Inclusive Regional Value Chains: Blockchaining Perishable Agricultural Products in Southern Africa

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Abstract - **In Southern Africa due to unsystematically and uncoordinated regional value chain (RVCs), plenty of perishable agricultural products are lost because of spoilage and poor postharvest system misaligning upstream and downstream partners. Although appeal for increasing trade in Southern Africa region may seem plausible, there are strictly speaking no well-grounded economic reasons why perishable agricultural products trade should be an obsession. Broad-based inclusive RVCs through blockchaining perishable agricultural products could enable far more effective responses to region's sustainable developmental challenges as it does in developed and emerging economies. Recently, the rise and expansion of inclusive RVCs and emphasis on blockchain has spurred major paradigm shift on revamping postharvest system. The investigate relevance of blockchaining initiatives towards inclusive RVCs to perishable agricultural products in Southern Africa. Through a quantitative research approach involving quantitative data collection methods, the research aims to assess the current challenges, opportunities, and perceptions regarding blockchain technology in the agricultural sector. Study findings practically and empirically contribute to excel blockchain for supporting development of inclusive and resilient value chains, providing insights for policymakers and stakeholders in promoting sustainable economic growth in Southern Africa's agricultural sector.**

Keywords - **inclusive regional value chain, blockchain, perishable agricultural products**

I. INTRODUCTION AND BACKGROUND INFORMATION

Improving performance of agricultural inclusive regional value chain development (RVCs) has potential to benefit large numbers of low-income and marginalised sectors to realize long-term sustainable development (Mitchell, *et al*., 2009; Seville, *et al*., 2011; UNIDO, 2011). Essentially, integration of inclusive RVCs and perishable agricultural products (PAPs) have remarkable efforts in sustainable development to developing and emerging economies, but in Southern African countries it remains less efficient (Goyal and Nash, 2017; Fan *et al*., 2018). Presently, inclusive RVCs on PAPs in Southern African countries subsist on barriers that slowly incentivise smallholder farmers and small agribusiness by forming unproductive and unsustainable linkages (Gradl *et al*., 2012; Teng and Oliveros, 2016). These barriers and disconnections impede development of agribusiness sector to stimulate inclusive RVCs on PAPs (Minten *et al*., 2015; Rankin et al., 2016). This grounds most of isolated and marginalized smallholders and small scale agribusinesses dealing with PAPs to have little opportunity to escape poverty (von Braun and Mirzabaev, 2015; Gatzweiler and von Braun, 2016).

Value chain inefficiencies on PAPs create delays in logistics that raise operating expenses and limit market opportunities (Kang *et al*., 2016; Guritno, 2017). As it was denoted by Kiaya (2014), that deterioration and spoilage of PAPs are more likely when there are delays coupled with inadequate temperature-controlled logistics, and inadequate storage capacity. FAO (2014) highlighted that, currently, there is emergent pressure on businesses and governments in developing countries to pay more attention to deterioration and spoilage of PAPs by maintaining safety, quantity, quality and velocity of PAPs. Serious concerns have been expressed on inclusive RVCs when accessing new technologies for smallholder farmers and small agribusinesses to reduce postharvest failures and create a fairer trading environment (Sjaauw-Koen-Fa, *et al*., 2016; Poole, 2017). In order to create a system that is responsive to changing needs of upstream and downstream partners, a system's evolution from a production-push to a market-pull orientation is one of the main issues in the sustainable development agenda. Another major issue is how to ensure the equitable involvement of smallholder farmers and smaller scale agribusinesses.

Increasingly, however, more smallholder farmers and small agribusinesses in Southern African countries are focusing on narrow specialised tasks on tiny specialised local areas along the value chain of PAPs (Paglietti and Sabrie, 2013; Proctor and Lucchesi, 2012). To inclusive RVCs, such narrow task unbundling has resulted in the emergence of value chains that offer not only constricted benefits of specialisation but also suffering from poorly adopted and unperceived use of blockchain. Such that, existence of poorly adopted and unperceived use of blockchain can further restrict and confine value chain coverage causing PAPs to become even more exclusive. Nowadays, blockchain initiatives are seen as best mechanisms to strengthen the interaction between actors in PAPs through inclusive RVCs.

Blockchain is a decentralised, digital ledger whereby a series of digitally stamped connected records are shared openly and publicly verified through a cluster of computers (Kuhn *et al*., 2018; Gabl and Krehl, 2017). The most typical role of blockchain initiatives to inclusive RVCs is reducing frictions of transactions between smallholder farmers and small agribusinesses through cost-effective flows on information, processes, financial and PAPs (Tripoli and Schmidhuber, 2018; Caro *et al*., 2018). Conversely, blockchain initiatives are more importantly viewed to have a role in supporting the collaboration and coordination of inclusive RVCs through information sharing on PAPs (Andersson and Sigvardson, 2018; Petersson and Baur, 2018). Also, blockchain can be used for decision support whereby the analytical power of blockchain technology is used to provide assistance to accelerate decision making process.

Relationships between inclusive RVCs and blockchain initiatives of PAPs are highly complex and slightly understood. According to Aghazadeh (2004), in order for PAPs to be effective, the partners in the value chain must receive the appropriate product in the right amount, in the right condition, at the right time, and for the right price and this has a positive impact on the success of the partners in the value chain. Therefore, developing Blockchaining initiatives can result to spillover effects on inclusive RVCs and PAPs.

The issue for new entrants within established value chains is that these pressures may be too great for them to enter and join, even though trading within RVCs may offer firms more competitive pressure to upgrade (Keane, 2015). But in some cases upgrading processes may be easier to achieve within RVCs, precisely because value chains are less dominated by a few Multinational Enterprises (MNE). Some types of upgrading processes by domestic firms may be more suited for regional value chains than tightly controlled GVCs, given the opportunities and challenges they present, especially the more tightly controlled and hierarchical types (Humphrey & Schmitz, 2000; Keane, 2015). The primary obstacle, though, is the challenge of methodically defining a shared agenda among member nations with conflicting and occasionally divergent interests in RVCs.

Divergence is interpreted to mean that a trend is weak or potentially unsustainable and dysfunctional characterised by inefficient forms of governance, informal, and non-regulated or poorly regulated forms of economic behaviour. In general in RVCs, economic divergence means that an economic integration diverts value chains, away from a more efficient supplier outside the RVCs, towards a less efficient supplier within the RVCs. When a country's economic growth path is influenced by regional integration arrangements, it may have dynamic effects that ultimately outweigh trade benefits and put a country on a slower growth path in the short term. The majority of research on regional economic divergence has focused on how certain regions can perform better than others in a global economic competition that has been made worse by changes in policy in the late 20th century (Harvey 1989; Rodríguez-Pose and Gill 2004).

Entry barriers in RVCs distort and lessen the incentives for productivity and transformation, which directly impede inclusivity (De Mello & Dutz, 2012; Economic Policy Division, 2019). In such situation, MNEs with resources can navigate and accrues possible gains while compounding impediments such as high institutional burdens present significant obstacles for small business. Within developing countries, RVCs are influenced by the Southern Africa institutional framework during oprerationalisation of Blockchaining PAPs. In order to link to inclusive RVCs and Blockchaining PAPs, Southern Africa need to

continuously increase their level of competitiveness in compounded dimensions. Therefore, this study will investigate blockchaining initiatives towards inclusive RVCs to PAPs in Southern Africa.

