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Rural-Urban Linkages: Structure and Dynamics of Irish Potato Value Chain

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Abstract: ***Population growth coupled with urbanization processes in most African countries including Tanzania has significantly change demand and supply trends of goods and services. For example, observed changes in food demand, taste and preferences, lifestyle and culture influences caused by mobility of people in-and-out of rural local territories. Linkages between rural and urban areas have impact on economic growth, and also influence transformation of the agricultural activities including agricultural trade. Furthermore, agricultural trade flows characterized by geographical diversification (production and market) and increasing intensity of exchange within the area. Household have shifted to the production of high valued crops; demanded in local and neighbouring rural and urban markets responding to new demand and supply. The concept of Global Value Chain (GVC) was adopted to examine the structure and dynamics of Irish potato value chain in Njombe region. Data collection methods include household survey, Interviews and focus group discussion. Ordinal logistic regression used to analyse factors influencing marketing channels (1 = Traders at farm; 2 = Local market and 3= Urban/regional market) choice by Irish potato farmers. Results reveals that unit increase of distance to Njombe town (Urban center), the odds ratio of being in higher marketing channel categories versus lower categories was 0.8911 ($p<0.05$) times lower, given other effects constant. However, unit increase in the price sold, the odds ratio of being in higher marketing channels categories versus slower categories was 1.0069 ($p<0.05$) times greater, given the effect of other predictors are held constant. There is evidence for agricultural transformation in form of changes in production practices and increased use of technology and new actors involved into Irish potato value chain.***

Keywords: Rural-Urban Linkages, Value Chain, Irish Potato, Development

1. Introduction

Agricultural is still the main occupation of the majority of population in both export earnings and foodstuff for both rural and urban population. A new form of agriculture stimulates rural dynamics in the sense that new investment opportunities open up mainly in rural communities. Understanding of the different type of structural change and rural dynamics that drive rural-urban linkages, shape diverse patterns of agricultural development and determine opportunities for rural development. Urban markets are plays an important role as they concentrate demand and act as link to wider regional and international markets [1]. Various researches on rural urban linkages have shown the importance of links between rural and urban development [2]. Value chain analysis of Irish potato will be used as a case for presenting an understanding of different types of structural change and rural dynamics resulting from rural-urban linkages.

Rural-urban linkages have a major role in the changing local economies and livelihoods of people. The interdependence between urban and rural becomes more intense, a better understanding of the rural-urban linkages becomes more important to the implementation of development strategy aiming at poverty reduction. Rural-urban linkages and interactions play an increasingly significant role in local economies and livelihood transformation [3]. Despite the fact that the linkages between rural and urban is widely acknowledged in literature [2], [4], there are an increased an increased interest in understanding the impact of rural-urban linkages into changing livelihood in rural and urban areas. This article seeks to understand the changing in agricultural trade, access to market due to rural-urban linkages as impact to rural development opportunities.

2. Concept of Rural urban dynamics

Rural-urban linkages generally refer to the growing flows of public and private capital, people (migration and commuting) and goods and services (trade) between urban and rural areas [5]. It is important to add to these the flow of ideas, the flow of information, the flow and diffusion of innovation [5], [6]. Urban and rural sector in many developing countries is characterized by an economic dualism which is the coexistence of a modern sector and a traditional rural sector [7]. The view of a dichotomous relationship between the rural and urban economies must be rejected as the two are interdependent and complementary [8]. Many urban and cities have positive effect on rural development and agricultural productivity through a range of goods flows, cash flows and flows of services [9], [10].

Policies that support positive rural-urban linkages can therefore help to promote local economic growth and reduce rural and urban poverty [11]. However, their successful formulation and implementation require a better understanding of the different ways in which rural-urban linkages may create opportunities for local economic and social development, and for different groups of people through agricultural transformation. It is important to stress that the nature and scope of rural-urban linkages vary according to local geographical, socioeconomic and ecological conditions [11].

3. Agricultural transformation

The literature on urbanization is diverse with varied (negative and positive) views on how it impacts rural as well as urban poverty and there is no general consensus on how it

influences changes in the rural sector, including transforming the agricultural sector [12] - [14]. Other indicate the globalization not have fostered the desirable kind of structural change such as movement of labour from productive to less productive activities [15].

In the changing region, agricultural transformation increases agricultural productivity, result into changing composition of household income which shifts importance of farm and non-farm activities to local economy. Nevertheless in stagnant region, it results into out-migration of rural poor people to a distant region with low productivity [15]. Growth of principle economic activities is vital in the improvement of well-being of rural population [16], urbanization is closely associated with this change.

