of their inputs. They wholly used the inputs to support their tobacco production. This therefore means that the 21.5% had to underfeed the crop as well, hence small-scale tobacco production is characterised by reduced production, grading and profitability. This emanates from selling inputs by small-scale tobacco farmers under contractual arrangements, hence, improving tobacco production remains difficult.

As a result, smallholder maize farmers could not fully invest in optimum inputs or attain optimum production and profits as well, under leasehold.

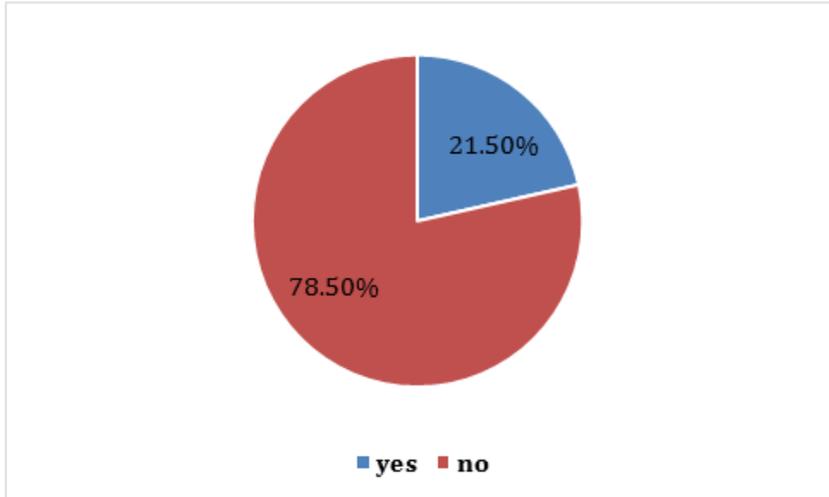


Figure 4: Selling of tobacco inputs (Survey, 2021)

The findings and discussions on small-scale tobacco production under contractual arrangements are displayed in the following sections.

Table 4: Testing for independence of residuals (Survey, 2021)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.709 ^a	.582	.509	2.383

The regression model results in Table 4 showed that the R-Square of 0.582 means 58.2% of the variation in profits is being explained by the model independent variables representing the small-scale tobacco production in Marondera District. Furthermore, results in Table 4 show the test for autocorrelation of the residuals done using the Durbin Watson test. The error term or residuals are said to be independent if and only if the Durbin Watson test is closer to 2.0 (Gujarati, 2004). Based on the Table 4, Durbin Watson value of 2.383,

implies that the error terms generated by the regression model are free from auto correlated.

Table 5: Model Goodness of Fit the ANOVA Table (Survey, 2021)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	8125417.116	13	625032.086	11.715	.000 ^b
	Residual	8056125.382	151	53351.824		
	Total	16181542.498	164			

A Multiple Regression Model (MRM) was used to analyse the effect of the small-scale tobacco on profitability, basing on data obtained from small-scale farmers, Marondera District. The study results are shown in Table 5. Collectively, the regression model is a good fit for the data (F=11.715, p=0.000). Thus, the characteristics of the small-scale farmers are statistically significant in determining tobacco profits.

Table 6: Profitability Coefficients for Small-Scale Tobacco Farmers (Survey, 2021)

Model	Unstandardised Coefficients		Standardised Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.945	.390		2.423	.017
Age	.932	.469	.123	1.987	.491
Gender	.410	.953	.026	.430	.668
Education	.448	.321	.087	1.395	.165
Membership	.033	.013	.147	2.381	.019**
Land size	-.422	4.652	-.006	-.095	.924
Selling puts	-.136	.021	-.428	-6.260	.000*
Divert inputs	-.975	.163	-.435	-5.946	.000*
Outstanding balance	-.034	.053	-.046	-.648	.518
Hired labour	.504	.391	.078	1.289	.199
Non tobacco crop	.768	2.648	.017	.290	.772
Tobacco income	-.047	.207	-.014	-.226	.822
Warehouse	.937	.534	.104	1.752	.082
Household size	.781	.528	.097	1.477	.142

A. Dependent Variable: Profit

Basing on the SPSS output shown in Table 6, the regression model results confirm that only three variables, i.e. membership, selling of

inputs and diverting of inputs, were significant in explaining variation in profit as indicated by their p-values of less than 0.05 at 5%. Basing on the SPSS regression results shown in Table 6, the regression model which only considers the effect of statistically significant variables on profits, is thus given as shown as:

$$Y_i = .945 + .033 \text{ Membership} - .136 \text{ Selling puts} - .975 \text{ Divert inputs}$$

The above model results show that membership, selling inputs and diverting inputs were statistically significant in explaining the variation in profitability on small-scale tobacco production. A .033 coefficient for membership implies that when all other variables are held constant, an increase in membership by a unit leads to an increase in profitability per hectare by about .033 units. Selling inputs has a significant impact on profitability as indicated by a significant t-statistic ($t=-6.260$, $p=0.000$) at 5% level of significance. This implies that selling inputs was an important factor contributing to decrease small-scale farmers' low profitability under contractual farming. It also means that farmers who sell tobacco inputs had low profitability under contractual farming. These results are consistent with several researches done worldwide, including one by Chingosho *et al.* (2020) who analysed the impact of Tobacco Farming and Current Debt Status among Smallholder Farmers in Zimbabwe using multivariate the Tobit model and found out that tobacco contract farming is making farmers indebted by about 15% to 20% points more compared to independent farmers. In their concluding remarks, they found out that an increase of land size by one acre of the farm was likely to increase the probability of the farmer going into debt by 1.6% to 1.8% points.

Secondly, membership to farmer training groups was also significantly impacting on tobacco profitability as indicated by significant t-statistic ($t=2.381$, $p=0.000$). The positive coefficient of .033 shows that increasing membership on tobacco production leads to increase of profitability per hectare. This also implies that more extension training should be availed to all smallholder farmers under the leasehold tenure system to increase tobacco profitability. It also means farmers who had greater access to extension training had higher profitability levels.

Lastly, diverting inputs and using them for other non-tobacco crops also appeared to have a statistically significant effect on profitability ($t=-5.946$, $p=0.000$). Looking at the coefficients, holding all other variables constant, increasing diverting inputs for other non-tobacco crops by small-scale farmers by one unit will force tobacco profits to also decrease by .975 units.

Overall, it is evident from the regression results that contract farming has a negative effect on profitability of small-scale tobacco farmers. Three variables proved to have a positive impact on profitability, and these are membership, selling inputs and diverting inputs for non-tobacco crops. Li *et al.* (2019) and Chingosho *et al.* (2020) posit that the small-scale tobacco production under contract farming is not profitable, after considering all the costs of factors of production, such as family labour used. However, given that the small-scale tobacco production under contract farming is labour intensive, relies on family labour and discourages farmers' opportunity to grow other crops, it is thus evident that the small-scale tobacco production, when family is considered in profit accounting, has a negative impact on profitability. Results proved that an increase in area of planted tobacco will result in family using more labour and also decrease profitability when labour is included in the accounting under contractual arrangements. These results are consistent with Ruckert *et al.* (2022), who concluded that farmers under the tobacco contract scheme are left in debt-traps as they fail to pay off the loans obtained from contracting companies.

CONCLUSIONS ON FARMER PROTECTION AND SUSTAINABILITY OF SMALL-SCALE TOBACCO PRODUCTION IN ZIMBABWE

The objective of the study was to determine the effect of farmer protection and sustainability on small-scale tobacco production. The research ran a regression model of various factors under the tobacco contractual arrangements. Collectively, the regression model was a good fit for the data ($F=11.715$, $p=0.000$), prompting the research to conclude that the characteristics of the small-scale tobacco farmers under contractual arrangements are statistically significant in determining profitability as the independent variables managed to explain 58.2% of the variation in profitability as evidenced by an R-

Square of 0.582. The regression model results show that membership, selling inputs and diverting inputs to non-tobacco crops were statistically significant ($p < 0.05$) in explaining the variation in profitability on small-scale tobacco production under the contractual arrangements. Of the three variables, diverting inputs to other non-tobacco crops proved to be the leading factor that determines profitability, coinciding with the fact that small-scale farmers divert some tobacco inputs to non-tobacco crops as they are resource constrained and do not have the required capital to finance other food crops. To this end, overall, this proves that small-scale tobacco production under contractual arrangements has a negative impact on profitability of small-scale tobacco farmers.

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Digital Economy in the Developing World: Implications on Policy and Practice

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Abstract

The article explores and examines policy and practice in the digital economy in the developing world. It analyses the policies put in place in the global and regional context in relation to the digital economy, their viability and success, while drawing lessons for Zimbabwe. The background to the subject under discussion is the increased importance of the digital economy which rough estimates place its value at around 5% of the global Gross Domestic Product (GDP), contributing about 3% to global employment. The article is based on a desktop study involving interrogation of literature and documents mined from Google Scholar and other websites with news and/or information on policies, statutes and other related materials on the subject matter. For data analysis, the study engaged mainly textual analysis. Key observations from the study were the undeniable increase in the importance of digitalisation due to adverse effects of the COVID-19 pandemic, among other factors; the need to formulate policies that perpetuate the smooth running of the digital economy which will enable it to be beneficial to all, as well as to hammer and fully implement the prevailing ones and getting rid of all hindrances to

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the desired outcome. The study also noted that there is limited knowledge on the digital economy in some developing countries, like Zimbabwe, for instance. To establish and maximise the benefits of digitalisation, the article recommends that there should be increased knowledge on the issue at hand and, there should be policy instruments set up to spearhead and speed up the whole digital economy process with high levels of transparency and governance.

Keywords: Digitalisation, global, COVID-19, governance, Gross Domestic Product, Zimbabwe.

INTRODUCTION

Digital technologies are spreading globally at a fast pace. The dissemination of technology is re-shaping consumer behaviour, the way people interact socially through the social media, business models and governments. It is cumbersome to develop exponentially without access to digital technologies. However, it is foolish to acquire such technologies without digital literacy skills. Digital renovation has significant implications for world economies and people's livelihoods. There is no one commonly accepted definition for the digital economy, hence posing a difficulty in measuring it. Bukht and Heeks (2017) estimate that the digital economy makes up around 5% of global GDP and 3% of global employment. Dahlman *et al.* (2016: 11) defines it as:

... an economy that encompasses the physical infrastructure that digital technologies are based on (broadband lines, routers), the devices that are used for access (computers, smartphones), the applications they power (Google, Salesforce) and the functionality they provide (IoT, data analytics, cloud computing).

In defining the term this way, Dahlman *et al.* (2016) observe that the internet is a necessary but not sufficient feature of the digital economy. Contrary to this perspective, Bukht and Heeks (2017) acknowledge that the Internet is the foundation for the growth of the digital economy and economic changes are related to its advent. From an Internet perspective, the digital economy is an economy that functions mainly by means of digital technology, for example, electronic transactions that are made using the internet (OUP, 2017).

For developing economies to achieve inclusive and sustainable growth, the digital economy can be harnessed. Digital technologies come with many benefits in life for both citizens and consumers. Mobile phone networks and their related applications are used to change the way people communicate, socialise, shop, travel and work, and are creating entirely new business models and markets. In the work environment, it has helped to promote and increase workers' and firms' productivity and helped governments extend key services to the people at national level. The use of digital technologies enables firms to participate in global value chains and help to raise capital and labour efficiency (Miller and Atkinson, 2014). Electronic commerce (e-commerce) in the digital economy has helped in contributing to greater inclusion in business by lowering transactional costs and increased access to international trade across borders network effects (Mansell, 2001; World Bank, 2016a). Economies have tried to address the problem of information asymmetry through exploiting digital technologies, hence achieving economies of scale. Furthermore, digitalisation has helped to circulate knowledge and entertainment among the world's populace at an exceptional rate. In the academic world, it has helped to disseminate education and carry out research using online surveys. The medical world has also benefited through the rise of digital imaging and advances in artificial intelligence (AI) that have aided doctors diagnose and cure many diseases.

Potential drawbacks also exist despite all these seemingly benefits of the digital economy. Despite the creation of new jobs in the information and technology industry, digitalisation has also destroyed manual jobs and changed the structure of existing ones. Digitalisation contributes to a change that is biased towards the technological industry. It is this change that has contributed much to the rise of labour income inequalities (OECD, 2011; Cowen, 2015). Such developments may work against the governments' macro-economic objectives such as reducing unemployment, as digitalisation continues to worsen unemployment (Cowen, 2015). Many governments have adopted reliance on digital technology systems but, at the end, they become vulnerable to cyber terrorism (Dahlman *et al.*, 2016).

Looking specifically at the developing world level, the digitalisation process has posed particular challenges (Manyika *et al.* 2013). For developing economies to optimise the benefits derived from the digital economy, there is need to reach a certain basic level of technological infrastructure. Many developing countries have not yet reached such a level since they lack the infrastructure and institutions (Murphy and Carmody, 2015). These emerging economies have a lot to gain if they have the basic level of infrastructure but will lose more if they are further away from the technological boundary (Dahlman *et al.*, 2016). This calls for developing economies to develop strategic planning to optimise their benefits from digitalisation. Failing to move along with the current digitalisation economy exacerbates the risk of lagging behind on the international business map. This also means even the people's wellbeing in the country is under threat.

The implications of digital economies for developing countries at the level of government, firms and workers, remains under-researched (Bukht and Heeks, 2017). The discussion above shows that digitalisation has both pros and cons for developing economies. It is the aim of this study to locate these challenges and opportunities in the context of the African developing countries to cover the research gap. It analyses why the digital economy matters for developing economies and the policies they need to consider when developing a national digital strategy for digitalising the economy. The study introduces the concept of the digital economy and illustrates trends, opportunities and challenges.

BACKGROUND AND OVERVIEW

The global digital economy is growing and supporting economic growth and productivity. McKinsey Global Institute (2016), quoted in Dahlman *et al.* (2016), posits that between 2013 and 2014, cross-border data flows raised annual global GDP by 3% which was equivalent to US\$2.2 trillion in 2014. The use of Internet has almost trebled in a decade, from approximately one billion users in 2005 to over three billion in 2016. Two thirds of these users are located in developing countries. The access to Internet remains a challenge with approximately 40% of households in upper middle-income economies

having access to it, compared to 10% in low-income countries (World Bank, 2016b).

The revolution of global digital economy coincided with the evolution of the mobile broadband internet that has reached over 5.5 billion mobile phone subscriptions in developing countries to date. Indicative of the increase in technologies is the rapid spread in the internet and the usage of mobile broadband. Most people access internet products through their mobile phones. Good examples are the usage of products like WhatsApp and Facebook applications that use the internet to allow users to send instantaneous text and multimedia message to other people. Another one is the Uber digital platform that matches drivers and passengers through a mobile application.

E-commerce is growing rapidly with important implications for developing countries. Firms, such as Alibaba in China, are in a position to exploit large markets and become the predominant platforms in e-commerce. For Alibaba and other Chinese firms, was made possible by the Chinese government which put in place a firewall to protect domestic firms from foreign completion. Developing economies continue to be important factors behind the growth of the media spending with the Latin America and the Asian countries contributing more (McKinsey and Company, 2015). The use of digital systems is making life easier, bringing greater convenience to consumers in the developing world. They can call a driver with Uber, find jobs in the comfort of their homes using LinkedIn, and buy second hand goods using eBay.

The education sector in developing economies has also advanced in the use of digital systems through the use of massive open-online courses. These are free online courses conducted by instructors from certified institutions. The use of these online courses has helped so much to improve the education system of the marginalised in the developing world. Provider of university level massive open online courses, edX, acknowledged that 40% of its 3.5 million students are from developing countries (Valerio, 2015). In countries like Kenya, Tanzania and the Democratic Republic of Congo, the Vodafone Instant Classroom was deployed to over 15 000 children and young adults in

the year 2015 (Vodafone, 2015). It provides a digital school in a box that provides tuition to refugees and communities with poor infrastructure.

The digital economy brought financial inclusion to developing economies. However, to other people in developing countries, financial services provided through the internet, is a luxury. The mobile banking services offered through mobile phones reduces the marginal cost of financial transactions, a situation that allows service providers, like banks, to offer mobile banking services to the marginalised poor. In many developing countries, mobile banking is already showing great potential. Mobile banking services, like M-PESA in Kenya, has attracted quite a number of people into the use of financial products. In Zimbabwe, Ecocash has dominated the mobile money system in which Telecash, One Money and Mycash are also critical players. In Bangladesh, there is bKash, that processes about two million transactions a day (Dahlman *et al.*, 2016). Increased mobile banking usage over the internet has prompted African banks like Ecobank, Standard Chartered and Barclays, to mention a few, to launch mobile banking applications. Mobile bank applications that do not use data were also developed to offer convenience into the digital space to those who cannot afford data.

Governments are exploiting the digital economy to simplify service provision and enhance the delivery of social welfare programmes. Digital technologies help governments in developing countries to deliver services. Annual revenues in Rwanda increased through digitalisation, whereas South Africa reduced the cost of tax collection by embracing the modern systems of doing things (Songwe, 2019). The service sector is benefiting from the digital technology through taxes and data collection, provision of healthcare and formulation of policy. The World Bank (2013) estimates that close to 40% of global food aid is wasted due to the absence of personal data records in the developing world. The developing countries are now benefitting from the digital economy in this field by safely keeping files in electronic formats. Despite earning these benefits within, there is a huge digital divide among developing and developed nations.

INEQUALITIES WITHIN THE DIGITAL ECONOMY

Findings by various authors revealed that there are inequalities among men and women; developing countries and developed countries; the rich and the poor; the educated and the uneducated; the young and the old, to mention a few. These divides exist due to various financial, political, economic and socio-cultural factors.

To start with, we look at the existence of inequalities amongst men and women in developing countries. Literature reveals that men have an upper hand than women in the digital space within developing countries (Hilbert, 2011; Pande, 2012) due to lack of access to education, exacerbated by various factors, including lack of time to attend school, household chores and cultural norms that give low priority to education (Pande, 2012; Chadwick *et al.*, 2013). Hilbert (2011) has associated this to women being more technophobic, and the technology itself has not been designed to meet their needs. Traditional culture accelerates the rate of growth of inequalities at all levels. For example, in African countries and in Southern India, there is a belief that women are a source of family support (Johnson, 2012). This brings a lot of disadvantages in upholding women's individual needs and their roles in society, and the technological space is not an exception. Findings in literature reveal that in some African countries like Ghana, there is a strong relationship between the environments that one works in and his or her access to digital resources (Antonio and Tuffley, 2014). In Zimbabwe, poverty forced many citizens to join the informal sector. Zimbabwe has the largest informal economy in sub-Saharan Africa and second largest to Bolivia in the world (Madina and Schneider, 2018;23). Such an informal environment is dominated by women and does not promote digital literacy, according to Antonio and Tuffley (2014). The number of men using internet is greater than that of women across all age groups in developing countries. Education is more important in breaking the yoke, but women are given low priority in education (Hafkin, 2007).

Digital technology reduces costs and improves competence, whilst protecting inclusion. In developing countries, it offers an avenue to deliver services in areas where old-fashioned rules of the game are weak. The potential to realise this is, however, far from being achieved.