II. LITERATURE REVIEW

A. Hypothesis Formulation

There is rising substantiation on positive association of diffusion of technology and poverty reduction as well as development outcomes. Whereas, the internationally it was observing increases in exclusiveness on RVCs appears to be motivated by technology backwardness, the unbalanced distribution of ICTs have also played a critical role. It's interesting to note that the affective revolution that has been occurring in regional contexts over the past few decades has highlighted how crucial it is to use technology diffusion for inclusive development. Despite the many positive aspects of these developments, diffusion in technology has made it easier for postharvest challenges in most of developed countries. Therefore, bringing these technological advancements to LDCs and giving ownership to a larger number of common people is a crucial component of the challenge of closing exclusive gaps. Numerous studies have demonstrated that there are unmistakable advantages to technological diffusion, from the macro level—improve GDP growth—to the micro level thus improving farm output. The question is whether these benefits can be sufficiently diffused to have a major impact on inclusive RVCs on PAP in Southern Africa.

Due to value chain complexities, as well as lack of integrated common platform to share the most up-to-date progress status of perishable agricultural supply chain, parties often end up not only receiving postharvest losses of PAP but also outdated or inaccurate data. In various of the Southern Africa region, they are today in practice inclusive RVCs as a potentially important source of agricultural growth, but type and amount of RVCs varies significantly across countries also there is much variation in the institutional design while inclusion of smallholders is uncertain.

H_1: PAPs is positively related to inclusive RVCs in Southern Africa

Furthermore, perishable agricultural supply chain are gaining importance in local, regional and global supply chains, generating revenues from increasing consumption. Blockchain initiatives play a very important role in meeting this demand and providing post-harvest and institutional infrastructure, and their significance is further increased due to the nature of perishability and short shelf life. It contributes to maintaining and raising the quality of the delivered produce, which is perishable in nature, in addition to helping to reduce costs (Veena *et al*., 2011).

Due to value chain complexities, as well as the lack of integrated common platform to share the most up-to-date progress status of perishable agricultural supply chain, parties often end up not only receiving post-harvest losses of perishable products to out of date or inaccurate data. In various countries of the Southern Africa region, are lowly practicing RVCs as a potentially important source of agricultural growth, but type and amount of RVCs varies significantly across countries with much variation in institutional design on inclusion of small scale businesses. The following hypothesis that reflected the research questions is tested:

Hypothesis 2: Post harvest infrastructure positively influence inclusive RVCs in Southern Africa

The ever-widening gap in the ICT security risk management and regulatory framework of blockchaining initiatives has significantly undermined RVCs in the developing world creating a notion of underdevelopment. Considering the importance of ICT security risk management and regulatory framework of blockchaining initiatives in the development of a country, it is exceptionally essential that developing countries seek on ways of closing the gap. Some of the initiatives to bridging underdevelopment gap of through blockchaining initiatives which have shown a desirable degree of success in developed and emerging economy countries. A candid look at the impacts of the ICT security

risk management and regulatory framework of blockchaining initiatives will guide on the direction and speed of bridging the underdevelopment gap.

Consequently, the challenge that nations and economic regions face is not limited to simply joining value chains; it also involves increasing the amount of value added produced locally and climbing the chain hierarchy from simpler to more complex tasks (Ramdoo, 2014). RVCs in regional integration tend to boost growth for all parties, according to theory and empirical data, and as a result, they will typically aid poorer nations in catching up to their higher income chain partners (De Backer & Miroudot, 2014; Kowalski, *et al*., 2015). Due to the 'catch-up effect' gains available for least developing countries to take advantage of are so great that they tend to grow at a much higher rate. The following hypothesis is given to test the research model:

Hypothesis 2a: Blockchaining initiatives will positively moderate the influence of post harvest infrastructure on inclusive RVCs in Southern Africa

As economic actors adhere to common regulations, markets expand in size and complexity, and regional economic growth stabilizes, regional integration produces increasingly similar economic outcomes. Effective pursuit of regional integration can yield significant multifaceted benefits. The growth of RVCs may be aided by additional regional integration of goods and services. Regional value chains offer opportunities as well challenges for enhancing productivity both for domestic, intra-or extra-regional firms to participate and upgrade in value chains. Accordingly, utilising regional integration should give LDCs' small businesses a platform, though these are probably going to vary in terms of the effects of poverty and subsequent growth. This raises the question of what institutionalized mechanisms of preferences and incentives might be needed to control the distribution of gains among members of RVCs, where strong members are likely to dominate the value chains and weaker economies are likely to lose out. Based on above facts, the following hypothesis is positioned to test the research model:

Hypothesis 3: Institutional infrastructure positively influence inclusive RVCs in Southern Africa

The issue for new entrants within established value chains is that these pressures may be too great for them to enter and join, even though trading within RVCs may offer small-scale entrepreneurs more competitive pressure to upgrade. But in some cases upgrading processes may be easier to achieve within RVCs, precisely because value chains are less dominated by a few MNEs. Some types of upgrading processes by domestic firms may be more suited for regional value chains than tightly controlled GVCs, given the opportunities and challenges they present, especially the more tightly controlled and hierarchical types. The primary obstacle, though, is the challenge of methodically defining a shared agenda among participating nations, given their frequently conflicting and occasionally divergent interests in RVCs.

The majority of academics studying regional economic divergence have focused on how certain regions can perform better than others in a global economic competition that is made worse by changes in policy in the late twentieth century (Harvey 1989; Rodríguez-Pose and Gill 2004). Divergence is interpreted to mean that a trend is weak or potentially unsustainable and dysfunctional characterised by inefficient forms of governance, informal, and non-regulated or poorly regulated forms of economic behaviour. In general in RVCs, economic divergence means that an economic integration diverts value chains, away from a more efficient supplier outside the RVCs, towards a less efficient supplier within the RVCs. However, a warning was issued that regional integration arrangements may have dynamic effects that could outweigh trade benefits when they affect a country's long-term economic growth path and put it on a shorter growth path in the short term.

Regional policymakers have acknowledged the role that trade plays in promoting growth in the region. Two types of policy approaches are available to support developing countries' entry and upgrading into regional and global value chains: policies that are intended to support entry into specific segments of a

GVC and economy-wide, horizontal policies that are crucial for providing the fundamental conditions needed to participate in international trade (Gereffi & Sturgeon, 2013). But comprehending developing nations' participation in RVCs and creating policies that effectively encourage sustained involvement necessitates knowledge of institutional infrastructures.. Thus, it is expected that:

Hypothesis 3a: Blockchaining initiatives will positively moderate the influence of institutional infrastructure on inclusive RVCs in Southern Africa

B. Research Framework

The schematic diagram that shows the relationship between the independent variables (post-harvest and institutional infrastructure), mediating variable (Blockchaining initiatives) and dependent variable (inclusive RVCs) is portrayed in Figure 1. According to Sekaran (2003), The theoretical framework that conceptualizes how one theorizes the relationships among the various factors that have been determined to be significant to the issue is known as a study model. This framework investigates how institutional infrastructure and post-harvest affect inclusive RVCs.

As a result, the following sections cover the definitions of each attribute listed in the framework. Figure 1 shows the theoretical framework of the study. According to literature, the link between PAPs and inclusive RVCs is shown in Figure 1. The relationship is analyzed so that a number of factors influence RVCs, which determines the ultimate result in terms of inclusive RVCs that increase or decrease PAPs in value chain.