One of the consequences of the urbanization on rural sector has influence changes in demand and supply of goods and services in urban areas. Such changes can be caused by changing in food tastes and preferences, lifestyle of the people including culture, employment and living environment which bring changes to the economic growth and reduction on poverty. Contribution of agriculture to both economic growth and poverty reduction are contributed by provision of income and employment in rural areas but also provision of food at reasonable prices [17].

Rural household are shifting to the production of high valued crop. Majority of rural households in Njombe District derive their livelihood from Irish potato production and related activities. Irish potato occupies about 20% to 67% of the total area cultivated by households and about 88% of the output that is sold [18]. The number of Irish potato producers increased between 2002 and 2008 by 18% [19]. Partly due to the increased number of producers as well as the introduction of new cultivation technologies (irrigation) the production was reported to have increased from 2009/10 (47,931 ton) to 2011/12 (154,719 ton) by more than 220% [20].

3.1 Agricultural value chain

Value chain consists of all the activities which are required to bring the product/service from the conception the final consumer and final disposal [21]. Value chain described as the chain of activities for the product/service to gain the value [22]. The value of the product in the value chain includes, time, space, packaging, etc. Value chain approach used to examine the interrelationships between diverse actors involved in the marketing [23]. Nonetheless, it allows the assessment of linkages between and among productive activities.

Relationship among the buyers, seller, service providers and regulatory institutions that operate within or influence the range of activities in the value chain are described through value chain governance. According to [24] identifies five main ways of firm coordinate/govern the linkages between value chain activities. 1) Simple market linkages governed by price; 2) modular linkages, where complex information regarding the transaction is codified; 3) relational linkages, where the tacit information is exchanged between buyers and highly competent suppliers; 4) Captive linkages, where less competent supplier are provided with detail instruction; and 5) Linkages within the same firm, governed by management hierarchy. The five linkages patterns are associated with predictable combination of three distinct variables: the complexity of information to be exchanged between the value chain tasks; the codifiability of that information; and the capabilities resident in the supply base.

Changing market chain with trade libelization and globalization result farmers diversity into high value product and meeting requirement of emerged markets. These changes create new opportunities through transformed market [26]. Small farmers trade in small volumes due to low quality standard product, lack of market information and few links with buyers in marketing chain. Improvement of the rural-urban linkages will bridge this problem to the small farmers.

3.2 Irish potato production

Irish potato (*Solanium Tuberosum L.*) is the fourth largest yielding crop plant in the world behind wheat, rice and maize. Early 1960s, the growth in Irish potato production area has rapidly overtaken all other food crops in developing countries. 125 countries in the world are grown Irish potato; furthermore, more than one billion people are consumer of Irish potato over the world. Nevertheless, China and India are producing about third of total world Irish potato [26]. Recently, more than half of global potato production comes from developing countries. Sub-Saharan African (SSA) has more than doubled production of Irish potato since 1994, with about 70% of that growth are in Eastern Africa [27].

Potato in Tanzania is essentially a food security crop with growing domestic demand in urban and rural areas. The production of Irish potato in Tanzania doubled since 2009 indicated in the FAO statistics [28]. Prior to this recent development only a minor increase can be seen from 1990 – 2013. About, 90% of the national Irish potato production conducted in southern highlands. The recent growth in production is most likely in respond to increased market demand, and the main drive is changed food preferences and taste due to general economic growth and increased urban population. Farmers in the rural areas are taking the opportunities of meeting the demand and changes of food preference from urban and rural population by changing their production techniques towards the high value crops including Irish potato.

4. Research methodology

4.1 The study area

The study was conducted at Njombe region. Njombe Region is a recently formed region in Tanzania; it was announced officially on March 2012. The Region has an area of 24 994 square kilometres out of which 21 172 square kilometres is land (84.7%) and 3 822 square km (15.3%) is covered by water [29]. Njombe Region borders Iringa Region in the North, Morogoro Region in the East and Ruvuma Region in the South. In the north-west and west Njombe Region borders Republic of Malawi and Mbeya region respectively.

Njombe Region lies between latitudes $08^0 40'$ and $10^0 32'$ south of the equator and between longitudes $33^0 47'$ and $35^0 45'$ east of the Greenwich. Administratively the region is comprised of four districts namely, Njombe District, Makete District, Ludewa District and Wanging'ombe District. Njombe District comprises of three councils namely; Njombe Town Council, Njombe District Council and Makambako Town Council.