The digital gap still exists between developed and developing countries. Bukht and Heeks (2017) observe that there is a disparity in the digital economy between the global north and the global south. It seems rich countries benefit more in the digital space than poor countries (Melhem *et al.*, 2014). More still needs to be done, especially in investing in information and communication technology (ICT) infrastructure. The policy environment in developed countries promotes development of skills in digital economy that enhances efficiency in the digital field. Developing countries have a limited digital enabling policy environment that also lacks privacy and security (Songwe, 2019). Africa digitalisation may play a critical role in reducing the gaps that exist between the developed and developing world in all sectors. It is easy to open a company in developing countries than in developed countries due to institutions in which digitalisation is not an exception. In Africa, some countries have managed to shorten the time needed to open a business using electronic commerce (e-commerce). The number of small to medium enterprises grew in Mauritania, Rwanda and Senegal, through embracing the use of e-commerce. Rwanda and South Africa benefitted in revenue collection and reducing cost of tax collection as alluded to above.

AFRICAN DIGITAL POLICY

Africa lags behind the rest of the world in internet use, with an average of only 40% of people using it in 2019, compared with 60% for the rest of the world (Tralac, 2020). The African Union (AU) introduced the digital transformation Strategy for Africa (2020-2030) in 2019. It is based on previous creativities and consultations with many stakeholders in the digital ecosystem in Africa . Through the usage of technology, the strategy aims at transforming the economies of Africa, targeting mainly inclusive growth through digital transformation and innovative systems. Inclusive growth is the major target of the strategy that is aligned with Africa's sustainable development goals. In line with the African Continental Free Trade Area agreement (AfCFTA), the digital economy in Africa builds upon the existing framework. The Agreement promotes free trade across borders of 55 African member states and the digital policy aims to create a single digital market for Africa that promotes access and engagement in online activities. The

scope of digital trade differs considerably across African countries. Just 10 African countries are responsible for 94% of all online business on the continent (ITC, 2020). Most of African countries use platforms that allow only domestic industry transactions, with only 28% of the operations offering online payments (ITC, 2020). Banga *et al.* (2021) highlight some of the challenges that restrict e-commerce across borders in Africa. These include high postal, delivery and transport costs, double taxation and VAT regulations, customers not being aware of the regulations that are within the African region, no reliable payment solutions and custom duties and procedures. The AfCFTA comes with a critical role to play in promoting and boosting intra-African trade. However, the AfCFTA is a recent agreement that does not yet include any specific provisions in the area of data protection or privacy. There are prospects that this agreement will promote home-grown digital content and solutions.

Africa sets to drive digital transformation through securing privacy, providing access to the internet at lower cost, using gadgets that are made in Africa sold at competitively lower prices. Specific objectives to drive digital transformation have been set. To facilitate extensive use of digital systems, the continent aimed at providing e-learning skills and knowledge to millions of Africans by the end of the year 2021 (Denis, 2021). The AU is willing to invest in digital transformation that is strengthened by policies, regulations and legislation from 2020 up to the year 2030. The transformation strategy of the African digital economy is based on creating an enabling environment, providing digital infrastructure, offering digital skills, promoting digital innovation and entrepreneurship in Africa. The AfCFTA provides an opportunity for Africa to realise its dreams in the digital sector. It enables the continent to harness opportunities that come along the pipeline in the digital sector, especially in the COVID-19 era. The agreement has already moved forward in promoting digitalisation through a digital payment and settlement platform for cross-border transactions within the continent. This will surely help Africa to move forward with flexibility and come up with more strategies that promote an upturn of the African economy during the COVID -19 pandemic economic downturn.

THEORETICAL FRAMEWORK

To understand the nature of the digital economy, focus should be put on theories related to it. The concept of “digital economy” was introduced in 1995 by Dan Tapscott, a business consultant. This section analyses the digital economy in the developing world from a theoretical perspective. The section focuses on the knowledge gap hypothesis, the 4As perspective.

The knowledge gap hypothesis explains that distribution of knowledge is uneven across social systems in the world. Just like wealth, the theory posits that people of high socio-economic status are always ahead because they find out about new sources of information first because they can afford access to them. The knowledge gap hypothesis is often mentioned in connection with social consequences of information sharing. However, the assertion of the theory can also be transferred to fit in what happens in the digital economy. The flow of digital infrastructure is not homogenous across the divide due to social structures of the society. As the new digital systems are infused into the world, developed countries are always ahead and poor countries will always lag behind. As such, the rich will always receive the material first than the poor. Developed countries acquire digital systems at a faster rate than the less developed nations. The gap in the knowledge between these two groups tends to widen rather than decrease (Tichenor *et al.*, 1970). The educated are also ahead of the uneducated because of the internet. The internet, on its own, is a factor that widens the digital gap (Nie and Erbring, 2000). With the supply of information by internet, new factors emerge that are not captured by the supply traditional media, like television and radio on which the marginalised depend. In most African countries, access to the internet is, to some extent, restricted, with those who have access to it facing exorbitant data charges.

The leapfrog hypothesis proposes that big companies holding monopolies based on incumbent technologies, are less likely to innovate. Small and incremental innovations lead a dominant firm to staying ahead. Sometimes, major innovations can make new firms to leapfrog the traditional dominant firms. This phenomenon can also apply to leading countries in the digital economy. Developing

countries can skip some stages of the path taken by developed countries in the digital economy, enabling them to catch up faster in terms of economic growth. The leapfrog can arise from the fact that a developed nation has reduced earning rents from old technology. Developed nations have less incentive to innovate as compared to their potential rivals, the developing nations.

LITERATURE REVIEW

Korovkin (2019) carried a study on 17 African countries, with the major aim of comparing their national digital strategies, and to find effective approaches for the formulation of digital strategies to offer policies targeting national economic strategizing in the 17 African countries with market and partly-market economies. Countries must find a niche particularly in the global digital economy to accelerate inclusive social and economic development using technology. Conclusions from the study revealed that from the 17 developing countries' perspective, developing strategies for the digital economy is not yet part of their national digital strategy. The majority do not have dedicated documents for digital strategy. They have neither addressed the issue with commitment within their overall national strategies. Some nations, like Algeria, have taken up the process of national digital strategizing, but abandoned it. The study highlights that the same problem is also present in west Asia,⁸ only yet to be adopted by some stakeholders. The study also acknowledges that the African continent still faces digital infrastructure challenges. It recommends that Africa should nurture some commendable solutions to help its nations to frog leap into digital development. This can be done only by constructing modern digital systems and developing markets for new digital enterprises.

The digital economy plays a significant role in international trade. With the aim of examining the role played by the digital economy, Abendin and Duan (2021) assessed its impact on growth of 53 African developing countries. The study used static and dynamic models to consistently draw on the digital economy's significant effect in influencing international trade impact on Africa's economic growth.

⁸ Saudi Arabia, Iran and Kuwait have no national digital strategies, while Bahrain, Jordan, Lebanon and Iraq have abandoned digital strategizing.

Panel data was used to carry out the study from the year 2000 to 2018. Results are estimated by Pooled Ordinary Least Squares (POLS), random and fixed effects, and the General Method of Moments models. Findings revealed that trade has positive effects on economic growth only when interacted with the digital economy in the POLS estimations. The digital economy's output elasticity showed a positive significant impact on Africa's growth, suggesting that an increase in the digital economy development level stimulates Africa's growth. Digitalisation is a way forward for the continent to leapfrog the phases of economic development. This is consistent with some studies that were carried in the same field (Pradhan *et al.*, 2017; Wamboye and Tochkov, 2018; Ehigiamusoe and Lean, 2018; Nkikabahizi *et al.*, 2018; Adeleye and Eboagu, 2019). The study recommends that concentrated efforts be directed towards developing the digital economy to ensure international trade's full economic effect in Africa. Thus, governments must strengthen and further develop the digital economy to ensure full economic benefits of international trade.

Dahlman *et al.* (2016) singled out the point that digital economy matters for developing countries and what they need to consider when developing a national digital strategy. The study revealed that the world is experiencing a digital revolution, with more important effects for global economies and their incomes. This was attached to the revolution the ever-increasing pace of technological advance and diffusion. It is important for countries to encompass the digital economy in their national strategies. The study acknowledges that the digital revolution is too important for every country to overlook, especially in the developing world. The article further articulates that the digital economy can be harnessed for inclusive and sustainable growth. These technologies make life easier for consumers, citizens and the government. It recommends that governments must engage in strategic planning to maximise the development impact of digitalisation and ensure that its benefits are evenly distributed.

Denis (2021) carried a study with the purpose of presenting support for the African continent's transition to a digital economy, predominantly in response to the problems raised by the COVID-19

crisis and with the aim of building inclusive, long-term economic resilience. The study acknowledged that the pandemic was taking lives and called for economic resilience, digital technologies and solutions that can significantly alleviate the effects should be created and made available to all African people. The COVID-19 pandemic activated a call for solutions through exceptional demand for digital health technology. The internet is a vital communications tool that can help communities deal with the crisis. The article also revealed that the technology sector was helping many industries to adapt to this new situation and reduce the risks induced by the pandemic. However, while the growth figures are still remarkable, a huge digital divide still remains in the continent. Close to 900 million people are still not connected to the internet. The study recommended that there is a need for sufficient savings and investment in digital technologies to positively stimulate all sectors of the economy and society. The growing importance of the digital sector was found to be an instant reaction to COVID-19 economic shocks that has potential to bring back strength in all sectors of the economy.

METHODOLOGY

In line with similar studies conducted in this field (Dahlman *et al.*, 2016; Manyika *et al.*, 2016), this article adopted a mixed methods design. It used a content analysis of literature based predominantly on desk review to concretise the arguments. Qualitative research methods were used, drawing literature from books, journal articles and other publications. For data analysis, the study engaged textual analysis. Secondary literature review of previous studies was done on the digital economy in developing countries, especially the Africa's sub-Saharan region. This was supplemented by direct interviews that were carried out to gather information from experts in the digital space. Policy and statutory documents were visited to assess the current standing and provisions by the government on information, communication and technology in African countries. Thus, this study classifies various policies that have a hold on the nourishment of the digital economy to recognise where policy alternatives and improvements are needed.

DISCUSSION

The main reason inspiring developing countries to digital transformation is that they are craving to survive in a changing economic environment (Ismail *et al.*, 2018; Dolganova *et al.*, 2019). Digital economy financing in Africa seeks to address the emerging needs of the African continent in its transition to a digital economy. The internet is a vital communications tool that can help communities deal with the crisis. The technology sector is helping many industries adapt to this new situation and reduce the risks induced by the COVID-19 pandemic.

Digital technologies are spreading globally at a fast pace. The dissemination of technology is re-shaping consumer behaviour, the way people interact socially through the social media, business models and governments. It is awkward to develop at an exponential rate without access to digital technologies. The internet is the foundation for the growth of the digital economy and economic changes are related to the advent of the internet.

For developing economies to achieve inclusive and sustainable growth, the digital economy must be harnessed. Digital technologies come with many benefits in life for consumers. People communicate, socialise, shop, travel and work, and are creating entirely new business models and markets. Despite creating new jobs in the information and technology industry, the digital economy destroys jobs and changes the structure of existing ones. Digitalisation contributes to a change that is biased towards the technological industry.

The global digital economy is growing and supporting economic growth and productivity in the world. The revolution of the global digital economy coincided with the evolution of the mobile broadband internet that has reached over 5.5 billion mobile phone subscriptions in developing countries to date. Indicative of the increase in technologies is the rapid spread in the internet and the usage of mobile broadband. Most people access internet products through their mobile phones.

E-commerce is growing rapidly with important implications for developing countries. The education sector in developing economies

has advanced in the use of digital systems through the use of massive open online courses. The digital economy brought financial inclusion to developing economies. However, for other people in developing countries, financial services provided through the internet are a luxury. The mobile banking services reduce the marginal costs of financial transactions, a situation that allows service providers, like banks, to offer mobile banking services to the marginalised poor. In many developing countries, mobile banking is already showing great potential.

Governments are exploiting the digital economy to simplify service provision and enhance the delivery of social welfare programmes. The service sector is benefitting from the digital technology through taxes and data collection, the provision of healthcare and the formulation of policy. There are inequalities between men and women; developing countries and developed countries; the rich and the poor; the educated and the uneducated; the young and the old, to mention a few. These divides exist due to various financial, political, economic and socio-cultural factors. Traditional culture accelerates the rate of growth of inequalities at all levels. For example, in African countries and in southern India, there is a belief that women are a source of family support. This brings a lot of disadvantages in upholding women's individual needs and their roles in society and the technological space is not an exception.

Digital technology reduces costs and improves competence, whilst protecting inclusion. In developing countries, it offers an avenue to deliver services in areas where old-fashioned rules of the game are weak. The potential to realise this is, however, far from being achieved. The digital gap still exists between the developed and the developing countries. The policy environment in developed countries promotes development of skills in the digital economy that enhances efficiency in the digital field.

In line with the AfCFTA, the digital economy in Africa builds upon the existing framework. The agreement promotes free trade across borders of 55 African member states and the digital policy aims to create a single digital market for Africa that promotes access and engagement

in online activities. There are prospects that this agreement will promote home-grown digital content and solutions.

The AfCFTA provides an opportunity for Africa to realise its dreams in the digital sector. It enables the continent to harness opportunities that come along the pipeline in the digital sector, especially in the COVID-19 era. Countries must find a particular niche in the global digital economy to accelerate inclusive social and economic development using technology.

CONCLUSIONS AND RECOMMENDATIONS

For digitalisation to be successful in the developing world, policy instruments should be set up to lead and speed up the process of digital economy. Transparency and good governance should be put at the forefront as they are significant factors in achieving all this. The digital economy is very important in boosting growth in the developing world. The economy touches various sectors such as trade, the education system, and industry, among others. For these sectors to effectively enhance economic growth, governments should ensure that they strengthen and develop the digital economy to maximise the economic benefits derived from it.

The developing countries, especially African countries, have insufficient internal demand due to either being small or poor. Competition is, however, a very big challenge they face when trying to enter or expand into big international markets. Some platform companies create barriers to potential entrances since they dominate, especially in online search and mobile advertising. Despite barriers created by the size, developing countries can still find their niche in the global digital economy. There are multiple entry points into the global digital economy and that size is not the only determining factor of success. It is recommended that developing countries should find market niches where they can gain competitive advantages in the digital space. Technology should be utilised especially in sectors like agriculture, in which they are well vested. Finding these niches help to

accelerate technology led inclusive growth. Policies associated with the digital economy to achieve set goals must be a priority. Policies targeted towards private public partnerships may help to achieve these goals.

Developing countries should not overlook digitalisation as it is significant for achieving growth. Promoting digitalisation does not only come with benefits of growth in general, but inclusive sustainable economic growth, helping governments to extend key services to its citizens. This needs the government to engage in strategic planning that ensures equality in the distribution of the benefits derived from digitalisation. There is need to learn from the pioneers who are already ahead with digitalisation. Using the experience of leading economies in the digital space will help significantly to frog leap developing economies in this field. Upcoming economies need to learn that growth and benefits from the digital economy do not come in a short period of time. Growth is an iterative process. Those who have become big started small, facing challenges, but through learning, they have succeeded. There is a lot to learn and also expect changes as the digital world is rapidly evolving with time. The implementation phase is always cumbersome, hence the need to continuously adapt and change policies to meet the current position, rather than withdrawing.

There is a strong need for government to create an equal platform for everyone to participate in digital technologies and services. For this sector to be inclusive, equal opportunities should be created at all levels. Strategies should be devised to make sure that developing countries are moving at the same pace with the diffusion of technology. This can be ensured through adopting basic infrastructure and accessibility gaps being faced by developing countries at the moment.

Developing countries also need to invest much in research and development, targeting the digital economy. There is need to create institutions that promote digitalisation in the country. Funds should be set aside in the budget to cater for the digital economy. Governments also need to fund the development of digital skills in the education

sector since digitalisation is the way to go in the future. This way, developing countries' governments promote the growth of the digital economy in a smart way.

It also recommends that it is importance to invest in digital services as a long-term strategy that immediately responds to the urgent need to boost digital economy in Africa. Governments must concretise actions to invest in broader ICT infrastructure development to enable innovative use of ICT for socioeconomic purposes, such as e-health, e-banking, e-commerce, e-government and other ICT-enabled services.

Digitalisation is a powerful tool that can be used to promote financial inclusion for the vulnerable people in the developing world. Remote financial services, delivered via banks and microfinance institutions (MFIs), enable more affordable (by reducing transaction costs) and wider (by increasing outreach) access to financial services, particularly for the most vulnerable populations such as women and rural inhabitants. Africa needs to promote financial inclusion through mobile money services, for example, Mpesa in Kenya and Telecast, My Cash, One Money, Ecocash in Zimbabwe, to reach those in remote areas.

The African region is presented with a challenge of addressing gaps in investment that targets a growing population of young entrepreneurs in sub-Saharan, since it has the strongest culture of entrepreneurship worldwide. The region, however, is at the global bottom in terms of innovation. The article recommends that strong steps need to be taken to improve innovation on the continent. Innovation and entrepreneurship are recognised as the most powerful engines for the growth of the region. These may bring prosperity and sustainable growth.

Despite its substantial growth potential, Africa's mobile industry faces many infrastructural and operational challenges. Mobile operators face difficulties in powering their existing networks, both off-grid and on-grid, due to unreliable power supplies and heavy reliance on expensive and polluting diesel generator power. Adopting green power alternatives from energy service companies (ESCOs) presents a

strong financial and corporate social responsibility opportunity for mobile operators.

The foundation of creating connectivity is providing devices, electricity and access to the internet. Governments should make sure these are available at affordable prices in their respective countries to enhance inclusive growth through the use of digital systems. Without promoting this, the digital economy in African countries will continue to be piecemeal and unevenly distributed. There is need to promote access, otherwise only the already advantaged will continue to benefit without promoting the growth of micro institutions and shutting out the poor.

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The Nexus between Personal Life Events of Medical Students and Distress: A Case of Two Newly Established Medical Schools in Zimbabwe

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Abstract

The article is based on a study whose aim was to investigate sources and levels of distress among medical students at two newly established medical schools in Zimbabwe. The study used a mixed methods approach and a concurrent parallel design. A sample of 123 medical students, drawn from two newly established medical schools in Zimbabwe, was used for the study. The participants' ages ranged between 18 and 47 years. The study used a structured questionnaire and face-to-face interviews to collect data. Quantitative and qualitative data were collected separately, analysed independently, and merged at the interpretation stage. Numerical codes were used for the quantitative data. The quantitative data were entered into the SPSS version 21 and analysed using regression analysis. The computed quantitative data showed significant relationships between personal life events and medical students' distress. The qualitative data were analysed thematically. Personal life events were examined under the following themes: death of a loved one and distress, pregnancy and distress, a gain of a new member in the family, change in the health of self or family member, and distress, and marital separation and distress. The death of a loved one was found to be the only significant factor affecting medical students at the two newly established schools in Zimbabwe.

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Keywords: anxiety, burnout, coping, depression, stressors,

INTRODUCTION

Personal life events and distress among college students have long been topical areas of research among academics. Studies such as by Gungor *et al.* (2021), Buizza *et al.* (2022) and Torres-Chávez *et al.* (2022) investigated the link between personal life events and their stress levels among students drawn from the general population and at different universities. In their study, negative life events were found to be unpleasant, uncontrollable and generally stressful. Life events, as alluded to above, describe numerous stimuli experienced during the progression of life (Seo *et al.*, 2018; Steinmayr *et al.*, 2019). Life events are one of the major factors in the mental health of university students in general. Personal life events include, but are not limited to; pregnancy, gaining a new member in the family, change in the health of self or family member, death of a loved one and marital separation. Extant literature reveals that university students, with the capacity to cope with stress through healthy life events, will probably exhibit better life fulfilment (Saha *et al.*, 2014). Nevertheless, some studies reveal that stressful life events can have short- and long-term outcomes on subjective well-being (Senocak and Demirkiran, 2020). While the above studies by Saha *et al.* (2014), Seo *et al.* (2018), Steinmayr *et al.* (2019), Gungor *et al.* (2021), Buizza *et al.* (2022) and Torres-Chávez *et al.* (2022) focused on personal events of general university students, this study focused exclusively on medical students to establish if the cited effects experienced by general university students are also applicable to medical students from a Zimbabwean sample.