Since the performance of the PAPs and their effect on inclusive RVCs form the basis of the suggested model, it serves as the dependent variable. Consequently, it is critical to pay attention to PAPs factors because improving these factors could result in changes to inclusive RVCs. As for the independent variables, the study derived them from previous studies as shown in this study. On the other hand, the new variables in this model are post harvest and institutional infrastructure with Blockchaining initiatives as mediating the inclusive RVCs in Southern Africa.
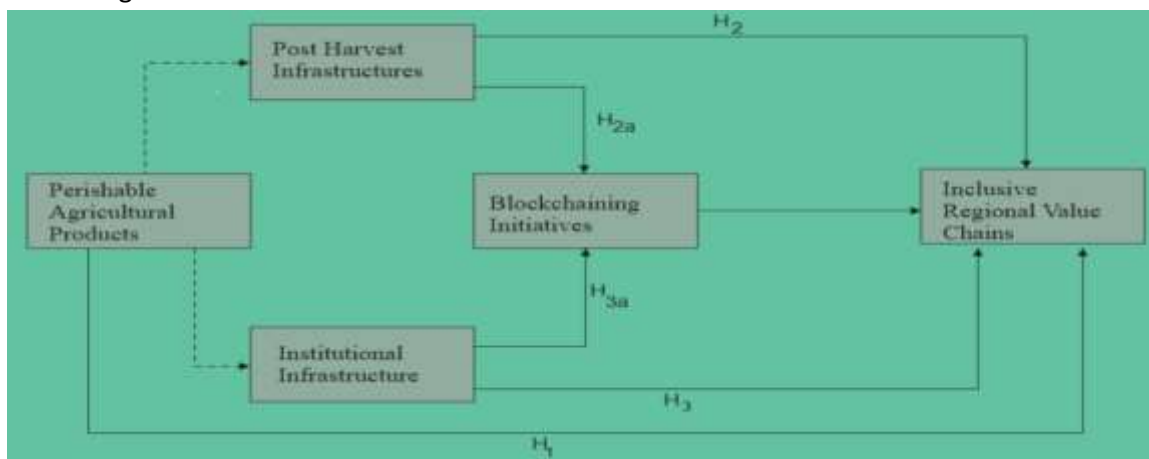

Figure 1: Research Framework

III. METHODOLOGY

The study used mixed research method, where quantitative approach was applied. The key benefit of the quantitative strategy is that it capitalises on the strength of quantitative method while minimising the weaknesses as well (Creswell, 2013) thus enable to get in-depth data from key informants respectively by using quantitative data collection methods, that is to say, the survey (questionnaire).

A. Sampling Procedures

The study employed purposive sampling technique. Purposive sampling was used to select leaders from community-based organizations (CBOs, e.g., farmer's groups, associations, cooperatives societies and civil networks) engaged in PAPs and government officials. CBO leaders will be selected because they occupy the top management positions in their respective communities. Furthermore, officials from government institutions in high management positions were interviewed because they are familiar with the PAPs policies and regulations.

B. Data Collection Methods and Instruments

The cross-sectional survey method was the research design used for this investigation. Self-administered surveys were employed to gather data. Using back-translation, an instrument version in Swahili was created. For accuracy, each measure was translated into Swahili and then back into English. In order to perform descriptive statistics and gain insight into the sample, demographic items were included. Furthermore, the survey consisted of three distinct, previously established, valid, and dependable multi-item scales. Every scale consited items that were rated on a 5-point Likert-type scale ranges from 1 (strongly disagree) to 5 (strongly agree), with high scores indicating high levels of perceptions of PAPs, blockchaining initiatives and inclusive RVCs.

C. Measured Variables

In this context, measurement is a tool used to define some properties of the research variables through valid and consistent number allocation (Sekaran and Bougie 2010). Using the study's instruments ensures an easy method of quantification and analysis. Similarly, the tools used aim to gather respondents' opinions, attitudes, feelings, and perceptions. They are therefore suitable. This study's measuring items are modified versions of those used in earlier investigations. The variables are distributed as shown in Table 1.

Table 1: Measured Variables

Variable	Dimension	Items	Scale
Perishable Agricultural Products	Post Harvest Infrastructure	8	Likert Scale 1-5
	Institutional Infrastructure	7	Likert Scale 1-5
Blockchaining Initiatives	ICT Security Risk Management	7	Likert Scale 1-5
	Regulatory Framework	8	Likert Scale 1-5
Inclusive Regional Value Chains	Shared Prosperity	6	Likert Scale 1-5
	Sustainability	8	Likert Scale 1-5
	Inclusive Growth	7	Likert Scale 1-5
	Social Cohesion	9	Likert Scale 1-5
	Value Chain Upgrading	7	Likert Scale 1-5
	Financial Inclusion	6	Likert Scale 1-5

IV. DATA ANALYSIS AND RESULTS

The descriptive-inferential method and SPSS version 23.0 software were used to analyze all the data. First, reliability analysis was used to calculate the Cronbach's alpha coefficients for each scale used in this study in order to evaluate the internal consistency of the measuring tools. Based on the characteristics of the variables, descriptive statistics were calculated, including mean scores and standard deviations. In order to determine the degree of autocorrelation and multicolliniarity in the variables as well as the nature of any significant relationships between them, Pearson product-moment correlation analysis was used.

Several statistical methods were used to analyze the data. First, descriptive statistics of the characteristics of the respondents were found and used to analyze the data. Second, the linear relationships between inclusive regional value chains, blockchain technology, and perishable agricultural products were assessed using correlation analysis. Multiple regression analyses were the main method of data analysis used to test the research hypotheses. In order to evaluate the mediating roles of Blockchaining Initiatives on Perishable Agricultural Products and Inclusive Regional Value Chains, hierarchical regression was employed to model the relationship between each dimension of PAPs, Blockchaining Initiatives, and Perishable Agricultural Products. The multiple regression analyses were all conducted using standardized betas, whereby p values less than 0.05 or less than 0.01 were taken into consideration for statistical significance.

A. Descriptive Statistics of Demographic Data

The respondents' demographic information was reported in this section. The demographic data includes the respondent's age, gender, experience, educational background, type of informant, location, and type of institution. In Table 2 the demographic data is displayed.

Table 2: Descriptive Statistics of Demographic Data

Analysis of Descriptive Statistics of Demographic Data					
Characteristics	**Frequency**	**%**	**Characteristics**	**Frequency**	**%**
Gender			**Age**		
Male	216	76.6	Between 18 Years and 30 Years	98	34.8
Female	66	23.4	Between 31 Years and 40 Years	108	38.3
TOTAL	282	100	Between 41 Years and 60 Years	51	18.1
Educational Background	**Frequency**	**%**	60 Years and above	25	08.8
Primary School Education	83	29.4	**TOTAL**	**282**	**100**
Secondary School Education	68	24.1	**Years of Experience in Perishable Agriculture**	**Frequency**	**%**
Advanced Level Secondary Education	21	07.4	Below 5 years	72	25.5
Certificate	26	09.2	5-10 years	125	44.3
Diploma	36	12.8	10 -20 years	49	17.4
Degree	29	10.3	20 Years and above	36	12.8
Post Graduate	19	06.8	**TOTAL**	**282**	**100**
TOTAL	282	100	**Type of Informant**	**Frequency**	**%**
Geographical Location	**Frequency**	**%**	Academician	13	04.6

Tanga	64	22.7	District/Regional Market Trader	54	19.1
Iringa	42	14.9	Government Officer/Policy Maker	26	09.2
Dar Es Salaam	76	30.0	Rural Market Collector	76	27.0
Mbeya	54	19.1	Brokers/Dealers	67	23.8
Arusha	46	13.3	Small Scale Dealer/Producer	46	16.3
TOTAL	**282**	**100**	**TOTAL**	**282**	**100**
Type of Institution	**Frequency**	**%**	**Position of Value Chain Member**	**Frequency**	**%**
Government Authorities	39	13.8	Rural	168	59.6
Community-Based Organisation	78	27.7	Urban	114	40.4
Civil Society Organisation	36	12.8	**TOTAL**	**282**	**100**
Informal Groups	129	45.7			
TOTAL	**282**	**100**			

The profile of the study's respondents is shown in tabular form in Table 2. It shows that the majority of respondents—45.7%—run their operations through informal groups. The Table 2 presents the profile of the respondents of this study in a tabular form. It demonstrates that most the respondents (constituting 45.7%) are operating their activities on informal groups. Only 40.5% of the respondents are in the formal organisations while 13.8% are from government institutions. This shows that most of the study respondents are informal organised in their value chains, yet they are "engineers" who are responsible for organisation of PAPs activities.