The article is so organised that it has ten sections. The first section is the introduction which highlights to the reader what the whole article is about. The second is the conceptual framework, highlighting how the authors view the relationship between personal life events and distress. The third section is the review of literature related to the relationship between personal life events and distress. The fourth section examines the relationship between personal life events under the following subtopics: Death of a loved one and distress, marital status and distress, illness of oneself and distress, pregnancy and distress, and marital separation and distress. The fifth section is a presentation of the methods used in the study. The sixth section

discusses the instruments used to collect data from the participants. The seventh section is on the ethical clearance for the study. The eighth section presents the results of the study. The ninth section discusses the results of the study. The last section is about the conclusions and recommendations of the study.

THE CONCEPTUAL FRAMEWORK

The conceptual framework for understanding the link between personal life events and distress is based on the notion that life events can contribute to distress whether they are positive or negative events (Figure 1). When these life events happen, individuals cannot cope with the resultant distress and hence may require outside resources to manage the distress. As alluded to, personal life events are either positive or negative and unpleasant events experienced by medical students during their training. At the core of the framework is the identification of personal life events that the medical students have already faced or are likely to face during their training and are beyond their coping capacity. Among other personal life events, the framework identifies the death of a loved one, illness of self or of a loved one, pregnancy and marital separation as possible causes of distress among medical students undergoing training at two newly established medical training schools in Zimbabwe.

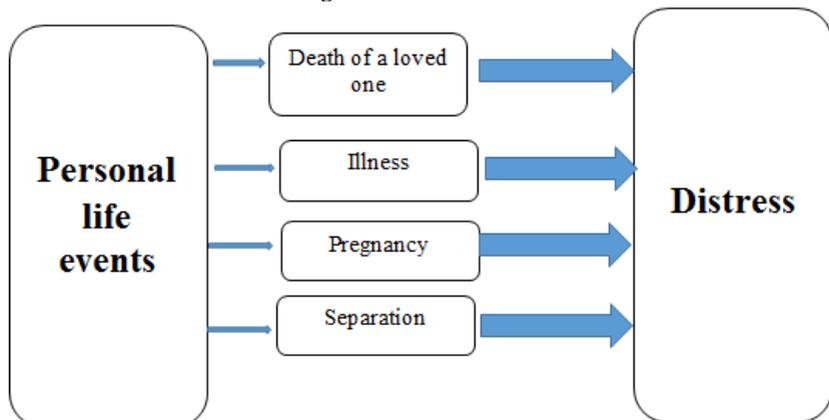


Figure 1 The conceptual framework for personal life events and distress link

LITERATURE REVIEW

In illuminating the association between life events and distress, studies such as by Hill *et al.* (2018), Fontana *et al.* (2020) and Howarth *et al.* (2020) examined the role of personal life events in causing medical students' distress and found an association between life events and distress. The Hill *et al.* (2018) study concluded that personal life events make medical students, especially susceptible to stress and poor life fulfilment. The study identified the personal life of medical students such as the loss of a loved one such as a parent, job loss, gaining a new family member and spousal separation as the leading causes of distress among medical students (*ibid.*). The weakness of the Hill *et al.* (2018) study, just like other quantitative studies already cited, is that it used a structured questionnaire to collect data. The weakness of using such a data collection tool without other supporting tools is that it does not tell us about the feelings of the participants as expressed by themselves. The present mixed methods study addressed the rigidity element of the structured questionnaire by including a semi-structured interview to also understand how medical students feel about their distress.

While there is evidence of a link between personal life events and distress among medical students, there is also evidence that medical students also experience numerous personal life stressors common to individuals their age (Dyrbye *et al.*, 2006). In the Dyrbye *et al.* (*ibid.*) study, involving more than 1 000 medical students, many participants reported personal illness or injury (25%), or change of health in a relative (42%) within the past year as personal life events that were stressful to them. Work-life balance (family/parenting), lack of time for self-care (sleep, exercise) and complex personal relationships, were some of the personal events found to cause distress to medical students. However, the exponential rise of multiple factors places even the most resilient student at high risk for burnout (Shapiro, 2011; Bell, 2013; Anne; 2014).

To understand the nexus between personal life events and distress, an Iranian cross-sectional study conducted on medical students by Hassanzadeh *et al.* (2017), with 4 763 participants, used a scale comprising 46 items in 11 various dimensions. The study utilised self-

administered standard questionnaires to collect data. Data were analysed using latent factor regression for grouped outcomes to model the relationship of stressful life events, as latent predictors, with psychological problems, as the grouped outcomes. The study observed that stressful life events were directly associated with components of psychological problems and their profile scores, with greater associations in females than in males. The researchers identified five prevalent sources of potential distress. First, home life was measured with addiction, divorce or separation, concern about addiction of a family member, quarrels with a spouse, being accused, legal problems, and troubles with children, Second, financial problems were measured with getting in debt, low income, major financial problems, taking on a mortgage and financial inflation. Third, social relations included social discrimination, major social changes, social insecurity and concern about the future. Fourth, personal conflicts included loneliness, lack of social support, cultural alienation, not having an intimate friend and failure to achieve life goals. Fifth and finally, job conflicts were measured with quarrels with colleagues/boss, dealing with customers, increased working hours and improper working place and environment. The sentiments of Hassanzadeh *et al.* (*ibid.*) were echoed by another study conducted in Syria by Al Hourri *et al.* (2023) who reported that personal events such as financial problems and social relations were some of the causes of distress among medical students.

A major strength of the Hassanzadeh *et al.* (2017) study was their use of a large population to which they applied latent factor regression modelling for grouped outcomes with confirmatory latent predictors for evaluating the association of stressful life events and psychological disorders. The current mixed-methods study used a similar approach with a small sample. The Hassanzadeh *et al.* (*ibid.*) study accedes that due to the cross-sectional design of the study, cause-effect relationships could not be inferred from their findings and, as such, the current mixed-methods study attempted to overcome the failure to determine the cause-and-effect hurdle through method triangulation, in which modelled data were further explained using interview data.

CHANGE IN HEALTH OF SELF OR FAMILY MEMBER AND DISTRESS

Major personal illnesses and those of close family members have been implicated in university student distress. Numerous studies such as by Stewart-Brown *et al.* (2000), Modis *et al.* (2021) and Amass *et al.* (2022) researched on the correlation between personal illness and distress among the general population of university students. The above studies found that among other personal life events, the health status of students is a serious indicator of distress among university students. In support, Stewart-Brown *et al.* (2000) opine that students who fell ill in the last 12 months seem to have higher levels of distress compared to students who had not had major illnesses within the last that period. According to the study by Stewart-Brown *et al.* (*ibid.*), falling ill while at university is part of human development most students are not prepared for as this sometimes leads one to assume a sick role at the end of school assignments, school tasks and even examinations. The other study that focused on the general population of students, Schwarzer and Luszczynska (2012), found a correlation between the illness of a loved one and distress. According to this study, the illness of a close member of the family is associated with distress because it disrupts the way of life for family members. The family is normally affected following the illness of a family member due to, among other things, fear of loss and assumption of duties previously done by the ill member. These responsibilities also add to the emotional burden faced by students who concentrate on academic work.

Also focusing on the general population of university students, Khandelwal *et al.* (2020) conducted a study on the relationship between the illness of a member and distress in the United States of America. Their study used a sample of 175 students drawn from the University of Washington and the University of North Carolina. They reported high levels of psychological distress, symptoms of depression and anxiety among family members who lived with critically and chronically ill members. In another study, Chronister, Fitzgerald and Chou (2021) interrogated the role of the family as a source of social support to ill members of the family and how they are impacted by the change of life for any one member of the family. Chronister, Fitzgerald and Chou (*ibid.*) focused on the mental illness of a member of the adult population who was not going to school.

While not focusing on college or university students, the study, however, provides a useful insight into understanding how the illness of a family member can contribute to the distress of other family members. Chronister, Fitzgerald and Chou (*ibid.*) used a sample of 14 adults in a qualitative approach and concluded that family members endure the most stress and anxiety due to the change in family circumstances, such as the role of assuming responsibilities previously done by the ill member. As alluded to, while Chronister, Fitzgerald and Chou (*ibid.*) used a qualitative approach that captured students' lived experiences, it could not be generalised to medical students since its focus was on the general population of adults who were not attending any school or university. The lack of generalisation prompted the present study to investigate sources and levels of distress among medical students using a mixed methods approach to allow for the generalisation of the study results.

Further, while studies by Stewart-Brown *et al.* (2000), Modis *et al.* (2021) and Amass *et al.* (2022) used quantitative approaches, the fact that they focused on non-student populations meant that a more direct study focusing on the sources and levels of distress among medical students needed to be carried out, hence the present study. The present study focused on medical students because their mental well-being, or lack of it, may affect the health outcomes of their patients. To understand distress emanating from the illness of a member, Khandelwal *et al.* (2020) used a quantitative approach to measure distress among adults not going to college or university students. The study, like other cited quantitative studies, typically had a weakness of failing to capture the lived experiences of students and, as such, the study might have failed to provide a full account of students' distress as told by students themselves. Given the highlighted weaknesses, the current mixed methods study sought to determine the relationship between the illness of a family member and distress specifically in medical college students to get a fuller appreciation of medical students' distress and to generalise the findings.

DEATH OF A LOVED ONE AND DISTRESS

While death is inevitable, the death of a family member or any significant other is difficult to contend with. Studies such as by Stroebe

et al. (2010) and Joaquim *et al.* (2021) researched the link between the death of a loved one and distress among the general population of university students and found that the death of a loved one is one of the leading causes of distress in students. While buttressing the psychological effect of losing a loved one, Joaquim *et al.* (2021) observe that the mixed experience of the loss of a close family or friend, especially at the height of the COVID-19 pandemic, could elicit negative manifestations of affection, and psychological distress. In examining the impact of losing a loved one, Stroebe, Abakoumkin and Stroebe (2010) observe that the intensity of the stress caused by the life event depends on the extent to which the perceived demands of the situation tax or exceed the individual's coping resources, given that failure to cope can bring harmful effects. According to Stroebe, Abakoumkin and Stroebe (*ibid.*), the loss of a significant other in the last 12 months, especially a partner, leads to discrepancies in areas that can broadly be characterised as loss of instrumental support, loss of validation support, lack of emotional support and loss of social contact. Furthermore, the foregoing study postulates that the loss of a spouse is a key contributor to distress levels. This is largely so because the extent to which spouses feel supported by their partners is a key indicator of marital satisfaction. In addition, the loss of loved ones, like a child, a sibling or a mother is, ordinarily speaking, a source of distress. While studies by Stroebe, Abakoumkin and Stroebe (*ibid.*) and Joaquim *et al.* (2021) focused on general university students and found a correlation between personal life events of students and distress, the present study sought to establish if medical students experienced the same effects as those experienced by the students from other faculties.

A study by Corden, Hirst, and Nice (2008) found that the loss of loved ones does not cause distress in general, but observed that a lot depends on the timing of the interviews after such loss. The timeframe is the most critical aspect when determining distress due to the loss of a loved one. If interviews on distress are conducted 10 months after the loss, the participants might not necessarily show distress. Not only does the loss of a loved one predict distress for students, but also people whose psychological well-being was relatively secure, as well as those already experiencing high levels of distress, were vulnerable

to the emotional impact of loss. In a study aimed at understanding the effects of the death of a loved one, Laranjeira *et al.* (2022) found that 51% of participants in their study faced high susceptibility to sorrow and showed a raised need for emotional support, particularly in dealing with expressing emotions and feelings. Most bereaved individuals adapt to loss, but a significant minority report high levels of persistent grief symptoms long after the loss. The Laranjeira *et al.* (*ibid.*) study reported that complicated grief manifests in excessive rumination, alienation, hopelessness and intrusive thoughts about the dead.

Preceding studies like Corden *et al.* (2008), Joaquim *et al.* (2021) and Laranjeira *et al.* (2022) appear to suggest that the experience of distress because of the loss of a loved one is a subjective experience. The foregoing literature review presented mixed and perhaps inconclusive findings on the impact of the death of a loved one on distress. Given the inconclusive nature of the preceding findings, the current study, therefore, sought to examine the effect death of a loved one had on the distress of medical students at two Zimbabwean universities. The medical students were chosen in the present study because of the clinical nature of their duties that expose them dying patients and deaths in the wards. Deaths in the wards may make the medical students' distress unique when contrasted with students from other academic programmes. For this reason, understanding the impact of losing a loved one on a medical student may allow decision-makers to allow medical students sufficient time off after losing a loved one, to give them enough healing time. Such may help reduce negligence-related hospital accidents.

MARITAL SEPARATION AND DISTRESS

In a bid to understand the impact of marital separation on human well-being, Crabtree and Harris (2020) carried out a study comprising 20 married male individuals who were non-students. At the time of the interviews, these were identified as having separated from their wives. According to the study, separation and divorce are not synonymous. Marital separation is an understudied phenomenon related to divorce-related processes and transitions (Crabtree and Harris 2020; O'Hara *et*

al. (2020). Crabtree and Harris (2020:01) investigated marital separation and found that:

During separation, a couple remains legally married, but their relationship is on hold, either legally or informally, due to relationship distress. ... a socially ambiguous status – not quite married, not quite divorced. Treating separated persons as divorcing suggests an assumption that separation inevitably and linearly leads to divorce and leaves little room to examine different outcomes (e.g., reconciliation, long-term separation), pathways to various outcomes, or unique elements of the separation experience. This also implies that marital decision-making happens before separating when it may continue after.

The preceding study concluded that separation is not sustainable and that those involved in separation cannot go on indefinitely as the doubt of the future is too much to bear. In support of the above findings, Wolchik and Sandler (2013) assessed how separation affected children and their parents and conclude that one may feel overwhelmed by everything that goes on during separation, especially when it comes to having to tell one's children or parents, friends or colleagues about one's separation. It also found that having to deal with and manage the emotions and reactions, or even the act of sharing and distributing the property and other possessions was stressful. While studies by Wolchik and Sandler (*ibid.*) and Crabtree and Harris (2020) focused on adults who were at neither university nor college, they however, have important implications for our understanding of the role of marital separation in human distress.

Similarly, studies such as by Tong, Chen and Shu (2019) and Reneflot *et al.* (2020) researched the association between marital separation and distress using secondary data and found a positive correlation between the two variables. The Tong, Chen, and Shu (*ibid.*) study used 2010, 2012, and 2014 data from the Chinese Family Panel Studies (CFPS), while the Reneflot *et al.* (2020) study used secondary data from the Norwegian Population Register between 2005 and 2015 to conclude that marital separation and distress had a positive correlation. The weakness of using secondary data as in the studies by Tong *et al.* (2019) and Reneflot *et al.* (2020) is that the data used was from China and Norway, respectively, hence, may not be relevant in the Zimbabwean context, hence the present study. In addition, secondary data used do not provide answers to some research questions in the present study,

hence the use of the current mixed methods approach that combines questionnaires and interview questions, to answer all the questions about medical sources and levels of distress among medical students in the two newly established medical schools in Zimbabwe.

To measure and explore the relationship between the personal life events of medical students and their distress, the following hypothesis and research question were formulated.

HYPOTHESIS

Personal life events are not associated with medical students' distress.

RESEARCH QUESTION

How far is personal life events of medical students linked to distress?

METHOD

PARTICIPANTS AND PROCEDURE

The study used a sample of 123 medical students chosen from two medical schools that were identified as Medical School A and Medical School B. The study used a stratified sampling technique, together with a simple random technique to select participants from the two medical schools. A mixed methods approach was used together with a convergent parallel design to understand how the personal life events of medical students impacted their distress. The choice of the mixed methods approach was meant to quantitatively measure the extent to which personal events contributed towards medical students' distress, while at the same time qualitatively understanding the subjective experiences of medical students regarding distress emanating from their negative life experiences.

INSTRUMENT

A structured questionnaire and a semi-structured interview were used to collect data from the participants.

REVISED STUDENT-LIFE STRESS INVENTORY (SSI-R)

Gadzella's (2005) revised Student-life Stress Inventory questionnaire was used to determine the extent to which personal life events

contributed to medical students' distress. The scale is a revision of the original Student-life Scale Inventory (Gadzella, 1991) which is a 51-item Likert-type scale. The Revised Student Stress Scale used in the present study has 21 items each rated from 1 to 5. On the scale, 1 means the identified stressor does not affect the student at all. A 5 on the scale means the identified stressor affects the student very much. In using this scale, researchers list only those areas that are rated 3 and above. This instrument sought to measure students' distress across two sections: *stressors* and *reaction to stressors*. The scoring for the revised student-life stress scale was the summation of the nine categories (scores) values (Gadzella *et al.*, 2012). The total stress score was, therefore, the summation of the nine categories. To interpret the SSI-R, it is important to note that those who obtain a score of 84-105, indicate having severe stress, those with 63-84, reflect having moderate stress and those who obtain a score of 42-63, reflect having mild stress. The Revised Student Stress Scale was relevant in the present study because of its reliability coefficient of .789.

SEMI-STRUCTURED INTERVIEW

The interviews were conducted face-to-face with medical students with strict adherence to the World Health Organisation (WHO) and the Ministry of Health and Child Care protocols on the COVID-19 pandemic. Fourteen medical students, comprising seven medical students from Medical School A and seven from Medical School B, were interviewed. The idea to interview a total of 14 medical students from both schools was informed by a study carried out by Guest, Bunce and Johnson (2006) that states that if you are generating data using interviews, about 12 participants should be interviewed as data saturates around 12 interviews. The semi-structured interview was considered ideal because it is flexible and it allowed the researchers to make follow-up questions and, at the same time, allowed respondents to freely express and share their thoughts on particular issues.

ETHICAL APPROVAL

Permission to conduct the study was obtained from the Medical Research Council of Zimbabwe and from the two newly established medical schools In Zimbabwe. The individual participants signed informed consent forms to indicate their willingness to participate in the study.

RESULTS

The researchers employed linear regression and analysis of variance to establish the association between personal life events and medical student distress and explain the amount of the variance in distress. Table 1 shows the findings.

QUANTITATIVE RESULTS ON HOW FAR MEDICAL STUDENTS' PERSONAL LIFE EVENTS LINK WITH DISTRESS

Table 1: The relationship between Personal Life Events and Medical Student Distress

ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.005	1	1.005	4.876	.033 ^b
	Residual	8.654	42	.206		
	Total	9.659	43			

a. Dependent Variable: Stress

b. Predictors: (Constant), personal life events

Coefficients

Model	B	Unstandardised Coefficients		Standardised Coefficients	T	Sig.	95.0% Confidence Interval for B	
		Std. Error	Beta				Lower Bound	Upper Bound
1	(Constant)	1.795	.292		6.156	.000	1.206	2.383
	Personal life events	.259	.117	.323	2.208	.033	.022	.495

a. Dependent Variable: Stress

The study hypothesised that personal events are not associated with medical students' distress. Table 1 reveals that there is a significant positive association between students' exposure to student personal life events and distress. Personal life events had a significant positive association with distress and explained a significant amount of variance in distress ($F = 5.545$, $p = .020$, $R^2 = .050$, $R^2_{\text{adjusted}} = .045$). Table 1 shows that 4.5% of the variability in distress of medical students is a result of personal life events experienced by medical students. The regression coefficient (Beta = .323, $p = .20 < .05$) suggested that a unit increase in life events of medical students results in an increase in medical students' distress by .323 points.

QUALITATIVE RESULTS ON HOW FAR MEDICAL STUDENTS' PERSONAL LIFE EVENTS LINK WITH DISTRESS

Most of the medical students indicated that personal life problems, such as losing a loved one, constituted another source of distress. Some students indicated that they experienced adjustment problems owing to losing loved ones such as a sibling, a parent or a guardian, while a few others mentioned that they had not experienced such life problems. The following verbal quotes illustrate the above:

Losing a loved one is a big problem because it can tear a person down. After all, they take long to accept the fact that someone is gone and is not coming back. This can cause a fall in academic performance; sometimes-suicidal thoughts can arise (Sithabile).

Losing a loved one is a great setback as it brings sadness and worry and this affects reading. When death strikes, you keep thinking about it as if it has just happened. This experience brings other negative feelings such anxiety and depression. In some instances, you feel so weak and develop suicidal tendencies because of the pain (Amukela).

Fortunately, I have so far not lost any close members of my family. I have seen how distressing it is for my friends who have gone through that sad chapter in life while at medical school (Nkanyiso).

While I have heard and seen fellow students showing signs of distress after losing loved ones, I am yet to experience such since I commenced my programme (Sibusisiwe).

Adjustment problems were cited as a major stressor in some medical problems. The next section presents results for research sub-question four that focused on the relationship between finance and medical students' distress.

DISCUSSION

The study hypothesised that medical students' events are not linked to their distress. The findings are discussed under the theme of the death of a loved one and distress. Other personal life events like pregnancy, marital separation and gain of a new family member, did not have a significant impact on the medical students' distress.

The study found that the death of a loved one had a positive correlation with distress. The finding in the present study that the

death of a loved one causes distress confirms findings by Gungor *et al.* (2021), Joaquim *et al.* (2021), and Torres-Chavez *et al.* (2022), that found that personal life events such as such death of a loved one contributed much to the general population of university students. It emerged from the present study that grief feelings cause an individual to lose concentration on their activities and focus on their loss. The grieving process, if not supported, can cause a decline in academic performance, thereby further increasing students' distress. The finding that the death of a loved one causes distress dovetails with findings by Laranjeira *et al.* (2022) who reveal in their study of general university students that the death of a loved one leads to complicated grief that manifests in excessive rumination, alienation, hopelessness and intrusive thoughts about the dead. Distress emanating from losing a loved one was linked to the nature of the relationship with the lost relative. The death of a parent has long been linked to more distress compared to any other death that might occur in the family.

CONCLUSION AND RECOMMENDATIONS

The study sought to establish the link between the personal life events of medical students and distress. It concluded that while the personal life events of medical students contribute to their distress, not all life events have a distressing effect on medical students. Only the death of a loved one seemed to distress medical students. Other life events, such as pregnancy, that affect only female students, and other life events like gaining a new family member and change of health, did not have significant contributions towards medical students. Given the foregoing, the study recommends medical college-specific policies on mental health to buffer students from the negative effects of distress. Further, the study recommends peer-to-peer counselling programmes at medical schools to complement the already existing counselling services offered by universities through Student Affairs Offices and Psychology Departments.

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The Herbicidal Activity of Spider Plant, *Cleome gynandra* L., Plant Tissue on Weeds in Sweet Pepper (*Capsicum Annuum*) and Tomato (*Solanum Lycopersicum*)

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Abstract

The indiscriminate use of synthetic fumigants is hazardous to farmers, consumers and the environment at large. This provided an interest in, and research on, biofumigation using different spider plant, *Cleome gynandra*, plant tissue on weeds in the laboratory and field trials. Two different biofumigant crops (green and purple spider plant) and four weed species (*Rottetboelia cocchinensis*, *Setaria verticillata*, *Amaranthus hybridus* and *Bidens pilosa*) were studied as model organisms in the laboratory. The other set of experiments was done in the field and inoculated with various weed species. In the laboratory study, the herbicidal activity of *C. gynandra* plant tissue was studied using three different levels on weight to volume basis, using a completely randomised design. The results showed that *Setaria verticillata*, *Amaranthus hybridus* and *Bidens pilosa* were significantly reduced in their early growth and biomass by the different *C. gynandra* plant tissues. In the field, the use of *C. gynandra* plant tissue as treatment increased field yields of the crop plants infected with different weed species. The weed species in the field were significantly reduced on the weed evenness on plots which had *C. gynandra* plant tissue as

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compared to the untreated controls. This study provides important information for choosing a green manure crop with the purpose of managing weeds.

Key words: bio fumigation, methy isothicyanate, crops

1.0 INTRODUCTION

Weed management remains one of the major constraints in crop production. Plant diseases, insects and weeds decrease the production of all the crops produced worldwide by 36% (Yuliar, 2014; Saquee *et al.*, 2023). Generally, weeds are severe and often a limiting factor in conventional production systems (Prasad *et al.*, 2015), but are even worse in sustainable agriculture systems in which the use of chemical herbicides are limited to protect the environment for the future. Herbicides are persistent in nature, negatively impacting beneficial animals and may be directly toxic to farmers and consumers (Grace *et al.*, 2016). Some of these herbicides have been scheduled under the Montreal Protocol on substances that degrade the ozone layer and has left famers with limited available alternatives for pre-plant soil treatments (Agostini, 2011; Karavina and Mandumbu, 2012). Most resource-poor smallholder farmers cannot afford herbicide weed control options and often their crop yield is heavily impacted negatively by weeds. Therefore, there is need to develop affordable and effective biological weed management options, such as biofumigation.

Biofumigation is the incorporation of glucosinolate-containing plant tissue to suppress soil-borne pathogens and weeds (Angus *et al.*, 1994; Matthiessen and Kirkegaard, 2006; Agostini, 2011; Handiseni *et al.*, 2011; Grace *et al.*, 2016.). It is a novel pest management technique presenting a potential alternative (Lord *et al.*, 2011). The use of plant tissue biofumigants in the soil has been shown to significantly reduce a wide range of weeds (Henderson *et al.*, 2009; Agostini, 2011; Handiseni *et al.*, 2011; Karavina and Mandumbu, 2012; Gopi *et al.*, 2016; Grace *et al.*, 2016;). Despite the success of biofumigation being reported, adoption of this technology is still a challenge. One major limiting factor is finding the ideal crop species for biofumigation. Although the Brassica species have biofumigation potential, they do

not always grow well in some areas, resulting in low-plant biomass production. It is, therefore, important to select a biofumigation crop that is adapted in each environment to maximise plant biomass production, thus ensuring the incorporation of enough dosages of glucosinolates for biofumigation. In most areas of Zimbabwe, especially in the southern part of Zimbabwe, *C. gynandra*, an indigenous vegetable plant, is well adapted and grows in abundance as a volunteer crop. It contains a glucosinolate group, which has Methyl-glucosinolate in its profile and can produce Methyl ITC when used as a biofumigant. This was also found in Brassicas which suppress weeds (Vaughn *et al.*, 2005). Methyl ITC is known to be used as a commercial soil fumigant and its residues must be degraded before planting the following crop to avoid phytotoxicity (Angus *et al.*, 1994; Brown and Morra, 1995). Methyl ITC suppresses growth and germination of many weed species (Brown and Morra, 1995).

The main objective of this study was to evaluate the efficacy of *C. gynandra* species on broad-leaved and grassy weeds under laboratory and field conditions. Four weed species, namely *Rottboellia cochinchinensis*, *Setaria verticillata*, *Amaranthus hybridus* and *Bidens pilosa*, which are economically important in horticultural crops in smallholder farms, were chosen as model organisms or test plants for this study. Two species of *C. gynandra* (green and purple variants) were compared with a non-biofumigant control for their efficacy on weeds.

MATERIALS AND METHODS

STUDY SITE

The research was carried out at the Horticulture Research Centre (18°11'S and 31°28'E), near Marondera, which is at an altitude of 1630 m above sea level. The Centre has an average day-length of 13.2 hours in summer and 11.1 hours in winter (Vincent and Thomas, 1962; Mhazo, 2011). Hot summer is between September and December with October being the hottest month of the year, with maximum temperatures above 30°C (*ibid*). Slightly more than two thirds of the total rainfall normally falls during the months of December, January and February (Mhazo, 2011).

CLEOME GYNANDRA ACCESSIONS GLUCOSINOLATE PROFILING

C. gynandra seed was collected from the Horticulture Research Centre gene bank in Marondera. Two types of *C. gynandra*, the green-stem and purple-stem, were used in the experiments. Five seeds from each accession were sown, each in a planting pot (25cm x 20cm x 15cm). At full flowering time, the plant above ground biomass was harvested, weighed, frozen at -80°C and subsequently freeze dried in an Edwards Minifast freeze-drier (from -40°C to $+18^{\circ}\text{C}$ in eight hours with a vacuum of 10^{-1} mbar). The freeze-dried materials were homogenised in a mortar, ground into fine powder and stored at 25°C . The materials were sent to Dr Jack Brown's lab at the University of Idaho, to determine glucosinolate content using the methe modified method described by Daun *et al.* (1989) to determine glucosinolate content.

WEEDS LABORATORY TRIAL

Sandy-loam soil was collected from the Horticulture Research Centre small nursery and autoclaved prior to use in the experiment. The *C. gynandra* plants were grown up to flowering stage. The wet pasteurised soil was weighed and used as media. *C. gynanadra* tissue was applied at a rate of 0, 5, 10 and 15% per weight (w/w) of plant tissue and the soil (potting mix) per treatment. Pots were filled with pasteurised soil. The soil treatments were either amended or non-amended with either green or purple stem *C. gynandra* plant tissue. All the weed seeds were scarified using 1% of hydrochloric acid for eight hours, rinsed thoroughly with distilled water and allowed to dry at room temperature for 24 hours. A total of 20 weed seeds were planted in each petri dish containing growth media. The petri dishes were filled with an additional little amount of soil. The control consisted of weed seed planted in petri dishes containing pasteurised soil without *C. gynandra* plant tissue amendment. Each treatment consisted of four petri dishes planted with 20 seeds. The experiment was arranged in randomised complete block design. The petri dishes were incubated at 25°C . Each petri dish was watered with 500 ml of distilled water immediately after planting and an additional 100 ml after three days. After 21 and 28 days after planting, weed seedling emergence and biomass were measured, respectively.

FIELD EXPERIMENT

A split plot design was used in the field experiment, with biofumigant crop treatments (glucosinolate containing green-stem and purple-stem *C. gynandra*, a non glucosinolate containing kale crop, and zero biofumigant (control)) as the main plots. Main plots were 4.5 m by 1.8 m and each cover crop treatment was replicated four times. The subplot factor was the weeds species. Within each plot, crop species' allocations were randomly assigned. The biofumigant plants (*C. gynandra* and kale crops) were transplanted from seedlings grown for six weeks in the nursery. The tomato and sweet pepper plants were drenched a day after planting after the first irrigation with the chemical Actara (Thiamethoxam) for the control of cutworms, aphids and leaf miners. The plants were grown with a basal dressing of 10 grams per plant of Compound C (N5%:P15%:K12%) fertilizer and a top dressing was done using 10 grams of Ammonium nitrate (34.5% N), split applied at three and five weeks after planting. The biofumigant crop treatments were grown up to flowering stage, mowed and incorporated by use of a tractor drawn disc harrow to a depth of 15cm. Before mowing and incorporation, biofumigant crops were sampled, freeze dried, ground into powder using a grinding mill and the glucosinolate content was determined. Above ground, biomass of the biofumigants was assessed in the field by collecting biomass from two quadrants per plot measuring 0.5 m x 0.5 m. Samples were dried for seven days at 65°C and weighed. Two weeks after biofumigant incorporation, four lines, with a spacing of 0.9 m by 0.3 m, were made in each main plot and six week-old tomato and pepper seedlings were transplanted. Control plots which had no biofumigants were incorporated. The tomato and sweet pepper plants were grown with a basal dressing of 20 grams per plant of Compound C (N5%:P15%:K12%) fertilizer and a top dressing was done using 10 grams of Ammonium nitrate (34.5%N), split applied when the fruits were marble size (six weeks after planting). Insecticide treatments were done across all plots using Actara (Thiamethoxam) at planting and, also Dynamec (Abamectin), Ampligo (lamda-cyhalothrin), Dimethoate (Dimethoate) and Proclaim (Emametin benzoate) chemicals at 14-day intervals using the recommended application rates on product labels. The main target pests were aphids, white flies, cutworms, leaf miners, bollworms and locusts. Fungicide treatments

were done as necessary after scouting. Scouting for forlia diseases was done weekly.

DATA COLLECTION

WEED LABORATORY TRIAL

The weed emergence counts was done at 7, 14, 21 and 28 days after sowing for all weed species, and weed fresh biomass was done at 28 days after sowing for all weed species . The dry biomass data was collected two weeks after the fresh biomass was collected.

FIELD TRIAL

Field weed emergence was assessed by counting the number of weeds emerging by species category in 0.5 m x 0.5 m quadrant at eight weeks after transplanting. In addition, all the weeds, seperated by their species in the quadrant, had their above ground plant biomass harvested, dried at 65°C for 14 days and weighed. This was immediately followed by weeding the whole plots. The quadrants were thrown systematically following a W pattern in a plot to collect weed counts at eight weeks after planting. The weed species in the quadrant were identified, counted and recorded. The number of weeds per square metre was determined. The number of different weed species in a given plot is known as weed species richness and is represented by **S**. Other parameters calculated were Shannon-Weiner Index (**H**) and weed species evenness (**E**). Shannon-Weiner Index was determined as follows: $H = -\sum p_i \times \ln(p_i)$. This gives a negative number and must be multiplied by -1 to make it positive. Weed species evenness (**E**) = $H/\ln(S)$. **Pi** is the number of each weed species, divided by the total number of weeds per quadrant and **ln** represents the natural logarithm. The weed density, **S**, **H** and **E** for this field were determined. At maturity, the crops were harvested, counted, graded and weighed.

DATA ANALYSIS

Data was subjected to Analysis of Variance using the Genstat 17th edition (VSN International, 2015). Significant differences between treatments means were examined using Fishers protected LSD multiple range test (VSN International, 2015).

RESULTS

CLEOME GYNANDRA GLUCOSINOLATE CONTENT ANALYSIS

The *C. gynandra* used in this study contained total glucosinolate content of 19 and 7 $\mu\text{mol g}^{-1}$ for purple stem *C. gynandra* accession and green stem *C. gynandra* accession, respectively (**Table 1**). The primary glucosinolate in both the green and purple stem *C. gynandra* is methyl-glucosinolate.

Table 1: *C. gynandra* accessions glucosinolate profiling

Plant type	Glucosinolate type	Amount per gram of dried green tissue ($\mu\text{mol g}^{-1}$)
Purple stem <i>C. gynandra</i> accession	methyl-glucosinolate	19
Green stem <i>C. gynandra</i> accession	methyl-glucosinolate	7

BIOFUMIGANT EFFECTS ON WEED SEEDLING EMERGENCE UNDER LABORATORY CONDITIONS.

The F probability values obtained after doing the analysis of variance are shown in Table 2. The interaction of Biofumigant type x Application Rate had significant effects ($p < 0.05$) on the emergence of *S. verticillata* only. This interaction had no significant effect on seedling emergence of *A. hybridus*, *B. pilosa* and *R. chochinchinensis*. The main effect of Biofumigant application rate had significant effects ($p < 0.05$) on the emergence of seedlings of *A. hybridus*, *B. pilosa* and *S. verticillata*. In contrast, Biofumigation rate had no significant effect on *R. chochinchinensis* emergence. The main factor of Biofumigant had significant effect ($p < 0.05$) on *S. verticillata* only.

The effects of varying the Biofumigant rates on the test weed species are shown in Table 2. The application of Biofumigant at 1.5g/30g soil significantly ($p < 0.05$) reduced *A. hybridus* count compared to the control treatment. However, further increase in the Biofumigant rate did not significantly decrease the *A. hybridus* counts compared to the 1.5g/30g soil. The effect of changing Biofumigant rates on *B. pilosa* counts was similar to the response given by *A. hybridus*. The application of Biofumigant at 1.5g/30g soil significantly ($p < 0.05$) reduced *S. verticillata* counts, compared to the control treatment. The Biofumigant rates of 1.5 and 3.0g/30g soil had similar effect on *S. verticillata* counts. However, the Biofumigant rate of 4.0g/30g soil significantly produced the lowest *S. verticillata* count. The application of Biofumigant had no effect on the *R. cochinchinensis* counts (Table 2).

Table 2: Analysis of variance (p value) for the effects different biofumigants and rate of application on weeds seedling emergence at 28 days after planting for *A. hybridus*, *B. pilosa*, *S. verticillata* and *R. cochinchinensis*.

Source	D.F.	Seedling emergence			
		<i>A. hybridus</i>	<i>B. pilosa</i>	<i>S. verticillate</i>	<i>R. cochinchinensis</i>
Rate of application	3	<0.001	<0.001	<0.001	0.580
Biofumigant spp	1	0.828	0.651	0.011	0.588
R × B	3	0.965	0.197	0.015	0.855

S. verticillata was significantly affected by the rate of application, the biofumigant species used and the interaction between the rate of application (Table 3).

Table 3: The effect of rate of amendment with *C. gynandra* species (at rates 0, 5, 10 and 15 % weight to volume) on weeds seedling emergence % at 28 days after planting

Rate (g/30g soil)	<i>A. hybridus</i>	<i>B. pilosa</i>	<i>S. verticillata</i>	<i>R. cochinchinensis</i>
0	51.9 a†	64.4 a	73.1 a	33.8
1.5	16.9 b	41.9 ab	31.2 b	23.8
3.0	5.6 b	32.5 b	17.5 b	27.5
4.5	5.0 b	31.9 b	13.1 c	26.9
LSD (5%)	12.15	24.81	15.57	NS

†The means followed by the same letter in a column are not significantly different

NS: Not significant

BIOFUMIGANT EFFECTS ON WEED DRY SHOOT BIOMASS UNDER LABORATORY CONDITIONS.

The main effects of Biofumigant rate, Biofumigant species and their interactions on shoot biomass is shown in Table 4. The Biofumigant rate x Biofumigant species interaction effects were significant ($p < 0.05$) on the shoot biomass of *B. pilosa* and *S. verticillata*. However, these effects were not significant on the shoot biomass of *A. hybridus* and *R. cochinchinensis*. The effect of the rate of Biofumigant application were significant ($p < 0.05$) on shoot biomass of *A. hybridus*, *B. pilosa* and *S. verticillata*. These effects were not significant on the shoot biomass of *R. cochinchinensis*. The main factor of the Biofumigant species was only significant on shoot biomass of *S. verticillata*.

Table 4: Analysis of variance (*P* value) for the effects different biofumigants and application rate on weeds seedling shoot dry biomass at 28 days after planting for *A. hybridus*, *B. pilosa*, *S. verticillata* and *R. cochinchinensis*.