In terms of years of work experience, 44.3% of the respondents have between 5 year and 10 years or working experience in PAPs activities, 25.5% of them have below 5 years of working experience in PAPs activities, while 17.4% of the respondents have between 10 year and 20 years of working experience in PAPs activities, but the remaining 12.8% have more than 20 years of working experience. This indicates that the majorities of responders have a great deal of experience and have been in the industry for a sizable amount of time. As a result, they are familiar with PAP industry norms and standards.

In terms of age and gender, 23.4% of respondents are female and 76.6% of respondents are male. Majority of the respondents, 73.1%, are within the age range of 18 years and 40 years. Respondents in the range of 18-30 years form 34.8%. Thereafter, it was observed that 38.3% of respondents fall between the ages of 31 and 40. 18.1% of them are between the age of 41 years and 60 years, while 08.8% are above the age of 60 years. These data show that most of the respondents are male and young.

In terms of the respondents' educational level, mostly (199 or 70.6%) showed to have above secondary school education. This suggests that respondents with secondary school education above had a significant influence in the study's outcome. Interestingly, of the total 29.4% respondents, had primary school education and 24.9% of respondents have secondary school education. 7.4% of respondents have advanced level secondary education. College certificate and diploma holders participated in this study and have contribution of 09.2% and 12.8%, respectively. Those with associate's and graduate degrees also took part in this survey, contributing 10.3% and 06.8%, respectively.

Furthermore, it appears that respondents who reside in rural areas had a significant influence on the survey's results. Their percentage of participation was 59.6% while urban respondents form 40.4% of

survey. Out of 282 respondents 22.7% are residing from Tanga, 14.9% are resides from Iringa, 30% are resides from Dar es Salaam, 19.1% are residents of Mbeya, and 13.3% are residing from Arusha.

B. Correlation Analysis

The next part of the analysis focuses on examining the connection between Inclusive Regional Value Chains, Blockchaining and Perishable Agricultural Products. Study dimensions such as post harvest infrastructure, institutional factors, ICT security risk management, regulatory framework, blockchain diffusion, shared prosperity, sustainability, inclusive growth, social cohesion, value chain upgrading, and financial inclusion. However, before such regression analyses are conducted it is important to find out first, if there is any correlation between the variables. In any regression analysis, determining whether there is a linear relationship between the variables to be investigated and the direction of such a relationship is a useful step in trying to determine the influence of an independent variable on an outcome variable.

In this study, Pearson's correlation coefficient is calculated to test if there is a relationship between the different study variables. Based on Dillon, Madden and Firtle (1993), The values of the Pearson correlation coefficient (r) span from -1 to +1. A correlation of zero (0) denotes the absence of correlation, while a positive 1 indicates a perfect positive correlation and a negative correlation suggests otherwise. The direction of correlation of analysed values indicates how variables are related. Thus, the closer the correlation is either to +1 or -1, the stronger the correlation and thereby indicating magnitude and strength of correlation.

The means, standard deviations, coefficient alphas, and intercorrelations of the research variables are shown in Table 3. Every scale has coefficient alpha estimates that are higher than the suggested level for the social sciences, which is 0.70. Therefore, all dimensions' internal consistency reliabilities were quite credible. Consistent with most of previous research on relationship between post harvest infrastructure and institutional factors to blockchaining initiatives, Table 3 shows overall post harvest infrastructure and institutional factors and all sub dimensions of blockchaining initiatives are positively and significantly related to post harvest infrastructure and institutional infrastructure. Institutional infrastructure have the strongest correlation with institutional infrastructure, ICT security risk management, regulatory framework ($r = 0.721$; $r = 0.534$ and $r = 0.639$ respectively; $p<.01$). Institutional infrastructure has positive correlation with the shared prosperity ($r = .353$; $p<.05$). Similarly, a positive correlation results was identified between sustainability, inclusive growth, social cohesion, value chain upgrading and financial inclusion ($r = 0.567$; $r = 0.824$; $r = 0.375$; $r = 0.682$ and $r = 0.639$ respectively; $p<.01$).

Table 3: Means, Standard Deviations and Intercorrelations of Dimensions

	Dimension	M	SD	1	2	3	4	5	6	7	8	9	10
1	Post Harvest Infrastructure	2.32	.624	(.91)a									
2	Institutional Infrastructure	2.57	.714	.721**	(.86)a								
3	ICT Security Risk	2.31	.692	.534**	.642**	(.76)a							

		Mean	SD	1	2	3	4	5	6	7	8	9	10
	Management												
4	Regulatory Framework	2.36	.654	.639**	.315**	.674***	(.84)a						
5	Shared Prosperity	2.92	.676	.353*	.552**	.765**	.567*	(.93)a					
6	Sustainability	2.34	.814	.567**	.675**	.346**	.765**	.474**	(.87)a				
7	Inclusive Growth	2.69	.648	.824**	.589**	.312**	.534**	.315**	.567*	(.85)a			
8	Social Cohesion	3.12	.753	.375**	.663**	.253**	.649*	.452*	.435*	.367*	(.82)a		
9	Value Chain Upgrading	2.58	.778	.682**	.562**	.567*	.673*	.269*	.242*	.464*	.442**	(.79)a	
10	Financial Inclusion	3.17	.725	.765**	.551**	.673*	.592*	.693*	.764**	.573*	.715	.753**	(.86)a

Note: *p<.05 (2-tailed test); **p<.01 (2-tailed test) while "a" = Cronbach's alpha

Table 3 presents a preliminary picture of the relationship between the study's variables which post harvest infrastructure, institutional infrastructure, ICT security risk management, regulatory framework, shared prosperity, sustainability, inclusive growth, social cohesion, value chain upgrading, and financial inclusion. The study's majority of variables have a strong correlation with one another. Additionally, there was no correlation found, with a 0.9 value indicating that there is no multicollinearity among the variables (Hair, *et al.*, 2010).

C. *Multiple Regressions and Hypotheses Test*

The degree and nature of the relationships between the independent and dependent variables are impartially investigated using multiple regression analysis (Sekaran and Bougie 2010; Hair, *et al*. 2007; Field 2009). In this instance, a regression analysis test was carried out to evaluate the study's generated hypotheses following the fulfillment of all multiple regressions' underlying assumptions. The regression coefficient in multiple regression analysis displays the relative significance and level of involvement of each independent variable in the prediction of the dependent variable. This indicates that the regression coefficient also displays the size effect of each independent variable's prediction of the dependent variable since the independent variables jointly predict the dependent variable.