Source of variation	d.f.	shoot biomass			
		<i>A. hybridus</i>	<i>B. pilosa</i>	<i>S. verticillate</i>	<i>R. cochinchinensis</i>
Rate of application (R)	3	<0.001	<0.001	<0.001	0.461
Biofumigant spp. (B)	1	0.286	0.674	0.019	0.425
R × B	3	0.402	0.045	0.005	0.322

The effect of the Biofumigant rates on shoot biomass of the weed species is summarised in Table 5. The addition of Biofumigant at 1.5g/30g soil significantly ($p < 0.05$) reduced *A. hybridus* shoot biomass when compared to the control treatment (0g/30g soil). Increasing the Biofumigant rate from 1.5 to 3.0g/30g soil further decreased the shoot biomass of *A. hybridus*. However, there were no significant differences between 3.0 and 4.5g/30g soil on *A. hybridus* shoot biomass. The effect of the Biofumigant rate on *B. pilosa* was similar to that of *A. hybridus* (Table 5). The addition of 1.5g/30g soil of Biofumigant significantly ($p < 0.05$) reduced the shoot biomass of *S. verticillata* compared to the control treatment (0g/30g soil). It was noted that increasing the rate of Biofumigant from 1.5 to 4.5g/30g soil caused no significant change in the biomass of *S. verticillata*. The Biofumigant rates did not affect the shoot biomass of *R. cochinchinensis*.

Table 5: The effect of rate of amendment with *C. gynandra* species (at rates 0, 5, 10 and 15 % weight to volume) on weeds shoot biomass (g) at 28 days after planting

ate (g/30g soil)	<i>. hybridus</i>	<i>. pilosa</i>	<i>verticillata</i>	<i>. cochinchinensis</i>
	08 ^{a†}	13 ^a	12 ^a	04
5	05 ^b	07 ^b	05 ^b	04
0	01 ^c	06 ^c	03 ^b	05
5	01 ^c	06 ^c	02 ^b	08
SD	03642	0324	03511	S

†Means followed by the same letter in a column are not significantly different

NS: Not significant

The Biofumigant rate x Biofumigant species interactions on shoot biomass of *B. pilosa* and *S. verticillata* are shown on Table 5. The addition of Green *C. gynandra* at 1.5g/30g soil significantly ($p<0.05$) reduced shoot biomass of *B. pilosa*. Further increase in the Biofumigation rate beyond 1.5g/30g soil did not bring about significant change in shoot biomass of *B. pilosa*, lthough the effect of Purple *C. gynandra* gave effects on shoot biomass of *B. pilosa* as those of Green *C. gynandra*. The rate of 3.0g/g soil produced the lowest amount of *B. pilosa* biomass.

The addition of Green *C. gynandra* at 1.5g/30g soil significantly ($p<0.05$) reduced shoot biomass of *S. verticillata*. Further increase in the Biofumigation rate beyond 1.5g/30g soil did not bring significant changes in shoot biomass of *S. verticillata*. Although the effects of Purple *C. gynandra* gave effects on shoot biomass of *S. verticillata* as those of Green *C. gynandra*, the rate of 3.0g/g soil produced the lowest amount of *S. verticillata* biomass (Table 6).

Table 6: The effect of rate of amendment and the *C. gynandra* species type on emergence of broad leaved weeds

Rate (g/30g soil)	S. verticillata		B. Pilosa	
	Green C. gynandra	Purple C. gynandra	Green C. gynandra	Purple C. gynandra
0	53.80 ^{a†}	50.00 ^a	73.80 ^a	55.00 ^a
1.5	17.50 ^b	16.20 ^b	43.80 ^b	40.00 ^b
3.0	6.20 ^b	6.20 ^b	36.20 ^b	28.80 ^c
4.5	3.80 ^b	5.00 ^b	22.50 ^b	41.20 ^b
LSD	17.18	17.18	24.81	24.81

†The means followed by the same letter in a column are not significantly different

FIELD TRIAL

Trials were done on the herbicidal activity of different *C. gynandra* variants on sweetpepper and tomato plants. The herbicidal activity of green and purple *C. gynandra*, rape (*B. napus*) and a non-biofumigant control, showed significant differences ($p < 0.05$) on overall yields, number of fruits and number of surviving on sweet pepper (Table 7). The effect of the different biofumigant effects showed significant differences on the total number of surviving plants on tomato. Sweet pepper yield was shown to have been affected significantly ($p < 0.05$) by the application of biofumigation treatments. Purple *C. gynandra* treatment was shown to positively affect the overall yield and fruit number compared to the standard control of rape and a non-biofumigant chemical control in sweet pepper plants (Tables 7, 8). Tomato yields was shown to have not been affected by the application of different biofumigant treatments and no significant ($p < 0.05$) differences were found in the overall yield and total number of fruits, except for total number of surviving plants (Tables 7, 8).

Table 7: Analysis of variance of the effect of the herbicidal activity of green and purple *C. gynandra*, rape (*B. napus*) and a non-biofumigant control on number and yield of sweet pepper and tomato

Source of variation	Sweet pepper			Tomato	
	D.F.	Overall yield	Fruit number	Overall yield	Fruit number
Biofumigant (B)	3	0.002	0.045	0.168	0.293
Weed (W)	1	0.249	0.981	0.212	0.036
B X W	3	0.964	0.177	0.766	0.661

Table 8: The effect of biofumigant herbicidal activity on the yield of sweet pepper and tomato

Biofumigant	Overall yield	Fruit number	Overall yield	Fruit number
Green <i>C. gynandra</i>	2939.00† ^b	49.90 ^b	17956.00	358.00
Non-biofumigant	5293.00 ^a	74.90 ^a	15070.00	309.00
Purple <i>C. gynandra</i>	5064.00 ^a	70.40 ^a	24947.00	419.00
Rape	5022.00 ^a	75.90 ^a	17492.00	414.00
LSD	1415.00	19.37	NS	NS

†The means followed by the same letter in a column are not significantly different from each other according to the LSD value. NS: Not significant

The mean weed species richness (S) for the four biofumigants quadrant samples collected ranged from 4.62 (green *C. gynandra*) to 6.00 (non-biofumigant control) in the sweet pepper plots and there were no significant differences noted ($p \leq 0.05$) (Tables 9,10). The Shannon-wiener Diversity index (H) for sweet pepper plots ranged from 1.049 for rape to 1.329 for purple *C. gynandra*. Shannon-wiener diversity index values of 1.118 and 1.148 were for non-biofumigant control samples and green *C. gynandra* samples, respectively. There were no significant differences ($p < 0.05$) noted on sweet pepper fields for species evenness. The species evenness (E) ranged from 0.62 for Quadrats with green *C. gynandra* to 0.79 for sweet pepper plots (Table 10).

The mean weed species richness (S) for the four biofumigants quadrant samples collected ranged from 4.75 (Rape) to 6.38 (purple *C. gynandra* and non-biofumigant control) in the tomato plots. There were significant differences ($p < 0.05$) observed on tomato fields (Table 10) for species evenness. The species evenness (E) ranged from 0.64 for Quadrats with green *C. gynandra* to 0.84 for tomato plots (Table 10).

Table 9. Mean squares from the ANOVAs of sweet pepper and tomato plot weed counts at 8 weeks after planting.

Sweet pepper	Sweet pepper			Tomato			
	E	H	S	S	E	H	S
Source of variance	df	SS	SS	SS	SS	SS	SS
Block	3	0.06445	0.11802	2.375	0.01148	0.2981	10
Block X MP treat							
Main plot	3	0.15031	0.34257	9.125	0.20778*	1.39782	14.25
Residual	9	0.21634	1.78367	29.375	0.1167	1.71442	44.25
Block X MP treat X SP treat							
Split plot	1	0.00478	0.00138	0.125	0.02192	0.00284	8.000*
Main plot X split plot	3	0.04043	0.73728**	15.125	0.01784	0.10119	2.25
Residual	12	0.25033	0.4701	22.75	0.17561	0.56231	16.75
Total	31	0.72664	3.45302	78.875	0.55138	4.07167	95.5

†* 0.01 < p < 0.05; ** 0.001 < p < 0.01; *** p < 0.001; all other mean squares were not significant.

E: species evenness; the population that each species comprises of the whole, H: Shannon Weiner diversity index, S: Species richness

Table 10: The herbicidal activity of Green *C. gynandra*, Purple *C. gynandra*, Rape (*B. napus*) and a non-biofumigant control of sweet pepper and tomato fields at 8 weeks after planting.

Main plot	Sweet pepper			Tomato		
	E	H	S	E	H	S
Green <i>C. gynandra</i>	0.77	1.15	4.62	0.64 ^b	1.13	6.00
Non-biofumigant	0.62	1.12	6.00	0.82 ^a	1.51	6.38
Purple <i>C. gynandra</i>	0.79	1.33	5.62	0.84 ^a	1.53	6.38
Rape	0.67	1.05	5.00	0.72 ^a	1.08	4.75
LSD	NS	NS	NS	0.13	NS	NS
CV%	15.40	27.10	24.00	10.70	23.50	26.70

†The means followed by the same letter in a column are not significantly different from each other according to the LSD value.

NS: Not significant

DISCUSSION

The findings of this work suggest that plant tissue biomass from *C. gynandra* can suppress weed emergence. *C. gynandra* plant tissue residues had an inhibitory effect on weed seed emergence. This confirms work done before which proved that biofumigation has been shown to suppress weed emergence and biomass. However, the level of response observed is dependent on both the ITC and the pest involved (Sarwar *et al.*, 1998; Kirkegaard *et al.*, 2001; Manici *et al.*, 2004). The suppression may be attributed to glucosinolate hydrolysis products from *C. gynandra* plant tissue. Brown and Morra (1995, 1996) attribute lettuce emergence inhibition to water soluble compounds from *B. napus* defatted seed meal and those from *B. napus* leaf tissue. These water-soluble glucosinolate products from *Brassica* seed meals are probably involved in the inhibition of germination (Brown and Morra, 1995; Mazzola *et al.*, 2007; Handiseni *et al.*, 2013, 2011;). The differences in the suppressive effect of the two *C. gynandra* species types observed in this study can sometimes be attributed to different methyl-glucosinolate content between the two *Cleome* species. The amount of methyl-glucosinolate found in in this study, both the purple and green *C. gynandra* accessions, were 19 and 7 $\mu\text{mol g}^{-1}$ per gram of dried green tissue, respectively. Bohinc *et al.* (2012) report that glucosinolate content varies between plant species. The study devised that the same plant material may affect different weed species in a different manner (Brown and Morra, 1995; Bohinc *et al.*, 2012; Handiseni *et al.*, 2013). It was also observed that the suppression of soil-borne pests using *Brassica* spp. will be aided using varieties possessing high glucosinolate content and those which supply sufficient volumes of moisture to promote the release of isothiocyanates (Taylor, 2013).

In this study it observed that different levels of weed emergence are exerted by different amounts of *Cleome* spp. plant tissue applied. Dhingra *et al.* (2004) previously showed that high concentrations of Allyl-ITC can be found within some mustard, horseradish and wasabi species. However, a high degree of variation exists between cultivars of the same species (Taylor, 2013). The mechanism of volatility, toxicity and effectiveness differs with type of the ITC R-group. However, reasons for differences in toxicity are not always clear.

The non-suppressive effect of *C. gynandra* on *R. cochinchinensis* was also similar to the findings by Handiseni *et al.* (2011) in which they report that the use of Brassicaceous residues for the control of weeds and soil-borne pests has not been widely implemented due to inconsistencies in performance across varied production systems. However, results in this study suggest that pre-plant soil incorporation of *C. gynandra* has the potential to act as an effective alternative to chemical herbicides for the control of the weeds in *B. pilosa*, *A. hybridus* and *S. verticillata*.

The results in this study showed that the application of *C. gynandra* plant tissue biofumigants has an effect on overall yield and the overall fruit counts. The results obtained in this experiment could be as a result of the allelochemical effects of GSLs on the weed species as what has been previously reviewed by Brown and Morra (1997) in. It is also reported that GSLs may greatly influence weed growth and are suspected to be the major suppressors of weed growth (Handiseni *et al.*, 2011; Bohinc *et al.*, 2012; Grace *et al.*, 2016).

In this study, the biofumigation with the purple and green *C. gynandra* increased the yields of both tomato and sweet pepper in the trials and it was comparable to the control treatments. These results supports the findings of Handiseni *et al.* (2011) and illustrates the potential of biofumigation for suppressing the growth of *Avena fatua*, *Amaranthus retroflexus* and *Lactuca serriola*. The findings indicate that biofumigation of fields by incorporation of *C. gynandra* plant tissue affect weed evenness in the field. This represents a useful reduction in weed species for farmers (Agostini, 2011; Karavina and Mandumbu, 2012).

The study shows that yields varied significantly between the non-biofumigant control, the green and purple *C. gynandra* plant tissue biofumigants. Different biofumigant effects were shown to vary significantly in sweet pepper yields and number of fruits. This suggests that the glucosinolate concentration of the tested *C. gynandra* accessions have variable effects as biofumigants on weed activity. Overall, the results of this study suggest that the candidate purple and green *C. gynandra* are effective in suppressing weed species activity and this was comparable to check treatments under field conditions.

Green *C. gynandra* plant tissue, as a treatment, had low levels of glucosinolates and it has been increasing yields comparatively with the chemical controls, which are effective in weed suppression. The results indicate that weed suppression is not always associated with high production of glucosinolates (Brown and Morra, 1995; Gimsing and Kirkegaard, 2009). In the present study, the mechanisms behind any suppressive effects of green manure *C. gynandra* crops were not investigated, but since the *C. gynandra* had specific suppressive effects, it can be concluded that green *C. gynandra* glucosinolates had a suppressive factor in this case, even at low levels (Soldevilla-Martinez, 2009).

The results indicate that biofumigation using *C. gynandra* from the field trials was not consistent on the tomato trials. However, the use of different cultivars which possess glucosinolate profiles more resistant to the effects of abiotic factors, including moisture and temperature, may produce different results. The high volatility level of ITCs has often been highlighted as an aspect which may limit the efficiency of a biofumigation system (Gimsing and Kirkegaard, 2009). However the biofumigation principal works on the 'mustard bomb' effect, releasing a short blast of isothiocyanates at high concentrations which aims to kill weeds within the soil (Agostini, 2011). It is also hoped that this approach will limit any adverse effects on non-targeted soil organisms. However, investigating an incorporation method which will best seal ITCs into the soil, and limit their initial depletion, will allow them to come into contact with increased numbers of weeds within the soil (Handiseni *et al.*, 2011).

The weed species in the field are primary sources of future weed populations and this provides seed bank, a unique source for predictive management studies (Karavina and Mandumbu, 2012; Grace *et al.*, 2016). Species richness (S) quantifies how many different types, weed species, are contained in the field under study, the number of different species in the corresponding list ranging from 4.62 to 6.38. Weed richness (S) is different from weed abundance, as it is different from diversity. Species evenness refers to the proportion that each species comprises of the whole. The results above show that the diversity is high on all the quadrats sampled. The diversity index is a

quantitative measure reflecting how many different weed species are there in the field under study and, simultaneously, takes account of how evenly the weed species are distributed among the types.

CONCLUSIONS

The most important result of this study was that *C. gynandra* biomass incorporation suppressed germination and early seedling growth of *Setaria verticillata*, *Amaranthus hybridus* and *Bidens pilosa*, but not *Rottetboelia cochinchinensis*. These results are very interesting and indicate possible alternative potential for use in cropping systems to suppress weed growth by smallholder farmers. For the biofumigant accessions investigated, purple *C. gynandra* proved to be more effective at suppressing the weed species tested.

The result demonstrate that the application of *C. gynandra* plant tissue had a herbicidal effect and can suppress the growth of weeds species in the field studied. The results also conclude that the effects between different *C. gynandra* biofumigants and weed species can vary depending on the combination of *C. gynandra* plant tissue type and weed species. However, the use of different *C. gynandra* species, which possess more glucosinolate concentrations, more resistant to abiotic stresses, including moisture and temperature, may produce different results.

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Exploring the Motivations and Critical Factors of Successful Enterprise Resource Planning Implementation in Organisations in Zimbabwe

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Abstract

Enterprise Resource Planning (ERP) systems have become increasingly popular among organisations worldwide, aiming at streamlining business processes and enhance overall efficiency. This article investigates the essence of ERP adoption in Zimbabwe, focusing on the motivations and critical factors contributing to successful implementation within organisations. A qualitative methodology was employed, involving 12 participants from four companies who have implemented ERP systems. Interviews and document analysis were used as methods for collecting data. The findings reveal that the main motivations for ERP adoption in Zimbabwe are centred around modernising the information technology (IT) environment, replacing aging systems, improving operational efficiency and enhancing customer satisfaction. Moreover, the research identifies critical success factors that significantly influence the implementation of ERP systems. Executive management support emerges as a crucial factor, indicating the importance of top-level commitment and leadership in driving successful implementation. Additionally, company-wide support, a positive organisational culture that embraces change and meaningful user involvement, are highlighted as vital factors in ensuring the successful adoption and utilisation of ERP systems. The findings provide valuable insights for organisations considering, or in the process of, implementing ERP systems in Zimbabwe, and for researchers and practitioners in the field of information systems and technology management. By understanding the motivations and

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critical success factors, organisations can make informed decisions and develop effective strategies for successful ERP implementation in Zimbabwe.

Keywords: Enterprise resource planning systems, implementation, critical success factors, challenges

INTRODUCTION

Enterprise Resource Planning (ERP) systems have become an integral part of modern organisations, facilitating the management and integration of various business processes and functions.(Xie *et al.*, 2022). According to Kumar and Hillegersberg (2015), an ERP is a package that combines information and all data-based processes in an organisation and across all functional departments. ERP adoption offers numerous potential benefits, such as enhanced operational efficiency, improved decision-making, streamlined processes and increased competitiveness. However, implementing an ERP system is a complex undertaking that requires careful planning, substantial resources and organisational commitment.

Qureshi (2022) has pointed out that enterprise systems are software systems for business management, encompassing modules supporting functional areas such as planning, manufacturing, sales, marketing, distribution, accounting, financial, human resource management, project management, inventory management, service and maintenance, transportation and e-business. An ERP software provides an end-to-end information management solution for a company. The software can be used by all departments of the company to manage the information.

Salih *et al.* (2022) argue that the main goal of ERP is to provide the right information to the right person at the right time. It is modular and integrated, meaning it is made up of several modules that share information with each other. A module can share information and that information can flow from one module to another. The development of the ERP facilitates visible interconnection of modules that provides transparent flow of information between all functional departments in an organisation. Legacy systems are replaced by ERP that facilitates

the introduction of a single integrated system that links all functions. ERP is defined as a tool or method for best practices in planning and controlling of all resources needed in an organisation (Sitinjak and Jayadi, 2023). ERP is the result of business systems evolution. Manufacturing Resources Planning (MRP) was the first system to be developed in the early 1960s. It has evolved from the basic legacy system used by organisations. ERP brings many benefits to the organisation in form of increased operational and financial performance.

Despite the widespread adoption of ERP systems, many organisations still struggle with successful implementation. Nepal (2022) observes that there are numerous factors that contribute to the challenges faced during the implementation process, including technical issues, organisational resistance, inadequate training and poor change management strategies. Understanding the motivations behind ERP adoption and identifying critical success factors are crucial for organisations seeking to optimise their implementation efforts and maximise the benefits derived from these systems.

The process whereby the top executive makes a decision to install a computer based information system and is well integrated into the operations of an organisation, is called implementation (Burns and Turnipseed, 2016). Ghayas *et al.* (2022) argue that during the implementation process, much planning and consulting is done that it becomes a very difficult process all together. The whole process may take from three months up to one year. Many resources, such as money, investment time and internal resources, are required during the process of implementation. Generally, ERP systems implementation and the systems are very big and complex in nature and are associated with very large organisations. Legacy systems may seem good in small organisations as implementation of ERP will not yield desired results (Rajapakse and Thushara, 2023). ERP implementation comes mostly with changes in the operations that include change of staff and work practices. Due to its size and complexity, it is advisable that implementation consultants are hired as they are more cost-effective and are tried and tested than in-house

implementation. ERP benefits actually take time to accrue, in some cases, after three years.

ERP is characterised as the ability to assemble a cohesive suite of applications designed to manage various aspects of business operations. ERP tools share a general procedure and data model, covering a large and deep operational end-to-end process. These applications computerise and sustain a variety of managerial and operational business procedures across several industries, together with line of business, client-facing, administrative and the asset supervision aspects of an organisation. However, ERP systems tend to come at a considerable price and the business gains are complex to achieve and realise. (Gartner, 2013).

For an organisation to gain a competitive advantage, it must implement state of the art ERPs and new technologies to enhance its business operations. These systems are developed in such a way that they enhance organisations' business operations, i.e., customer interaction, real time response and preparation and manufacturing. The newly added concept of auditing has created both strengths and weaknesses in ERPs (Soral, 2017).

The aim of this article is to delve into the essence of ERP adoption by exploring the motivations that drive organisations to adopt ERP systems. By examining the underlying reasons for their adoption, we gain insights into the specific goals and expectations organisations have when embarking on an ERP implementation journey. Furthermore, this study seeks to identify critical factors that significantly impact the success of ERP implementation in organisations.

By unravelling the motivations behind ERP adoption, the strategic objectives that organisations seek to accomplish through the implementation of ERP systems can be better understood. Additionally, by examining the critical success factors, the key elements that organisations need to consider and address during the implementation process to increase the likelihood of achieving their intended outcomes, can be identified.

This research aims to contribute to the existing body of knowledge on ERP adoption and implementation by providing a comprehensive analysis of the underlying motivations and critical success factors. The findings from this study can serve as a valuable resource for organisations planning to adopt an ERP system and enable them to make informed decisions, develop effective implementation strategies and enhance the overall success of their ERP initiatives. Ultimately, this research aims to advance the understanding of ERP adoption and implementation, thereby supporting organisations in harnessing the full potential of these systems to achieve their strategic objectives.

RESEARCH QUESTIONS

- 1) Why do organisations adopt ERP systems?
- 2) What are the critical factors that have an effect on ERP systems implementation success in Zimbabwe?

LITERATURE REVIEW

HISTORY OF ERP SYSTEMS

The origin of Enterprise Resource Planning improvement was from MRP. In the 1960s MRP was known as the Materials Resource Planning system, its many thrusts being on planning tasks in manufacturing companies. ERP systems, with extra modules that deal with consumers and suppliers as in internal and external environments, later came as an improvement of the earlier systems. ERP became unlimited enterprise software systems (Katuu, 2020).

MRP I was recognised in the 1960s, almost the same time the first computers were developed. The growth in hardware development over the years also led to the development of more accounting functions and a little bit on business process. SAP and JD Edwards were the first companies in software organisation, along with Oracle with the SQL. IBM became the best hardware trader around the 1980s and then came MRP II with more business processes (Katuu, *ibid.*). The 1990s witnessed a fast growth in ERPs that saw the integration of all business functional units, i.e., the hardware and the transaction

processing systems. The choice in hardware and software increased on the market and the main among those that survived resistance, include Oracle and SAP. Resistance to change was the major contributor to failure of many ERP implementations. Projects and database management and budget overruns are other factors that cause the failure of ERPs. If the these above are done well, the rotation time and user friendliness for first-time users and frequent updating for active users, huge returns can be realised by the organisation (Nepal, 2022).

During the introduction stages of ERPs, they were used for simple accounting and human resource management applications. With the arrival of online technology, SAP and Oracle started to develop applications for ERP. New and better technology positively impacted the development of ERPs. Web technologies reduced costs as, generally, integration became simple and easy. Through the use of web-based services and other integrated compositions, the desire by users to access information without going through ERP systems was well achieved (Katu, 2020). This was because users were now in a position to effortlessly perform several application services like placing orders and checking their bank accounts. Web technology also offered a stage for all the users to converse with software through the online webpage. With that, they avoided the complexity of the systems in place. SAP introduced mySAP and Oracle also offered the same service of broker hub setup that acts as an intermediary between web technology and an ERP software called E-Business Suite (De Almeida *et al.*, 2018). A lot of improvements are still underway in the whole ERP production and use.

Lessa and Negash (n.d.) define information systems as a combination of software people, tangible components of a computer and infrastructure that aid decision-making in an organisation. Today's business has actually changed, it has been revolutionised through the development of new systems in all spheres of business, be it in insurance, wholesaling, finance, advertising and manufacturing. Information Technology has infiltrated in all departments with the

changing organisation of markets, product life cycle, production and redistribution patterns. Information systems have altered organisation of companies in this digital era.

Muchenje (2012) acknowledges that the digital era has resulted in intra-enterprise and inter-enterprise that is aided by customer relationship management (CRM) and supply chain management systems, demonstrating IT as an enabler in all organisational plans and strategies of today. The power of computers in helping decision-making in all organisations must be recognised through ways that gather, produce and assess data for managerial decision-making that is in line with organisational long-term plans, risk and controls. IT cannot increase the usefulness of auditing, but the responsible department must look for the best IT auditing systems to meet the objectives (Nepal, 2022).

IT has become the backbone of communications, for huge amounts of data to be moved from one organisation to another and risk mitigation, reliable and secure timely dissemination of information at all levels of the organisation. A well secured and foolproof system to be in place in an organisation. The introduction of ERPs has helped the dissemination of information. be it vertically or horizontally across organisations. The network of the internet also provides a way of disseminating information to external stakeholders (Muchenje, 2012).

ERP is a combination of systems that help in the administration of an organisation's resources, and they make it simple and include all processes contained by functional and technical lines in the company. These are very big management systems that combine a variety of software programmes that administer and integrate different processes in an organisation. The software programmes range from financial accounting, sales, distribution planning and production (Shehab *et al.*, 2019).

These packages are developed in such a way that they amplify the smooth flow of information in all processes, both internally and externally. ERP systems' main objective is to integrate the processes

within an organisation, both horizontally and vertically, to synchronise all software packages (Muchenje 2012).

If a corporation makes use of an ERP system, it can computerise all its main production aspects, reduce the difficulty and the cost of the organisation, force the organisation itself to partake in the business process re-engineering to optimise its operations and result in a successful business. Basically, ERPs are used to boost the performance of a supply chain network by reducing the rotation time. This can be in the high capital demanding companies like defence aerospace and building (Shehab *et al.*, 2019).

ERP LIFECYCLE

Chang (2004) highlights that the lifecycle of an ERP is made up of four stages, which are implementation, maintenance, upgrade and documentation. Each of the stages have phases, for the main one, i.e., implementation, has the phases Planning, Fit/GAP Building Testing and Deploying. Implementation is the most important stage in ERP and if is wrongly done, the ERP will fail. Several critical factors are supposed to be in place at several phases for it to succeed.

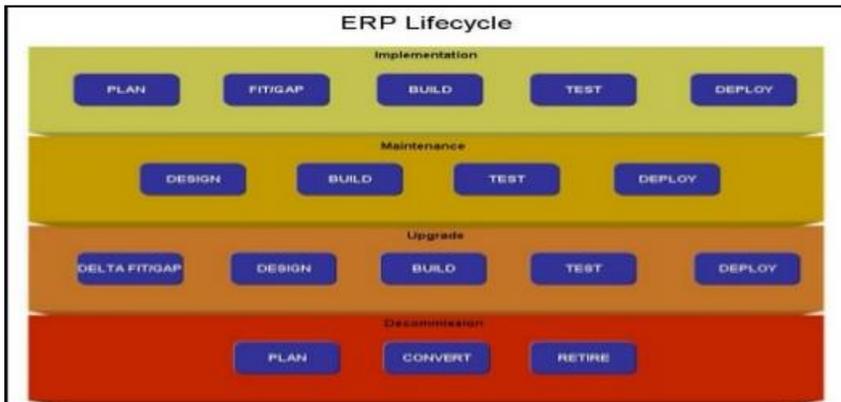


Figure 1: ERP Lifecycle (Chang, 2004)

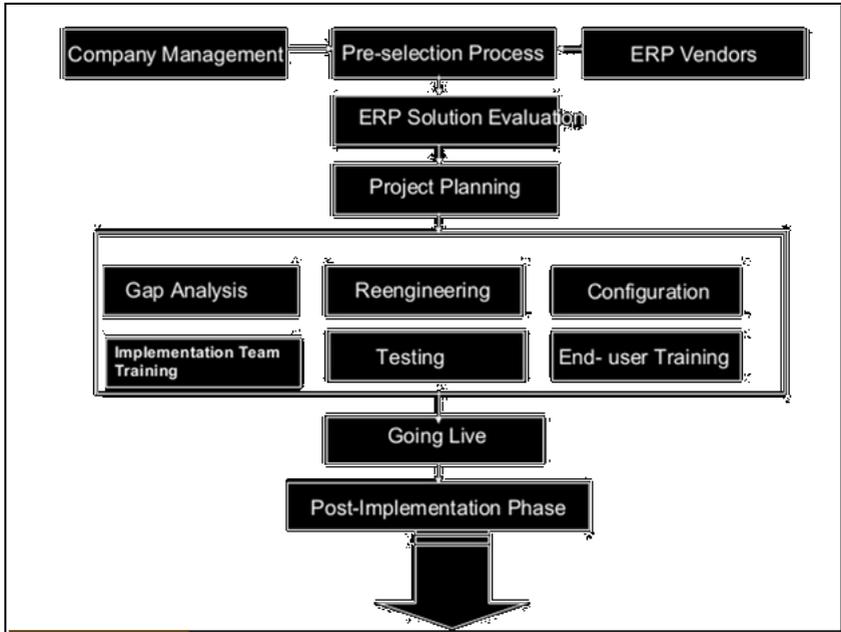


Figure 2: ERP Implementation Lifecycle (Chang, 2004)

According to Chang (2004), the implementation life cycle is made up of four phases of planning, GAP analysis, building and going live. Figure 2 illustrates a detailed implementation lifecycle.

ERP SYSTEMS IMPLEMENTATION LITERATURE

In comparison with other IT research and fields, ERP has attracted less attention. ERP systems, similar to other management information systems, are often perceived as very complex and difficult to implement. Most of available presentations in this area of ERP systems implementation lack concrete evidence, backed by academic and practical researches. Therefore, in this research information system literature is basically reviewed to find better theories that can adapt well to the less researched field of ERP. Limited studies have been conducted to identify critical factors affecting ERP systems implementation success, with many of them focusing on single-case studies of how ERP systems were implemented in a company.

This situation has led to the lack of a standardised way of implementing an ERP. Most writers have written much about how they managed to do their implementation (Harun *et al.*, 2022; Xie *et al.*, 2022; ; Anaya *et al.*, 2023)

Basically, the variables required during the implementation process determine the success or failure of the project. Rajapakse (2023) defines a success ERP implementation in two dimensions, improved performance and user satisfaction. Ali *et al.* (2023) recommend that the explanation and measurements of ERP success or failure are very difficult issues and that success is based on the angle from which one measures it.

CONCEPTUAL FRAMEWORK

Basing on ERP literature and information system research factors affecting ERP implementation, success has been identified. This was generally from the model of Ives *et al.* (1980). According to DeLone and Mclean (Year) information system success model variables that measure implementation success are all defined. These variables are combined with critical success factors.

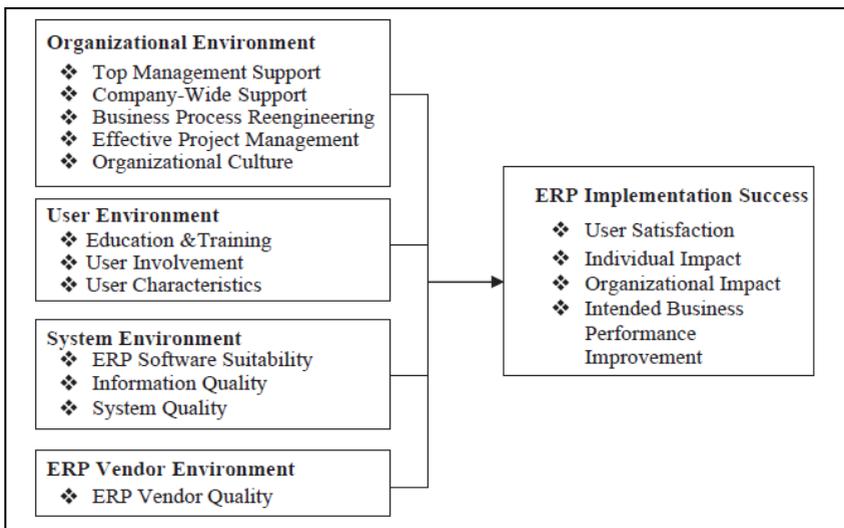


Figure 3: Conceptual Research Framework (Ives *et al.* 1980).

ORGANISATIONAL ENVIRONMENT

Organisational culture, re-engineering business process, top management support, effective project management and company wide support are the five factors under organisational environment.

TOP MANAGEMENT SUPPORT

Top management support has been stressed in many researches as the main ingredient to successful ERP implementation (Al-Mashari et al., 2003). In ERP implementation all staff members and all segments of an organisation need complete cooperation as it is an integrated Information System Top management must play a pivotal role in providing a clear way up and solving any problems within an organisation. ERP implementation is not all about removing legacy systems, but it is more about reengineering the business processes.

COMPANY WIDE COMMITMENT

An ERP is a well-integrated information system that requires commitment and support from all functional units in an organisation..(Ghayas et al., 2022). Every worker from each and every department must be involved in the implementation process without being frequently monitored in their job positions.

RE-ENGINEERING BUSINESS PROCESSES

Hammer and Champyas (2001) define business process reengineering as the essential reformulation and redesigning of organisational process to accomplish improvements in significant measures in performances such as speed, service quality and cost. During the process of implementation, current business processes are re-engineered to the standardised process.(Ghayas et al., 2022).

One of the critical failure factors in ERP implementation is the underestimation of the extent to which the organisation must re-engineer its process current process to accommodate the new system.

EFFECTIVE PROJECT MANAGEMENT

According to Coşkun et al. (2022), project management evolves because the company must control , plan and coordinate activities of big and commercial projects. A minimum of one to two years is needed in the

whole process of implementing ERP and involves all organisational functional units, therefore, there must be a strategy to control the process and the process must run within the budget and schedule.

ORGANISATIONAL CULTURE

Implementation failure is certain when an organisation tries to adapt the process to the current style of culture in that organisation (Xie *et al.*, 2022) As mentioned above on business re-engineering, a company must implement an ERP as it also changes its business processes. Customer culture is also affected by this change.

USER ENVIRONMENT

This element is more focused on people who will be using the system; therefore, lack of training and education and user involvement are the main factors that can lead to the failure of ERP implementation. It puts emphasis on the care of the stakeholders within the organisation.

EDUCATION AND TRAINING

Training and education refer to the management and workers with reason and general concepts about the ERP system (Yusuf *et al.*, 2004). This enhances the understanding of employees in relation to their functional areas within the organisation. Every user is held accountable to make the system produce results and perform up to expectations. This can be very effective if proper training and education is done.

USER INVOLVEMENT.

The participation of users either during development or implementation process is referred to as user involvement. Some other researchers argue that user involvement during the development stages is very important to the success of a system. (Salih *et al.*, 2022). User involvement is the greatest tool to deal with wrong perceptions about the system from system users (resistance).

USER CHARACTERISTICS

Ives *et al.* (1980) outline that user characteristics have an impact on the success of the ERP. Basically, it is concerned with education levels, technical orientation or business orientation and user characters. ERP

vendors have several packages developed by different languages and meant for different markets, therefore enterprises must choose the best ERP that suits the users.

RESEARCH METHODOLOGY

This article adopts a qualitative methodology to explore the motivations and critical factors contributing to the successful implementation of Enterprise Resource Planning (ERP) systems in organisations in Zimbabwe. The qualitative approach allows for an in-depth exploration of participants' perspectives, experiences and insights regarding ERP adoption.

SAMPLE SELECTION

A purposive sampling technique was employed to select 12 participants from four different companies operating in Zimbabwe. The participants were chosen based on their involvement in the ERP implementation process and ability to provide rich and diverse insights into the research topic. The sample size was determined based on the principle of data saturation, ensuring that sufficient information was gathered to address the research objectives effectively. (Mimansha Patel and Nitin Patel, 2019)

DATA COLLECTION

Semi-structured interviews were conducted with the selected participants to collect the primary data. The interviews were designed to elicit detailed information about the motivations behind ERP adoption, and the critical success factors identified during the implementation process. The interview questions were developed based on a comprehensive literature review and pilot-tested to ensure clarity and relevance.

DATA ANALYSIS

The collected interview data were analysed using thematic analysis. The process involved several stages, starting with familiarisation by repeatedly reading and immersing in the data. Initial codes were generated by identifying recurring patterns, ideas and concepts related to motivations and critical success factors. (*ibid.*) These codes were then grouped into higher-order themes, capturing the main ideas and

trends emerging from the data. The analysis was conducted iteratively, allowing for refinement and revision of the themes until saturation was reached.

RESEARCH RIGOUR

To ensure the rigour and credibility of the research, various strategies were employed. These included triangulation of data sources (interviews with participants from multiple organisations), member checking (providing participants with a summary of their interview data to validate the findings) and peer debriefing (discussion and feedback from colleagues knowledgeable in qualitative research methods). The research process was also documented thoroughly to enhance transparency and replicability.

ETHICAL CONSIDERATIONS

Ethical considerations were prioritised throughout the research process. Informed consent was obtained from all participants, ensuring their voluntary participation and confidentiality. The research also adhered to relevant ethical guidelines and protocols, protecting the rights and wellbeing of the participants.

LIMITATIONS

This qualitative study has some limitations. The findings are based on a relatively small sample size of 12 participants from four companies, which may limit the generalizability of the results. The research focused exclusively on organisations in Zimbabwe, which may restrict the transferability of the findings to other contexts. However, the study's rigorous methodology and detailed exploration of participants' perspectives provide valuable insights into the motivations and critical factors of ERP adoption in Zimbabwean organisations.

FINDINGS

The findings and discussion section provides an in-depth analysis of the motivations behind ERP adoption in Zimbabwe, delving into the core factors that drive organisations to embrace ERP systems. These factors are basically used during the measuring and evaluation of the whole process of ERP implementation. The factors are summarised below.

MODERNISE IT ENVIRONMENT

One of the primary motivations for organisations to adopt ERP systems is to modernise their IT environment. Legacy systems often become out dated and lack the capabilities to meet evolving business needs. By implementing ERP, organisations can leverage modern technologies and infrastructure, enabling them to streamline operations, enhance data management and improve overall efficiency. To this end Katuu (2020) and Xie *et al.* (2022) point out that most organisations adopt ERP to modernise their IT environments.

REPLACEMENT OF AGEING LEGACY SYSTEMS

Many organisations adopt ERP systems as a means to replace ageing legacy systems. Legacy systems may suffer from issues such as limited functionality, maintenance challenges and compatibility problems. ERP implementation allows organisations to migrate from these out dated systems to a comprehensive and integrated solution that offers enhanced functionalities and improved system reliability. According to Salih *et al.* (2022) and Katuu (2020), organisations adopt ERP systems with the intention of replacing their ageing legacy systems.

EFFICIENCY

ERP adoption is driven by the desire to improve efficiency within organisations. By implementing an ERP system, organisations can optimise processes, automate routine tasks and eliminate manual and redundant activities. This streamlining of operations leads to cost reductions, improved speed and increased accuracy in various business processes, such as inventory management, financial accounting and supply chain management. Ghayas *et al.* (2022) supports the assertion that ERP brings efficiency in organisations.