In that way, results of multiple regression analysis will show how much the dependent variable would change if an independent variable's unit value increased. (Sekaran and Bougie 2010; Zikmund et al. 2010). Next, a hierarchical multiple regression model was used to test the hypotheses concurrently. The hierarchical multiple regression model was also employed in this study because of its flexibility in accommodating non-normal distributions, which is crucial when utilizing the product-of-coefficients approach to test for mediation (i.e., the product of two coefficients is typically non-normally distributed). Moreover, hierarchical multiple regression model allows testing complicated models.

To test the suggested hypotheses, hierarchical multiple regression analysis was specifically used for a number of reasons. First, it is necessary to determine whether there is a relationship between the nesting variable and the measures of interest because the data were gathered at the individual level but nested in groups. Second, fixed and random effects can be simultaneously tested with hierarchical multiple regression analysis. Thirdly, the groups' sizes differed, but hierarchical multiple regression analysis can handle these differences. Fourthly, a model with both individual and group level variables can be handled

by hierarchical multiple regression analysis. The findings are shown in the section that follows. Prior to using hierarchical multiple regression analysis techniques, the hypotheses involving only individual level data nested in groups were examined. Analysis of the group level data was then conducted if the random effect of group membership was not significant or if the data collected was limited to the group level, as in the case of the Blockchaining initiatives and the Inclusive RVCs data.

Relationship between Perishable Agricultural Products and Inclusive Regional Value Chains

Whether there was a meaningful correlation between PAPs and inclusive RVCs through the application of multiple regression analysis. The pursuit of inclusive RVCs and economic transformation must be coupled with a focus on creating a solid institutional framework and interventions that radically alter the economic systems and patterns (Economic Policy Division, 2019). This means, trade policies should be closely correlated with investment strategies and policies for the growth of domestic companies; however, they frequently do not, which puts them at a disadvantage (Morris et al., 2012; UNCTAD 2015). Stated differently, advancing an agenda for inclusive growth and economic transformation cannot jeopardize a small open economy's long-term competitiveness (Economic Policy Division, 2019). ThereforeRVC strategies must be modified to account for national capabilities, segment of upstream and downstream of targeted value chain. The relationship between these concepts was presented in hypothesis one which stated that:

Hypothesis 1: PAPs is positively related to inclusive RVCs in Southern Africa

The association between PAPs with the extent of inclusive RVCs was assessed using multiple regression analysis with the results presented in Table 4. All two models were significant (sig value = 0.000) with R^2 values of 0.314 reported. The models reveal that all PAPs dimensions exhibited a significant association with the extent of inclusive RVCs. Specifically, the PAPs dimension, post harvest infrastructure exhibited a significant association with all inclusive RVCs: shared prosperity (β = -0.324, $p < 0.01$), financial inclusion (β = 0.408, $p < 0.05$), stability (β = 0.284, $p < 0.05$), sustainability (β = -0.351, $p < 0.01$) and social cohesion (β = 0.121, $p < 0.05$). In addition the PAPs dimension institutional infrastructure was significantly associated with the level of shared prosperity (β = 0.412, $p < 0.05$), financial inclusion (β = -0.291, $p < 0.01$), stability (β = -0.527, $p < 0.01$), sustainability (β = 0.348, $p < 0.05$) and social cohesion (β = -0.254, $p < 0.01$). The findings provide support relationship between PAPs and inclusive RVCs.

Table 4: Relationship between Perishable Agricultural Products and Inclusive Regional Value Chains

Variable	Inclusive Regional Value Chains									
	SPR		FIN		STB		SUS		SCO	
	R	*p*	R	*p*	R	*p*	R	*p*	R	*p*
PHI	-0.324	0.021**	0.408	0.011*	-0.284	0.014*	-0.351	0.016**	0.121	0.024*
INF	-0.412	0.017*	-0.291	0.024**	-0.527	0.025**	0.348	0.013*	-0.254	0.019**
R Square										0.314
Adjusted R Square										0.258
Sign. Of Value										0.000

				1.827
Durbin-Watson Statistics				

Note: *$p<0.05$ (2-tailed test); **$p<0.01$ (2-tailed test) while SPR= Shared Prosperity; FIN=Financial Inclusion; STB=Stability; SUS= Sustainability; SCO= Social Cohesion; PHI=Post Harvest Infrastructure; INF=Institutional Infrastructure

Effects of Post Harvest Infrastructure on Inclusive Regional Value Chains

This study is aimed at examining whether there was a significant relationship between post harvest infrastructure and inclusive RVCs through the application of multiple regression analysis. The relationship between these concepts was presented in hypothesis two which postulate that:

Hypothesis 2: Post harvest infrastructure positively influence inclusive RVCs in Southern Africa

In this part, effects of the five components of post harvest infrastructure were explored and examined by using multiple regression analysis. In order to confirm the hypothesis two of this study, inclusive RVCs was regressed against dimensions of post harvest infrastructure. Regression analysis yielded a significant regression coefficient of 0.602; $p<0.01$, indicating the overall significance of the model. It was established that inclusive RVCs and post-harvest infrastructure components had positive and significant relationships.

As indicated by the results of the regression test in Table 5, from the four dimensions of post harvest infrastructure, which are marketing infrastructure, post harvest infrastructure, quality management and value chain upgrading partially significantly and directly affected inclusive RVCs and thus were the predictors of inclusive RVCs. The results also showed that 16.8% of the variance in inclusive RVCs was explained by post harvest infrastructure dimensions ($R^2=0.418$). The Beta calculations showed that the highest variation was explained by post harvest infrastructure ($\beta=0.418$), the next highest was explained by quality management ($\beta=0.373$), and the lowest was explained by marketing infrastructure ($\beta=0.347$). However, the value chain upgrading had no significant effect on post harvest infrastructure ($\beta = -0.074$, $p>0.05$) and did not contribute significantly to the model. Therefore, hypothesis two was only partially supported.

Table 5: Effects of Post Harvest Infrastructure on Inclusive Regional Value Chains

Model	Unstandardised Coefficients		Standardised Coefficients	*p*	Sign.	Collinearity Statistics	
	B	**SE**				**Tolerance**	**VIF**
Constant	0.602	0.446		0.365**	0.0000		
Market Infrastructure	0.347	0.072	0.361	0.018*		0.712	1.567
Logistical Infrastructure	0.418	0.084	0.301	0.025**		0.854	1.134
Quality Management	0.373	0.081	0.210	0.031*	0.031	0.653	1.362
Value Chain Upgrading	-0.074	0.075	0.311	0.027*	0.031	0.724	1.254
R Square							0.418
Adjusted R Square							0.362

Sign. Of Value		0.000
Durbin-Watson Statistics		1.761

Note: *$p<0.05$ (2-tailed test); **$p<0.01$ (2-tailed test) while SE=Standard Error; VIF= Variance Inflation Factor

Mediation Effects of Blockchaining Initiatives on Post Harvest Infrastructures and Inclusive RVCs

The objective of this research was to determine driving forces behind the blockchaining initiatives on effects of post harvest infrastructure to inclusive RVCs in Southern Africa. The study had postulated that relationship between post harvest infrastructure dimensions (trade barriers, policy implementation, institutional frameworks, platform formation and facilitation and institutionalised incentives and preferences) and inclusive RVCs in Southern Africa in terms of technological application was thinly applied as a result African countries are highly under-represented in global value chains (GVCs) and RVCs is very low. The indicators of post harvest infrastructure were used to test the second hypothesis. To establish the relationship between post harvest infrastructures on inclusive RVCs in terms of blockchaining mediation, the following hypothesis was tested.