BETTER MANAGEMENT TOOLS (PLANNING)

ERP systems provide organisations with advanced management tools that facilitate planning and decision-making. The integrated nature of ERP allows for real-time access to critical data, enabling managers to make informed decisions based on accurate and up-to-date information. This improved visibility and data-driven decision-making contribute to more effective strategic planning and resource allocation

within organisations. As suggested by Salih *et al.* (2022) and Katuu (2020), organisations adopt ERP systems for better management tools.

INCREASED CUSTOMER SATISFACTION

ERP adoption can have a direct impact on customer satisfaction. Through the integration of customer relationship management (CRM) modules, organisations can effectively manage customer interactions, track customer preferences and provide personalised services. This capability enables organisations to enhance customer satisfaction by delivering improved customer experiences, addressing individual needs and maintaining strong customer relationships.

INTERNET-ENABLED WITH E-COMMERCE CAPABILITY

The integration of ERP systems with e-commerce capabilities allows organisations to expand their business reach and tap into online markets. By leveraging internet-enabled features, organisations can establish online storefronts, manage online transactions and seamlessly integrate online sales channels with backend operations. This integration facilitates efficient order processing, inventory management and customer support, leading to enhanced customer experiences and increased revenue opportunities. Internet-Enabled with E-commerce Capability is another factor why organisations adopt ERP systems, according to Aroba (2023).

INTEGRATION AND COLLABORATION WITH SUPPLY CHAIN

ERP adoption often aims to improve integration and collaboration within the supply chain. By implementing ERP systems, organisations can streamline supply chain operations, facilitate seamless information sharing and enable effective coordination with suppliers, distributors and other stakeholders. This integration and collaboration lead to improved supply chain visibility, reduced lead times, optimised inventory management and enhanced overall supply chain performance.

TIGHTER CONTROLS AND COMPLIANCE

ERP systems offer robust control mechanisms and help organisations ensure compliance with regulatory requirements and industry standards. Through standardised processes, centralised data

management and built-in security features, ERP systems help establish tighter controls over business operations and enhance data integrity. This capability is particularly important for organisations operating in highly regulated industries, such as finance, healthcare, and manufacturing. The aim of tighter controls and compliance motivates organisations to adopt ERP systems (Li, 2011).

The critical success factors identified in this research study are crucial elements that significantly influence the successful implementation of ERP systems in organisations. Participants drawn from four companies, the Grain Marketing Board, Telone, Enerst and Young and Guridge, highlighted the following critical success factors. Understanding and addressing these factors are essential for organisations to maximise the benefits derived from ERP adoption and achieve implementation success. The following discussion elaborates on each critical success factor:

EXECUTIVE MANAGEMENT SUPPORT

The support and commitment of top-level executives play a pivotal role in the success of ERP implementation. Executives who champion the ERP project provide the necessary resources, set clear goals and communicate the strategic importance of ERP adoption throughout the organisation. Their support ensures the allocation of adequate budget, personnel and time required for successful implementation.

COMPANY-WIDE SUPPORT

Alongside executive management, garnering support from all levels of the organisation is crucial. The active participation and endorsement of employees across departments create a collaborative environment and foster a sense of ownership for the ERP initiative. Company-wide support facilitates smoother change management, reduces resistance and promotes the adoption and effective utilisation of the ERP system.

PROJECT MANAGEMENT

Effective project management is vital for successful ERP implementation. Skilled project managers ensure proper planning, resource allocation, scheduling, risk management and coordination of

various implementation tasks. They establish clear milestones, monitor progress and address potential issues promptly, ensuring that the ERP project stays on track and meets objectives within defined timelines.

ORGANISATIONAL CULTURE

The organisational culture significantly impacts the acceptance and assimilation of an ERP system. An open and adaptable culture, characterised by a willingness to embrace change and continuous improvement, fosters a conducive environment for successful ERP implementation. Organisations that prioritise collaboration, knowledge-sharing and innovation are better equipped to navigate the challenges associated with ERP adoption.

USER INVOLVEMENT

Active involvement and engagement of end-users in the ERP implementation process are crucial. Users possess valuable insights into existing processes and requirements, making their input essential for effective system design and configuration. Involving end-users from the early stages, fosters a sense of ownership, increases user acceptance and facilitates smoother transitions.

USER CHARACTERISTICS

Understanding the characteristics and competencies of end-users is critical for ERP implementation success. Factors such as computer literacy, willingness to adapt to new technologies and the ability to embrace change, influence user adoption and system utilisation. Identifying user training needs and providing adequate support based on their characteristics ensures effective utilisation of the ERP system.

ERP SOFTWARE SUITABILITY

Choosing an ERP software solution that aligns with organisational needs and objectives is crucial. Evaluating the functionality, scalability, flexibility and compatibility of ERP software with existing systems and processes ensures a suitable fit. ERP software that meets organisational requirements and can be customised or configured to specific needs, increases the likelihood of successful implementation.

EFFECTIVE COMMUNICATION

Clear and consistent communication is essential throughout the ERP implementation process. Effective communication ensures that stakeholders are well-informed about the project's progress, benefits and expected changes. Transparent and timely communication helps manage expectations, address concerns and maintain stakeholder engagement and support.

SYSTEM QUALITY

The quality of the ERP system itself is a critical success factor. The system should be reliable, secure, scalable and capable of handling organisational demands. Robust system architecture, adequate system performance and data integrity contribute to the overall success of the implementation.

ERP VENDOR QUALITY

Selecting a reputable and reliable ERP vendor is vital. Vendors that offer quality products, on-going support and timely updates, ensure a smooth implementation process. Evaluating vendor experience, expertise and customer reviews helps in selecting a vendor that aligns with organisational requirements and can provide continuous support, post-implementation.

EDUCATION AND TRAINING

Providing comprehensive education and training programmes to end-users is essential for successful ERP implementation. Proper training enhances user proficiency, reduces resistance, and ensures effective system utilisation. Continuous education and training programmes. Katuu (2020) shares the same thinking.

CONCLUSION AND RECOMMENDATIONS

Results of this research demonstrate that organisations adopt ERP systems for a variety of reasons, including modernising IT environments, replacing ageing legacy systems, improving efficiency, providing better management tools, increasing customer satisfaction, enabling e-commerce capabilities, enhancing supply chain integration and collaboration, and establishing tighter controls and compliance. These findings underscore the multifaceted nature of ERP adoption

and highlight the critical factors that organisations consider when implementing ERP systems to achieve successful outcomes. Based on the findings of this article, the following recommendations are proposed for organisations considering the adoption and implementation of Enterprise Resource Planning (ERP) systems in Zimbabwe.

EXECUTIVE MANAGEMENT SUPPORT

Organisations should ensure strong support and active involvement from top-level executives throughout the ERP implementation process. Executives should champion the ERP project, provide necessary resources and communicate the strategic importance of ERP adoption to the entire organisation.

COMPANY-WIDE SUPPORT

Garnering support from employees across all levels of the organisation is fundamental for successful ERP implementation. Organisations should foster a culture of collaboration and ownership, encouraging employees to embrace the change and actively participate in the implementation process.

EFFECTIVE PROJECT MANAGEMENT

Implementing effective project management practices is essential for a smooth and successful ERP implementation. Skilled project managers should be assigned to oversee the implementation, ensuring proper planning, resource allocation, risk management and timely completion of tasks.

ORGANISATIONAL CULTURE

Organisations should foster an adaptable and innovative culture that embraces change and continuous improvement. This culture will support the successful adoption and assimilation of ERP systems, as employees will be more open to change, collaboration, and learning.

USER INVOLVEMENT

Involving end-users in the ERP implementation process is key for their acceptance and effective utilisation of the system. Organisations should seek input from end-users, understand their needs, and

actively involve them in system design, configuration and testing to ensure the ERP system aligns with their requirements.

EFFECTIVE COMMUNICATION

Clear and transparent communication is essential throughout the ERP implementation process. Organisations should establish effective communication channels to keep stakeholders informed about the project's progress, benefits and expected changes. Regular and timely communication will help manage expectations, address concerns and maintain stakeholder engagement and support.

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Phenomenological Insights into Challenges and Opportunities of Learning through Social Information Communication Technology Andragogy

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Abstract

Globally, Social Information Communication Technology Andragogy (SICTA) has long been advocated for in tertiary institutions. Yet, most lecturers have remained stuck in their traditional face-to-face andragogical practices. The lockdown to curb the spread of the corona virus, COVID-19, has accelerated the adoption SICTA. In this article, we adopted a phenomenological design from a qualitative research perspective to examine students' challenges, solutions and opportunities of SICTA learning. Six students doing a Postgraduate Diploma in Tertiary Education (PGDTE) shared their experience of SICTA learning. A three-staged process was adopted to generate qualitative data through written narratives, document analysis and dialoguing. The content qualitative analysed data revealed multiple and nested challenges grounded in the use of multiple SICTA based platforms. SICTA created learning opportunities such as online learning competences, learning material accessibility and sharing, time limitless collaborative learning and enhanced self-directed learning.

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The researchers recommend that educators at tertiary level should conduct professional students and staff development on social ICT, design and establish policies for the use of Social ICT and disseminate relevant information as well as uninterrupted access to internet and technological devices.

Keywords: andragogy, Social Information and Communication Technology platforms

INTRODUCTION

The outbreak of COVID-19 which brought about the lockdown and physical social distancing, has pushed the growth of sharing and exchanging ideas through Social Information Communication Technology (SICT) platforms. Today, SICT platforms are not only significant to online learning programmes, but also conventional face-to-face learning. In higher education, the COVID-19 lockdown to reinforce social distancing upped the adoption of SICT andragogy (SICTA). The COVID-19 lockdown forced students, lecturers and institutions to interact on teaching and learning matters through SICT platforms. In fact, the COVID-19 accelerated this technology-based communication in all economic sectors around the world. In education, in higher education classrooms, the use of SICT platforms rose significantly on the onset of COVID-19-induced lockdowns. At classroom level, university lecturers resorted to teaching through various social media platforms, such as Facebook, YouTube, blogs, Twitter, Myspace, LinkedIn, WhatsApp, Instagram, Skype and Zoom. Notably, when appropriately integrated into the classroom, these platforms provide social platform-based andragogical approaches that are inevitable in today's environment.

Arguably, adoption of SICTA in higher education taps into the advantage of the mushroomed use in social settings and interactions. This is because the new generation of students enter university with a strong command of competencies to communicate via social platforms. Social media was designed for entertainment and communication but is now being adopted and adapted for use in teaching and learning. However, the use of such social platform-based andragogical approaches has not been without challenges, particularly in

developing nations like Zimbabwe. In the view that many university programmes have been face-to-face, it became important to explore the preparedness of students, lecturers, institutions and nations in adopting SICTA. Hence, this article shares the Post Graduate Diploma in Tertiary Education (PGDTE) online programme students' experiences of SICTA learning in an institution of higher education in Zimbabwe. The purpose of this study is to give insights into university student challenges, opportunities and strengths of SICTA.

Three research questions were sought to answer in this study:

- (1) What challenges did students experience in learning through SICTA platforms?
- (2) What learning opportunities were availed to these students through SICTA platforms?
- (3) How did these students navigate the SICTA challenges encountered?

This study is of significance in that it targets to understand the experiences of university students who are lecturers by profession and were learning through SICTA platforms. Further, the study's location in Zimbabwe, a resource-limited context, makes it unique as many similar studies have been conducted in richer educational settings and industrialised nations. Finally, many studies have focused on Learning Management Systems (LMS), whereas our study interrogates the use of SICTA.

LITERATURE REVIEW

Ideally, students and lecturers are to use university software, the learning management system (LMS), specifically designed to create, distribute and manage delivery of educational content for teaching and learning interactions. Interestingly, in most universities, students and lecturers have tended to resort to using social media. This is a shift from the use of social media for entertainment within virtual communities and networks. Now in remote teaching and learning, social media assisted learning technologies facilitate effective sharing of information and ideas to cover the content of courses. SICTA implies that social media have been adopted and adapted for teaching and learning in higher education classrooms.

In Zimbabwe, SICTA is gaining popularity in higher education classrooms. This lends support to numerous researchers who concur that Facebook, WhatsApp, X (Twitter), YouTube, Instagram and Pinterest are highly popular social ICT platforms used in education (Nakagawa and Arzubiaga, 2014; Hamid *et al.*, 2015; Gon and Rawekar, 2017; Kustijono and Zuhri, 2018; Devi *et al.*, 2019;). These social ICT platforms provide advantages that enable internet users to express themselves on specific topics in various forms, inclusive of text, voice, photos or audio and video recording (Gon and Rawekar, 2017; Kustijono & Zuhri, 2018; Devi *et al.*, 2019). Table1 summarises social ICT platforms and how they are used.

Table 1: Social ICT Platforms and Uses

Social ICT	Uses
Facebook	<ul style="list-style-type: none"> ▪ Creates space for students to ask and answer questions. ▪ Enables collaborative learning. ▪ Ideal for a flipped classroom ▪ Post videos, photos, documents and other resources on the group's wall and students can access before class or when they work on their assignments.
X	<ul style="list-style-type: none"> ▪ Quick way to post class announcements and reminders. ▪ Helps classes track information on any topic
Blogs	<ul style="list-style-type: none"> ▪ Create opportunity for students to write and display their writings on a large scale.
YouTube	<ul style="list-style-type: none"> ▪ Excellent option of flipping classroom in that students can watch lectures and resources before entering the classroom
Instagram	<ul style="list-style-type: none"> ▪ Opportunity for students to showcase their work
Google documents	<ul style="list-style-type: none"> ▪ Students and teachers can use these tools to collaborate on assignments, projects, newsletters, among other things. ▪ Encourages teamwork
WhatsApp	<ul style="list-style-type: none"> ▪ Teachers and students can share notes, watch videos, answer questions and discuss content.
Zoom and Skype	<ul style="list-style-type: none"> ▪ Allow video/audio chat ▪ Collaborative learning ▪ Teachers can carry out classroom discussions and debate. ▪ Ability to connect with the outside world without leaving the classroom
Wikis	<ul style="list-style-type: none"> ▪ Offer capability to promote and facilitate “common creation” through joining academic ventures.

Andragogy focuses on adult learning, whilst pedagogy's focus on teaching and learning of children-students in high and lower levels of education. These two approaches to teaching and learning cater for different learning characteristics and needs of children and adults. Adult learners, unlike children, are self-directed, have more experience, seek relevant information that they perceive as useful in their personal lives and work environment, triggered to learn by knowing 'why to learn', and intrinsic motivation (Pappas, 2014, 2015). The four proposed principles to consider when designing courses for adults are: (1) involving adult students in the design and development of their learning; (2) grounding all learning tasks and activities on their experiences; (3) connecting the learning of course to real life applications and benefits; and (4) providing adult students with opportunities to absorb information (Pappas, 2014). Andragogy is highly motivational because adults are goal-oriented and stand to benefit when offered meaningful learning experiences.

A considerable amount of literature provides andragogic benefits of social ICT integration in teaching and learning at tertiary level (Ounis, 2016; Chugh and Ruhi, 2018; Devi *et al.*, 2019). Such benefits include social media tools creating a platform for improving the educational process through enriched text, videos and audio materials (Devi *et al.*, 2019). Furthermore, social ICT in teaching, as Chawinga (2017) and Devi *et al.* (2019) assert, enables collaborative learning where students can tap on the synergy of working on assignments and projects together from their homes and any time. More significantly, social ICT provides easy access to learning materials and high interaction with the lecturers to make learning occur anywhere any time (Chawinga, 2017; Gon and Rawekar, 2017; Devi *et al.*, 2019). In andragogy, social ICT platforms uses benefit students who find it difficult to express their thoughts in a face-to-face classroom context to make them actively involved in the learning process and helps build their confidence level as well (Devi *et al.*, 2019). Moreover, Kustijono and Zuhri (2018) posit that social ICT in teaching, such as Facebook and WhatsApp, leads to reading efficiency and promotes students' critical thinking skills through the elements of analysing, evaluating, applying, generating and expressing ideas, with which the categories measure clarity, accuracy, relevance, depth and logic indicators. It can

be seen from previous studies that there are andragogic benefits of using social ICT in teaching, which can lead to an effective teaching and learning process.

Even though social ICT had become an educational equaliser, it still has its flaws. In teaching, the high expectations of teachers' availability, message flooding, time-consuming and eye strain, are some of the disadvantages of social ICT platforms (Ahad and Lim, 2014; Gon and Rawekar, 2017; Rosenberg and Asterhan, 2018). Sometimes, as Abraham and Saini (2015) and Devi *et al.* (2019) argue, students' use of social media regularly results in them losing abilities to engage in face-to-face communication. Furthermore, these authors argue that social media can be a distraction, as it diverts students' attention from classroom participation, and ultimately disrupt the learning process. According to Abraham and Saini (2015) and Gurcan (2015), there is a likelihood of users not being courteous and respectful of each other, such that profanity, vulgarity, obscenity or language that is harassing, derogatory or otherwise inappropriate for the school environment, circulates on these platforms. Additionally, the issue of privacy is one of the major dilemmas teachers and students face when using ubiquitous social ICT platforms such as Facebook (Asterhan and Rosenberg, 2015). In a nutshell, the above-mentioned barriers are major concerns that need to be tackled to effectively integrate social media in the education system.

Like any other teaching and learning approach, the advantages of SICTA come with challenges. Chugh and Ruhi (2018) and Mangala and Neelamalar (2018) bring to our attention that lack of technological and infrastructural resources, lack of technical expertise and lack of technical skills, are some of the challenges of SICTA learning that students experience., Moran, *et al.* (2011), Gurcan (2015), Chawinga (2017), and Chugh and Ruhi (2018) point out that additional challenges are lack of integrity of online submissions, privacy concerns, lack of integration with existing learning management systems, a steep learning curve and lack of institutional support for effective SICTA. Moreover, as Gurcan (2015) adds, these technologies do not necessarily work in a classroom as a challenge that affects the incorporation of social ICT platforms in teaching at the tertiary level.

CONCEPTUAL FRAMEWORK

The conceptual framework used in this study was constructed based on the research literature on andragogical practices and the social ICT use in the classroom. The framework shown in Figure 1 is a modification of the Technology Acceptance Model (TAM) proposed by from Davis (1989).

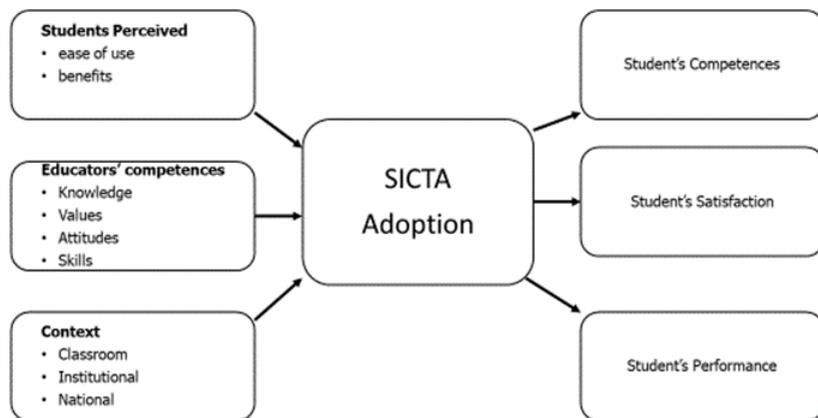


Figure 1: SICTA Conceptual framework (Davis, 1989)

TAM proposes that use of IT tools among users depends heavily on their perceived usefulness and ease of use (*ibid.*). However, this article's adaptation of this model, educator's competencies (knowledge, skills, values and attitudes) and context (classroom, institutional and national variables) influences SICTA practices and outcomes. As Figure 1 indicates, the perceived usefulness, ease-of-use, context and educators' competencies are significant variables and inputs to the behavioural intention to adopt any SICTA-based platforms in teaching and learning at tertiary level. The SICTA and its allied elements of approaches, such as collaborative learning, interactions among learning and teaching players, assessment and feedback and teaching-learning materials, are central to the outcomes of learning, such as learners' satisfaction, competencies and performances.