Hypothesis 2a: Blockchaining Initiatives Mediates Post Harvest Infrastructures and Inclusive RVCs

Hierarchical regression was performed to examine the mediating effect of Blockchaining initiatives. According to Baron and Kenny (1986), the following requirements must be satisfied in hierarchical multiple regression analysis in order to identify the variable's mediating functions: first, the independent variable must significantly influence the dependent variable in the absence of the mediator variable; second, the independent variable must significantly influence the mediator variable; and third, the mediator variable must significantly influence the dependent variable. When the mediator is included in hierarchical multiple linear regression and the regression's beta coefficient is lowered to a non-significant level, the independent variable and the dependent variable are no longer correlated, indicating full mediation. In hierarchical multiple regression analysis, partial mediation occurs when the independent variable's beta coefficient remains statistically significant following the mediator's inclusion (Newsom, 2012).

The outcome of regression analysis of the effect of post harvest infrastructure on inclusive RVCs showed that post harvest infrastructure significantly affects inclusive RVCs ($\beta= 0.257$, $p < 0.05$). In that way, the first condition of mediation in hierarchical multiple regression analysis is honoured. The second equation was carried out to test the effect of independent variables dimension (post harvest infrastructure) on the mediator variable (Blockchaining initiatives). This result shown that post harvest infrastructure has significant impact on blockchaining initiatives. Therefore, the second condition of mediation in hierarchical multiple regression analysis is met. Either, the third condition of mediation is to give explanation the effect of mediating variable on the dependent variable. The regression analysis result shows that Blockchaining initiatives significantly affects inclusive RVCs ($\beta= 0.569$, $p< 0.01$). This implies that the hierarchical multiple regression analysis's third requirement was satisfied. Overall, the regression analysis shows that the first, second, and third requirements of the mediation test are met; as a result, blockchain initiatives do function as a mediating variable in the relationship between inclusive RVCs and post-harvest infrastructure.

Table 6: Mediation Effects of Blockchaining Initiatives on Post Harvest Infrastructures and Inclusive RVCs

Variables	β	R^2	Adjusted R^2	ΔR^2	ΔF
Step 1	0.257**	0.228	0.267	0.281	0.000
Independent Variables					
TBA	0.358*				
PIM	0.311**				
IFR	0.228*				
PFF	0.326*				
IIP	0.227**				
Step 2		0.697	0.756	0.474	0.000
Moderating Variable					
BI	0.395*				
Step 3	0.569*	0.816	0.779	0.361	0.000
Interactions					
TBA*BI	0.361**				
PIM*BI	0.253**				
IFR*BI	0.179*				
PFF*BI	0.278**				
IIP*BI	0.373*				

Note: *$p<0.05$ (2-tailed test); **$p<0.01$ (2-tailed test) while TBA=Trade Barriers ; PIM=Policy Implementation; IFR= Institutional Frameworks; PFF= Platform Formation and Facilitation; IIP= Institutionalised Incentives and Preferences

Effects of Institutional Infrastructure on Inclusive Regional Value Chains

This study is aimed at investigating whether there was a significant relationship between institutional infrastructure and inclusive RVCs through the use of multiple regression analysis. The literature on economic integration (such as Ben-David, 1993; Diaz del Hoyo, *et al.,* 2017); Alcidi, *et al.*, 2018) shows that within the EU rapid growth of lower income countries is the main reason for this convergence. Magrini (1999) finds that economic growth in the European countries during the 1980s is associated with a tendency towards divergence. When economic actors follow common rules, markets grow in size and complexity, and economic growth stabilizes throughout the region, regional integration produces increasingly similar economic outcomes (Ilzkovitz, *et al*., 2007; Beckfield, 2009). Regretfully, theory fails to reveal a very clear picture of how regional integration will impact RVCs. Traditionally, RVCs in regional integration has been regarded as a device for "tariff jumping". The relationship between these concepts was presented in hypothesis two which posit that:

Hypothesis 3: Institutional infrastructure positively influence inclusive RVCs in Southern Africa

In this hypothesis, effects of the five components of institutional infrastructure on inclusive RVCs were explored and examined by using multiple regression analysis. In order to confirm the hypothesis three of this study, inclusive RVCs was regressed on the dimensions of institutional infrastructure. The regression outcomes demonstrated that the overall model was significant (β=0.502; *p*<0.001). It was established that inclusive RVCs and institutional infrastructure components had positive and significant relationships.

As shown by the regression results in Table 7, from the four dimensions institutional infrastructure, which are marketing infrastructure, post harvest infrastructure, quality management and value chain

upgrading partially significantly and directly affected inclusive RVCs and thus were the predictors of inclusive RVCs. Also results revealed that 16.8% of the variance in inclusive RVCs was explained by institutional infrastructure components (R^2=0.397). Based on the Beta calculations, post harvest infrastructure accounted for the largest variation (β=0.343), the next highest was explained by quality management (β=0.127), and the lowest was explained by marketing infrastructure (β=0.277). However, the value chain upgrading component had insignificant effect on institutional infrastructure (β=-0.176, p>0.05) and did not contribute significantly to the model. Henceforth, hypothesis was only partially supported.

Table 7: Effects of Institutional Infrastructure on Inclusive Regional Value Chains

Model	Unstandardised Coefficients		Standardised Coefficients	p	Sign.	Collinearity Statistics	
	B	**SE**				**Tolerance**	**VIF**
Constant	0.502	0.446		0.023	0.000		
Market Infrastructure	0.277	0.072	0.361	0.021		0.712	1.567
Logistical Infrastructure	0.343	0.084	0.301	0.019		0.854	1.134
Quality Management	0.127	0.081	0.210	0.011	0.031	0.653	1.362
Value Chain Upgrading	-0.176	0.075	0.311	0.009	0.031	0.724	1.254
R Square							0.397
Adjusted R Square							0.381
Sign. Of Value							0.000
Durbin-Watson Statistics							1.863

Note: *p<0.05 (2-tailed test); **p<0.01 (2-tailed test) while β= Standardised Beta Coefficient; SE= Standardised Error of Estimate; VIF= Variance Inflation Factor

Mediation Effects of Blockchaining Initiatives on Institutional Infrastructures and Inclusive RVCs

The primary objective of this study was to examine whether blockchaining initiatives can mediate relationship between institutional infrastructure and inclusive RVCs and how. Hierarchical multiple regression analysis of the control variables and the independent variables was performed to establish the relationship between institutional infrastructures on inclusive RVCs in terms of blockchaining mediation, and following hypothesis was tested.

H₃a: Blockchaining initiatives mediates institutional infrastructures and inclusive RVCs

To examine the mediating effect of Blockchaining initiatives on relationship between institutional infrastructure and inclusive RVCs, the regression analysis was conducted. To determine how the independent variables affected the dependent variable, the first hierarchical multiple regression equation was run.

Table 8 shows relationship among dimensions of Institutional Infrastructure and Inclusive RVCs. Results of hierarchical multiple regression analysis in Table 8 shows that institutional infrastructure significantly influences inclusive RVCs (β= 5.535, p < 0.01). In this manner, the first condition of mediation of hierarchical multiple regression analysis is met. The regression outcomes of second equation intended to test effect of independent variables on the mediator, Blockchaining initiatives. It was revealed that

institutional infrastructure has significant effect on Blockchaining initiatives, thus, the second condition of mediation is met. The third condition of mediation is to explain impact of mediator variable on the dependent variable. The regression analysis result shows that Blockchaining initiatives ($\beta= 0.568$, $p< 0.05$) significantly influences inclusive RVCs which meets the third criteria. Regression analysis shows that the first, second, and third conditions are met overall. Thus, Blockchaining initiatives do act as a mediator in the relationship between of institutional infrastructure and Inclusive RVCs.

Table 8: Mediation Effects of Blockchaining on Institutional Infrastructures and Inclusive RVCs

Variables	β	R^2	Adj. R^2	ΔR^2	ΔF
Step 1 **Independent Variables**	0.241*	0.228	0.267	0.281	0.000
MIN	0.358*				
LIN	0.311**				
QMA	0.228*				
VCU	0.326*				
Step 2	0.452**	0.697	0.756	0.474	0.000
Moderating Variable BI	0.395				
Step 3 **Interactions**	0.568**	0.816	0.779	0.361	0.000
MIN*BI	0.361**				
LIN*BI	0.253**				
QMA*BI	0.179*				
VCU*BI	0.278**				

Note: *$p<0.05$ (2-tailed test); **$p<0.01$ (2-tailed test) while MIN = Marketing Infrastructure; LIN = Logistical Infrastructure; QMA = Quality Management; VCU= Value Chain Upgrading; BI=Blockchaining Initiatives

V. DISCUSSIONS OF FINDINGS

All five (5) hypotheses that have been tested in this study were supported. This section summarises the results of the hypotheses testing as presented in Table 9. Hypotheses 1 examined the direct effects of PAPs on inclusive RVCs in Southern Africa. Therefore, it was found that PAPs had a significant effect on inclusive RVCs in Southern Africa. In other words, PAPs was positively associated with inclusive RVCs in Southern Africa. Hypotheses 2 and 3 predict that Post harvest infrastructure and Institutional infrastructure are positively and significantly correlated with inclusive RVCs in Southern Africa. These factors were received support. In other words, Post harvest infrastructure and Institutional infrastructure were positively and significantly correlated with dimensions of inclusive RVCs in Southern Africa.

Hypotheses 2_a and 3_a proposed that blockchaining initiatives play a mediating role on the relationships between Post harvest infrastructure and Institutional infrastructure. According to suggestions by Baron and Kenny (1986), one of the conditions for mediation effect is that the independent variable should have effect on the mediating variable. In this case, these blockchaining initiatives have mediating role on the associations between post harvest infrastructure and institutional infrastructure with dimensions of inclusive RVCs in Southern Africa.

Table 9: Summary of the Tested Hypotheses

Hypotheses	Supported
H_1: PAPs is positively related to inclusive RVCs in Southern Africa	Yes
H_2: Post harvest infrastructure positively influence inclusive RVCs in Southern Africa	Yes
H_{2a}: Blockchaining Initiatives Mediates Post Harvest Infrastructures and Inclusive RVCs	Yes
H_3: Institutional infrastructure positively influence inclusive RVCs in Southern Africa	Yes
H_{3a}: Blockchaining initiatives mediates institutional infrastructures and inclusive RVCs	Yes

Social and economic exclusivity in Southern Africa is prevalent and serious exists among smallholder farmers and small agribusinesses of PAPs. It is associated with an increase in unsystematically and uncoordinated regional value chain (RVCs), post harvest infrastructure, institutional factors, ICT security risk management, regulatory framework, shared prosperity, sustainability, inclusive growth, social cohesion, value chain upgrading and financial inclusion. The subjects of this study were smallholder farmers and small agribusinesses of PAPs with the focus of the research being the relevance of blockchaining initiatives towards inclusive RVCs to PAPs in Southern Africa.

Given the apparent increases on likelihood of deterioration and spoilage of PAPs as evidenced by the unsystematically and uncoordinated regional value chain (RVCs), it is useful to explore in more depth relevance of blockchaining initiatives towards inclusive RVCs to PAPs in Southern Africa. This study focused on relevance of blockchaining initiatives towards inclusive RVCs to PAPs in Southern Africa. The first research question is to identify which are driving forces behind the blockchaining initiatives on effects of post harvest infrastructure to inclusive RVCs in Southern Africa. Based on research findings, it was revealed that blockchaining initiatives have impact on post harvest infrastructure thus facilitate inclusive RVCs in Southern Africa. This finding is in line with prior studies (Ismail and Mahyideen, 2015; Ilzkovitz, *et al*., 2007; Beckfield, 2009) which trade cost is even larger in developing countries, thereby affect inclusiveness, in this manner post harvest infrastructure is relevant to trade facilitation, particularly in minimising trade cost and further enhancing competitiveness in terms of logistical infrastructure, quality management, marketing infrastructure and value chain upgrading.

The second research question is focusing on identifying mediation effects of blockchaining initiatives to institutional infrastructure on inclusive RVCs in Southern Africa. The mediation path for institutional infrastructure - blockchaining initiatives - inclusive RVCs in Southern Africa was significant. In other words, in the full structural analysis, blockchaining initiatives were found to mediate the relationship between institutional infrastructures on inclusive RVCs in Southern Africa.

Regarding the relationship between institutional infrastructure and blockchaining initiatives, it is confirmed that institutional infrastructure has a greater influence on inclusive RVCs in Southern Africa. However, finding of this study are similar to previous study view on regional development as inclusive development is not a mediating variable but dependent variable. Besides, the results of the statistical test aimed at finding support for mediating influence of blockchaining initiatives on relationship between independent variables such as market infrastructure, logistical infrastructure, quality management and value chain upgrading. Although these findings address the insufficiency empirical research on mediating role of blockchaining initiatives, however findings of this study are similar to other inclusive RVCs (Silvius, 2011; Payne, *et al*., 2009) who found ICT functions mediates the relationship between value chain development and economic performance.

A. Conclusion and Policy Implications

Conclusion

Unorganized and disorganized regional value chains (RVCs) with significant population shares living in extremely impoverished conditions are what define Southern Africa. In Southern Africa, policy thrusts up until recently have been directed toward increasing development exclusions in rural areas. But in order to improve population welfare given the high rate of underdevelopment, policies that both directly and indirectly lessen the exclusion of rural areas are required. Using aggregate data, the results of this study reveal that there is a positive relationship between inclusive RVCs and efficiency of PAPs. The study also suggests that though inclusive RVCs in general increases rate of inclusivity of PAPs, while ICT security risk management and regulatory framework of blockchaining initiatives exerts greater effect to inclusive development strategy relative to post harvest infrastructure and institutional infrastructure initiatives.

Initially, the government of Southern African countries that exhibit PAP market failure is actively involved in the development of institutional and post-harvest infrastructure. In this respect, there is a need for policy aimed at massive investment in post harvest infrastructure and institutional infrastructure on PAPs is crucial to inclusive development. The situation in Southern Africa is such that, though budgetary expenditure on post harvest infrastructure and institutional infrastructure on agribusiness has somehow increased in absolute terms, but real budgetary expenditure on post harvest infrastructure and institutional infrastructure on agribusiness has declined over the years. Therefore attention has to be focused on the post harvest infrastructure and institutional infrastructure in PAPs (that is, how shared prosperity, sustainability, inclusive growth, social cohesion, value chain upgrading and financial inclusion are attained) rather than on nominal expenditure. At this juncture, it becomes pertinent to ask: what are the policy implications of this study for the inclusive RVCs and efficiency of PAPs?