RESEARCH METHODOLOGY

This study adopted a phenomenological design from a qualitative research perspective. Phenomenological designs allow researchers to get a rich and detailed description of human experience (Groenewald, 2004). Thus, this phenomenographic study involved four student participants to report on how they experienced SICTA andragogy. These participants were enrolled in a Postgraduate Diploma in Tertiary Education (PGDTE) course in August 2019 at a university in Zimbabwe. It was a one-year course that ended in August 2020. Though the programme was intended to be online in the initial semester from August to December 2019, the lecturers tended to use a face-to-face interaction more than virtual. However, the eruption of COVID-19 and subsequent lockdown and the end of March 2020, forced the lectures to fully adopt SICTA. Thus, a phenomenology methodology was most suitable for this study, as it examined students' lived experiences and perceptions regarding the phenomenon of SICTA learning. The students studied five lecturers, five courses in the first semester and five courses in the second semester. A three-stage process of generating qualitative data was adopted, through written narrative, document analysis and dialogues. In Stage 1, data were generated through individual narrative writing, resulting in text data. Stage 2 followed with individual analysis of the four written narratives through constant comparative analysis and this generated field notes. The third and final stage involved group dialoguing that resulted in one document of the findings. The generated data were content qualitative analysed as informed by the conceptual framework and research questions. All the names used in the findings and discussion section are pseudonyms to protect participants through anonymity and confidentiality.

FINDINGS

The findings were thematically organised in three themes to provide answers aligned to the three research questions: (1) experienced multiple and nested SICTA challenges; (2) SICTA created opportunities for learning; and (3) convergent and divergent ways of overcoming SICTA challenges.

The researchers in this study were overwhelmed using multiple SICTA platforms adopted by lecturers. These included Short Message Service (SMS), Emails, Google classroom, WhatsApp and Zoom. These

platforms were external to the BUSE online management system. Moreover, they were nested and unsynchronised. By this it is meant that each of the five lecturers who taught in the second semester, adopted a different combination of SICTA platforms with the use of emails being the most common. All the lecturers used email to share learning materials, send assignments and give feedback. In addition to emailing, four of the five lecturers used WhatsApp to share learning materials, announcements and provide feedback on coursework. In some cases, lecturers adopted a blended model. However, blending was varied. For example, Dr. Sanyu blended Google Classroom with Google Email and WhatsApp texting, while Dr. Jasper and Dr. Marange blended emails and WhatsApp. Dr. Muyeza blended emails and Zoom.

The challenge that students encountered was to learn to use all these different SICTA platforms in a limited amount of time. The students were to learn to use these various platforms and at the same time carry on with our studies. In terms of the complexity of the SICTA platforms, Zoom was more complex to use, followed by Google Classroom, then WhatsApp and, lastly, emails. Alex, one of the student participants, narrated:

I was overwhelmed by the number of accounts I had to create, memorise for the different courses. The use of WhatsApp and email was quite familiar and easy, but they brought more accounts and groups to the more complex Zoom and Google Classroom. Eish! it took me more than three months to figure out how to turn in assignments in Google Classroom.

Further, the researchers were challenged by economic, adaptability, electricity load-shedding, and connectivity. Other challenge were costly internet bundles, equipment and accessories. Students were part-time in full-time employment and with family responsibilities. However, meagre salaries in an ailing economy failed to sustain both their family and personal needs as students. It was very stressful for each one of the students to always access the internet. This challenge is captured in another student's expression. Alice aid that:

During the lockdown, this online learning was a nightmare, Eish. I was not earning enough for both the upkeep of my family and purchasing data bundles to access learning materials. At times, I had to forego my family's needs, purchasing data bundles and many other times. I sacrificed accessing learning materials to provide for my family.

Besides, some of the students experienced the challenge of high cost of technological resources such as laptops and smart phones that are now needed in the absence of access to offices. These findings concur with Chugh and Ruhi (2018) and Mangala and Neelamalar (2018), who also established that the lack of technological and infrastructural resources are barriers to effective adoption of social ICT in teaching and learning. However, their economic challenges were unique to the students at individual level as nested within our institution and the broader Zimbabwe economic situation. Students believed other students in Zimbabwean institutions of higher learning and in other similar nations, might be experiencing similar challenges. Moreover, the COVID 19 lock down was reported to have adversely impacted many economies around the globe.

The students were also challenged by poor internet connectivity, depending on the service provider and data source used by an individual. For instance, students Flavia used the TelOne Wi-Fi, Alice used Econet data bundles, whilst Alex and Tony accessed the internet through NetOne data bundles. Regardless of the different service providers and data sources used, on several occasions all the students experienced poor network connections that made it impossible to learn through social ICT platforms. With poor network, downloading learning materials, uploading assignments, interacting and discussing via social media, became a nightmare. Flavia stated:

Most of the time, especially in the first-semester, internet connectivity was poor. This made it difficult to download materials, collaborate with other students and upload assignments.

There was frequent electricity load-shedding in Zimbabwe and Bindura, in particular, that exacerbated this connectivity challenge. Lack of electricity makes technology devices dysfunctional, thus retrogressing online learning to the extent that most of the students could not meet submission deadlines.

Also, the students all experienced individual student-based challenges related to health, discipline and online learning competences (knowledge, skills and values). They were all eye strained as reported in the following excerpt by Alex and Flavia.

Studying from the computer and phone caused us to have eye strain due to staring at the screen for a long time.

With regards to discipline, students were distracted by the high volumes of social chats such as WhatsApp and SMS, not related to learning, as exemplified in Tony's confession:

Sometimes, I ended up engaging in non-academic chats for a long time, viewing and uploading WhatsApp statuses, thus wasting time that could be productively used for learning. Social media, especially WhatsApp, negatively affected my concentration and motivation to learn.

Devi *et al.* (2019) observe that most students tend to spend most of their time on social networking websites at the expense of their online learning.

Two of the students struggled with the use of SICTA platforms. This was attributed mainly to their limited ICT competences. The other two were advantaged because of their ICT academic and work backgrounds. Alex said, "Turning in assignments via Google Classroom was a skill that took me time to learn.")

Alice iterated:

At first, I found it challenging to use some WhatsApp functions like sharing learning material and I was not familiar with using Zoom.

These competence-based problems were worsened by the lack of institutional technical expertise. The ICT BUSE desk could not provide support. Some scholars like Chawiga (2017) have heeded that lack of technical competences militates against social ICT andragogy.

The change from face-to-face to full online learning in the short time, was another big challenge. Adaptability challenge manifested as students abruptly lost physical classroom contact and got into the SICTA learning environment that physically isolated each of the students. This isolation denied them opportunities for explanation and clarification that occur naturally and timely in face-to-face interaction. Students preferred to discuss course content with their peers and the lecturer in the classroom, rather than online. Such sentiments were revealed to be grounded in the students' background experiences, inclusive of culture, education and profession. Flavia submitted that:

I faced some difficulty through social networking in expressing my views and ideas in writing, as I preferred to express my ideas orally. That is an approach I have used for many years through my studies.

This view is supported by Devi *et al.* (2019) who argue that students' use of social media regularly may lead to losing their ability to engage in face-to-face communication.

To answer the first research question: What challenges did students experience in teaching and learning through ICT platforms? It was found out that the multiple and nested challenges were related to the use SICTA. In a nutshell, these include costly internet bundles, equipment and accessories, poor internet connectivity, electricity load-shedding, eye strain, distraction in learning, competence issues and loss of face-to-face interaction. Though challenged, COVID 19 circumstances pushed the students to adopt SICTA and successfully completed their studies. This is mainly because the semester was extended to September from June. This provided each the students opportunities to address and minimise the challenges.

Students benefited from SICTA created teaching and learning opportunities. The social ICT platforms learning opportunities opened up were diverse that were categorised into four main groups: (1) online learning competences; (2) learning material accessibility and sharing; (3) time limitless collaborative learning; and (4) enhanced self-directed learning.

First, despite their varied backgrounds, the students gained and enhanced online learning competences through varied platforms. These included (1) selecting, design and using online andragogy; (2) joining and using varied learning platforms; and (3) awareness of the different learning platforms. Alice weighed in:

We learnt to use different SICTA platforms such as Google Classroom, Zoom and WhatsApp functions that I did not know previously, hence my ICT skills were enhanced.

Using multiple SICTA platforms enhanced online learning competencies as the students got to know how to use the various SICTA platforms such as Google Classroom, Zoom and WhatsApp.

Second, the students experienced the opportunity of easy accessibility and sharing of learning materials. Moreover, the online share materials and ideas were saved and stored for retrieval as when needed. In a dialogic discussion, it was observed that:

The students were able to access and share lecture notes, receive assignments and upload assignments and tasks via the social ICT platforms easily and from anywhere. This made work easier and led to more learner reflection and satisfaction.

Alice narrated:

SICTA enables storage of reading materials in digital form for accessing as when I purchased data bundles.

However, only one of the five lecturers used the Google Drive facility. For other platforms, such as Whatsapp and emailing, students had to download and organise the learning in folders. These findings are similar to the findings of many scholars (Chawinga, 2017; Gon and Rawekar, 2017), that social ICT leads to easy accessibility of teaching and learning materials.

Third, the SICTA platforms promoted time limitless collaborative learning in that the students engaged with course content and worked on assignments - group and individual, from their homes. The students could also ask each other and their lecturers questions mainly via WhatsApp and have them answered promptly. This enabled the students to understand the content better and thus improved their satisfaction and performance. Ultimately, time limitless collaboration increased their learning efficiency to attain their objectives of studying this PGDTE programme. Two of the students, Tony and Alex, opined that:

The students all experienced increased interaction between student to student and student to lecturers. We had extended time with fellow students and lecturers. I would ask the lecturers about content which was not clear or confusing and I would get answers via social ICT.

These findings are in sync with scholars like Chawinga (2017) and Devi *et al.* (2019), who also found that social ICT platforms encourage collaborative learning. However, many of such scholars do not qualify the types and forms of collaborative learning wherein our study characterises it.

Furthermore, two of the students were confidence boosted as exemplified in Alice's narrative below:

Sometimes I was unable to express my thoughts in the face-to-face classroom setting. However, I could easily clarify doubts by posting a message through social media that built my confidence level. I learnt to pause, express myself in different ways, ask myself if my messages would make sense when read by others. I studied how others expressed their thoughts. All these helped me to improve and gain confidence.

This view is confirmed by Devi *et al* (2019) who state that social ICT in teaching builds students' confidence level.

Fourth, the students enhanced their self-directed learning because of independent, individual, time flexibility, as well as location and time boundless SICTA-created learning opportunities. The andragogy was wholly learner-centred and self-paced. Learning could take place anywhere and the learning material could be accessed anywhere via social ICT. Also, learning is not restricted to given hours of the day and given days of the week. This made learning convenient. This opportunity is captured in the participants' statements below:

I could study from home or anywhere I felt comfortable. I was also able to study and to access learning materials at any time of the day (Tony's narrative).

Social ICT in teaching enabled me to take charge of my learning. I was more active in the learning process, and I could study at my own pace (Flavia narrative).

Besides, through teaching via SICTA, the teachers could structure the learning process and personalise it to meet individual learning needs that was advantageous for the students' performance (Alice' narrative).

Similarly, Chawinga (2017) and Gon and Rawekar (2017) indicated that learning anywhere at any time are among the benefits of using social ICT in teaching and learning. This perfectly suited the World Health Organisation (WHO) COVID-19-induced physical social distancing requirements.

In short, the teaching and learning opportunities reported were online learning competences, learning material accessibility and sharing, time limitless collaborative learning, and enhanced self-directed learning.

The students developed diverse and complementary strategies for overcoming SICTA challenges. These included: (1) creation of peer

networks or groups; (2) peer teaching and learning; (3) behaviour change/adapting to multiple SICTA platforms; (4) adjusting to electricity load-shedding and working as much as possible when available; (5) shared cost of internet/cost comparison of data bundles; (6) exploring SICTA tools such as adjusting font sizes, screen light, minimising screen exposure; and (7) creating a home classroom.

The students created learning networks or groups to minimise the negative impact of the loss of face-to-face learning or physically isolated learning. These networks assisted them to learn collaboratively, as highlighted by Flavia:

I felt the challenge of studying in isolation was minimised by increasingly interacting with fellow students and lecturers via SICTA. I would ask the lecturers and fellow students content that was not clear or was confusing and I would get answers via SICTA. Thus, collaborative learning minimised the negative impact of the loss of human contact.

The use of multiple social ICT learning platforms encouraged the students to quickly learn to learn. The students organised their learning themselves and navigated the SICTA platforms within the shortest time. Within these networks, some participants with limited or no confidence in expressing themselves in writing, adopted video and audio communications strategies via WhatsApp, Zoom and Google meetings. Flavia, again, said:

I faced some difficulty through SICTA in expressing my views and ideas in writing, but I overcame the challenge by expressing my ideas orally via WhatsApp audio call.

Students engaged in peer teaching and learning to overcome their lack of SICTA learning technical competences, Tony and Alice became teachers in the group and assisted to explore the use of SICTA platforms effectively. Ultimately, the students learnt and were able to use multiple social ICT platforms used by their lecturers. Flavia added:

Initially, I preferred to use emails that was a familiar platform to me...I then realised that I needed to access learning materials and attend lectures through platforms like Zoom and Google Classroom. I sought assistance from Tony

SICTA brought about behaviour change in the students. It forced the students to be self-disciplined, remain focused and desist from being

distracted by social media such as WhatsApp and Facebook. Alice affirms this view:

Avoiding non-academic chats during study time and setting up a study timetable, helped me to stay focused on my studies and to minimise social media distractions. I also learnt to ignore social messages.

All adjusted to the electricity load-shedding and worked as much as possible whenever electricity was available. This instilled in students the ethos of hardworking, commitment and adaptability. Alice states how she worked around this:

Since SICTA offers the time flexibility opportunity, I made sure I worked hard any time electricity was available. I worked mornings, afternoons or nights for not less than four hours whenever electricity was available.

The cost of learning was minimised through shared and compared strategies. The African philosophy of *Unhu/Vunhu/Ubuntu* of I am because you are, was put into practice. Three of the students opted for cheaper bundles such as Yomix offered by Econet and OneMoney offered by NetOne. Flavia also used such facilities whenever the TelOne internet source was down. Also, the the students minimised the cost of internet by sharing the internet. All this was obtained through research. Students downloaded materials from Google Classroom and shared them through cheaper platforms such as WhatsApp as confirmed by Alice

I learnt about cheaper internet bundles such as Yomix from friends and adverts from internet providers and this helped to save on internet costs. Also, I used to receive materials from friends downloaded from Google Classroom and shared via cheaper platforms such as WhatsApp.

Multiple strategies to address the eye strain challenge were used. These included increasing font size, adjusting screen light and limiting computer exposure as much as possible. We Material was downloaded and printed to read off the computer and line. Toney said, "I adjusted the screen light and the font size to avoid straining my eyes whenever I was reading from the computer."

The students created a working space at home, referred to as a home classroom. The home classroom was created by identifying a spare room and old furniture such as bedding and chair as well as setting up a learning schedule. Alice said, "*First, I create a working space and then I then up a learning schedule that I followed strictly.*"

Some of the students' ways of overcoming SICTA challenges were similar to what was reported in the literature. For example, Hand (2018) reports that to overcome physical isolation, it is important to have regular contact with peers to create a greater sense of community of practice in a digital environment. This is similar to social networks, such as WhatsApp groups the students created. Literature offers several benefits to the student involved in peer learning. These benefits include adjusting to university life, improving learning competence, acquiring a clear view of the course expectations and an increasing understanding of the subject matter of the course, as well as providing a less intimidating digital learning environment (Capstick, 2004; Edwards, 2012). In this study, this benefit translates to the student's adjustment to SICTA learning, improving not only learning competences, but students' competences of using online tools. Moreover, behaviour change to fully learn through online platforms is supported by Hand (2018), who says setting explicit best practices as early as possible enables students to remain focused. In this study, peer learning values set by the students at the outset of SICTA guided them to remain focused through the duration of their study. As all students were African, their peer values were grounded in *Unhu/Ubuntu*. *Ubuntu* is a communitarian philosophy that embeds and emphasises on values of compassion, tolerance, harmony, discipline, respect, care, empathy/compassion, morality, ethics, honesty, hospitality, and sharing (Letseka, 2012). The *Ubuntu* set values brought about positive interdependence (Seger *et al*, 2016) among the students. This is to say each student perceived his or her contributions in the form of cost-sharing and helping each other to navigate SICTA as to essentially guarantee the success of the group.

One major lesson drawn from this study is that using SICTA platforms in learning has many inherent challenges. However, it creates many opportunities for students that motivated them to use a myriad of strategies to overcome the SICTA challenges.

CONCLUSION AND RECOMMENDATIONS

In the students' PGDTE programme, the SICTA-based platforms adopted were: emails, SMS, Google Classroom, WhatsApp and Zoom. These platforms were used for sharing learning materials,

collaborative learning, interactions, announcements, posting and uploading assignments and making video and audio presentations. The researchers believe that SICTA offered value in teaching and learning due to the opportunities that were availed to the students as noted in the findings, such as online learning competences, learning material accessibility and sharing, time limitless collaborative learning and enhanced self-directed learning. However, the students experienced challenges in using SICTA as discussed above e.g., internet challenges, distraction in learning, lack of technical skills and technical expertise, to mention a few. Importantly, the study explained how the students used opportunities to minimise the challenges. SICTA is radically changing the way education has been traditionally delivered. Worth noting, with the introduction of online mode of study and the outbreak of COVID-19 that has induced physical social distancing and lockdowns, institutions of higher learning can only become sustainable if they promote the use of social ICT such as WhatsApp, Zoom, Google Classroom, Facebook, YouTube, etc. Hence, social ICT in teaching at tertiary level is on the rise.

Social ICT platforms can be very helpful in achieving higher order thinking and meta-cognitive skills. However, Abraham and Saini (2015) contend that achieving those objectives demands planned intervention. To counteract the challenges that affect the incorporation of social ICT platforms in teaching at tertiary level and maximise their potential, the following recommendations are proposed.

First, the professional development of staff and students on the use, importance and the impact of using social ICT platforms in teaching and learning at tertiary level should be provided. Besides, tertiary level institutions should put in place measures to ensure that both teachers and students have access to internet and technological devices on and off-campus. Moreover, educators at tertiary level should design and establish appropriate policies for the use of these platforms within their premises, always considering users' behaviour in these environments. For effective use of social networking sites, documented guidelines can provide clarity and practical advice to positively channel online discourse. Furthermore, educators at tertiary level should craft well-designed and organised methodologies or practices that integrate social networks in the educational community. Tertiary

education institutions need to find ways of incorporating social ICT for various uses, be it advertising, marketing, promotion or, importantly, for learning and teaching activities. Lastly, to reduce the distraction of students, social media usage in academia, tertiary education institutions should focus on the dissemination of relevant information, particularly so that it aids in meeting learning outcomes and scaffolding assessments.

As an area for further study, researchers could examine why lecturers in higher education prefer using external social ICT platforms to internal learning management systems. For example, at BUSE, most lecturers avoid the BUSE learning management system (Moodle) in favour of social ICT platforms.

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