B. Practical Implications

With this study, a clear research agenda has been identified to further enhance the effectiveness of stakeholders' interventions. Increased research and empirical evidence will help to further strengthen inclusiveness of PAPs smallholder farmers and small agribusinesses on RVCs and the effectiveness of specific interventions. Additional research on the overall impact of blockchaing initiatives to PAPs on inclusive RVCs would be helpful for the overall advocacy for practical interventions. Research on the optimal structure of interventions would help to further increase the shared prosperity, sustainability, inclusive growth, social cohesion, value chain upgrading and financial inclusion to smallholder farmers and small agribusinesses in Southern Africa.

Blockchaining initiatives play an important role in participation RVCs. They provide practical inputs to competitiveness of smallholder farmers in RVCs. ICT security risk management, regulatory framework of Blockchain in Southern Africa will provide value-added links where most postharvest losses and wastes of PAPs will be dealt with. Moreover, ICT security risk management, regulatory framework of blockchain in Southern Africa create export opportunities for smallholder farmers and small agribusinesses through cost-effective flows on information, processes, financial through facilitating trade of PAPs on inclusive RVCs. In that manner, PAPs sector contributes differently to progress on the Sustainable Development Goals (SDGs), with the contribution of post harvest infrastructure and institutional infrastructure significantly enabling coordination of RVCs links.

Targeted PAPs support, such as blockchaining technical assistance, helps to build up participatory, knowledge and expertise of smallholder farmers and small agribusinesses in RVC with respect to blockchaining initiatives, thus helping to catalyse independently sustainable smallholder farmers and small agribusinesses on inclusive RVCs. In this way, blockchaining initiatives play an important role in catalysing the inclusiveness of PAPs smallholder farmers and small agribusinesses on RVCs in developing countries. As with any governments intervention in PAPs, the paybacks need to outweigh the costs,

potential unfavorable incentives and unintended consequences. However, blockchaining initiatives are often better placed to support smallholder farmers and small agribusinesses on RVCs in developing countries than open markets, whose support ICT schemes often are less cost-efficient and more susceptible to developed countries capture. PAPs smallholder farmers and small agribusinesses on RVCs achieve their cost-efficiency by working through blockchained intermediaries, with the additional benefit of stimulating the creation of local domestic markets. ICT security risk management and regulatory framework of blockchain in Southern Africa is further enhanced by selecting and screening platforms, applying strict partipation standards and carefully calibrating controls and incentives.

Awareness about the effectiveness of ICT security risk management and regulatory framework of Blockchain in Southern Africa has focused attention on the importance of a new agenda for inclusive RVCs through facilitating trade of PAPs strategy where the focus is on the quality of government intervention in reducing postharvest losses and wastes of PAPs to reflecting shared prosperity, sustainability, inclusive growth, social cohesion, value chain upgrading and financial inclusion. The smallholder farmers and small agribusinesses of PAPs in many developing countries such as Southern Africa countries requires policy making to become more focused on the differential impact that policy reforms may have implications on inclusive RVCs. To that end, the design of post harvest infrastructure and institutional infrastructure strategy needs to be grounded on a useful typology of agriculture that allows identifying those smallholder farmers and small agribusinesses for which agricultural growth offers a realistic way out of exclusions and those for which other complementary strategies need to be devised.

From the point of view of inclusive RVCs policy making on PAPs, it is important to recognize that only under specific conditions will agricultural growth have a decisive impact on inclusive development at the local level. Contrary to off-farm activities, for many small PAPs producers and small agribusinesses, farming plays and will continue to play a trivial role in income formation, while, for many of the smallholder farmers and small agribusinesses, exit from agricultural production are the only reasonable paths for inclusive development. Through ICT security risk management and regulatory framework of Blockchain which PAPs growth have potential impact on inclusive development for strengthening shared prosperity, sustainability, inclusive growth, social cohesion, value chain upgrading and financial inclusion.

C. Recommendations for Future Research

The findings of this research suggest several avenues for future research. Stakeholder engagement and capacity building appear to be useful areas for continued examination; it is for that reason significant to explore strategies for stakeholder engagement and capacity building is crucial for inclusive regional value chains. Intention is to focus on identifying effective approaches to involve farmers, producers, retailers, logistics providers, and other actors in the adoption and utilization of blockchain technology. Secondly, due to the regulatory and governance frameworks having a high level of change and short life cycle, it is necessary to have effective frameworks to respond to this situation, especially in the ICT that face the change of new technology and a dynamic environment. This includes examining legal and policy considerations, institutional arrangements, and standards for data privacy, security, and interoperability.

Lastly, scalability and interoperability is useful for firms to face several changes. Exploring scalability and interoperability challenges of blockchain systems in regional value chains is essential. Therefore, future researches can focus on identifying approaches to address the stakeholder engagement and capacity building, scalability limitations, regulatory and governance frameworks of blockchain technology and ensuring seamless integration with existing systems and platforms.

COMPETING INTERESTS

The author declares that no competing interests exist.

AUTHORS' CONTRIBUTIONS

Corresponding author was the researcher of the original work from which this article is substantially derived.

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This article followed all ethical standards for research without direct contact with human or animal subjects.

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DISCLAIMER

The views and opinions expressed in this article are those of the author and do not necessarily reflect the official policy or position of any affiliated agency of the author, and the publisher/s.

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Vključujoče regionalne vrednostne verige: blokovnih verige za pokvarljive kmetijske proizvode v Južni Afriki

Povzetek - V Južni Afriki se zaradi nesistematično in neusklajeno oblikovanih regionalnih vrednostnih verig (RVC) veliko pokvarljivih kmetijskih proizvodov izgubi. Predvsem gre za kvarjenje in slab sistem po spravilu pridelka ter pomanjkljivo usklajevanje partnerjev na začetku in na koncu oskrbovalne verige. Čeprav se poziv k povečanju trgovine v južnoafriški regiji morda zdi verjeten, strogo gledano ni dobro utemeljenih ekonomskih razlogov, zakaj bi morala trgovina s pokvarljivimi kmetijskimi proizvodi predstavljati izziv. Široko zasnovana vključujoča RVC s pomočjo blokovnega povezovanja pokvarljivih kmetijskih proizvodov bi lahko omogočila veliko učinkovitejše odzivanje na trajnostne razvojne izzive regije, kot to počnejo v razvitih in nastajajočih gospodarstvih. V zadnjem času sta vzpon in širitev

vključujočih RVC ter poudarek na veriženju blokov spodbudila velik premik paradigme o prenovi sistema po spravilu pridelkov. Cilj prispevka je preučiti pomen pobud za veriženje blokov za vključujoče RVC za pokvarljive kmetijske proizvode v Južni Afriki. S kvantitativnim raziskovalnim pristopom, ki vključuje kvantitativne metode zbiranja podatkov, je cilj raziskave oceniti tudi trenutne izzive, priložnosti in zaznave glede tehnologije veriženja blokov v kmetijskem sektorju. Ugotovitve študije praktično in empirično prispevajo k razumevanju veriženja blokov za podporo razvoju vključujočih in odpornih vrednostnih verig ter zagotavljajo vpogled za oblikovalce politik in deležnike pri spodbujanju trajnostne gospodarske rasti v kmetijskem sektorju južne Afrike.

Ključne besede - vključujoča regionalna vrednostna veriga, veriženje blokov, pokvarljivi kmetijski proizvodi