The selections of the site for the study are based on the interrelationship between the rural area and urban linkages. Through the linkages the mainly focus was in the particular process of agricultural transformation caused by the land use changes resulted from the rural-urban linkages. This process resulted into the introduction of the new agricultural crop/change in the cultivation practices and also results into change in land use in the area. Moreover the area is characterised with boom production of the Irish potato. About 80% and 40% of household in Njombe and Wanging'ombe districts in Njombe region produce Irish potato respectively [20]. The Ulembwe ward and Iwungilo ward were selected for the study. Ulembwe ward are characterized by production of Irish potato depends in rain fed, while Iwungilo ward are producing Irish potato based on gravity irrigation.

4.2 Data collection

During the survey in the villages Igagala, Ulembwe, Iwungilo and Ngalanga, total of 429 household randomly selected were included in the household questionnaire survey. Household questionnaire were used to collect information from the household about household characteristics, Irish potato production and marketing. Focus group discussion was done by the group of 8 - 12 participants in each village. Selection of participants for focus group discussion at the village level was done from the list of interviewed household. The Focus Group Discussions (FGD) was guided by the interview guide questions. Matrix exercise and time trend methods were used to collect information's such as changes in crop production and marketing during FGD. However, In-depth interview were conducted with the people who know what is going on in the community. The purpose of the in-depth interview was to collect information from wide range of people participating in the Irish potato value chain. It includes the interview with community leader, professional (in villages and district) and Irish potato farmer.

4.3 Marketing channels by Irish potato producer

Logistic regression model is used to assess factors influencing marketing channel choice (Local market, Traders at farm and other form of marketing (urban and regional)) by Irish potato farmers at Njombe. The proportional odds model, used in analysis of ordinal categorical data and come from the class of generalized linear model [30]. The model uses the dependent variable which has more than two ordinal categories which are marketing channels for Irish potato available to the farmer. Logistic model describe the response probability $(p(y_i = 1))$ of the dependent variables y_i. For n sample of independently and identically distributed observation $i = 1,\ldots,n$ and $(k+1)$ dimensional vector x_i of explanatory variables, the probability that y_i takes value of 1 is presented as follows;

$$p(y_i = 1|x_i) = F(x_i'\beta) = F(z_i) \quad (1)$$

Where β is a $(k+1)$ dimensional column vector of parameters. The transformation function F maps the linear combination into $[0,1]$ and satisfies $F(-\infty) = 0$; $F(+\infty) = 1$ and $\frac{\partial F(z)}{\partial z} > 0$ (cumulative distribution function). When the transformation function F is the logistic function, the response probabilities are given by

$$p(y_i = 1|x_i) = \frac{e^{x_i'\beta}}{1 + e^{x_i'\beta}} \quad (2)$$

In an ordinal logistic regression model the outcome variable is ordered and has more the two levels. The ordinal variable is the marketing channel (1 = Traders at farm; 2 = Local market and 3= Urban/regional market) for Irish potato in Njombe. The logits in the model are cumulative categories above with categories at each point, contrasting categories above with categories below. The probabilities are attached to being in category and lower. However, the estimation rest on strong assumption that the latent error term is normally distributed and homoscedastic as well as the test for assumption of proportionality. To estimate $\ln(odds)$ of being at or below the j[th] category, the model can be rewritten as:

$$\log it[\, p(Y \le j|x_i) = \alpha_j + (-\beta_i x_i) \quad (3)$$

Where, α_j are the thresholds, and β_i are logit coefficients. This model predicts cumulative logits across $j-1$ response categories. Estimated cumulative odds and cumulative probabilities being at or below the j[th] category obtained by transforming the cumulative logits. The variables used in the model are summarised in table (1)

Table 1: Variable used in ordinal logistic regression

Variable	*Description*	*Measurement*
Channel	Main marketing channel	1=Traders at farm 2= Local market 3=Urban/regional market
Age	Age of household head	Years
Sex	Sex of household head	1=Male, 0=Female
Education	Education level of household head	Years
Quantity	Quantity of Irish potato harvested	Kilograms (Kg)
Area	Area cultivated Irish potato	Acres
Price	Price of Irish potato	Tanzania shilling
Distance	Distance to Njombe town	Kilometers (Km)
Mobility	Economic mobility of members	1=Urban mobility 0=Otherwise

5. Results and discussion

5.1 Structure of the Irish Potato Value Chain

The marketing of Irish potato is in many cases controlled by traders operating from Njombe Town, head quarter of

Njombe region. The district broker has an agent in the village that is responsible for collecting the information about the production and organizing the harvest and parking of Irish potato. The shaded green arrow indicates main channels of Irish potato from Njombe region. This channels used in selling large quantities of Irish potato from small farmer in the rural villages. Main marketing channel for Njombe Irish potato starts from small farmer to village traders/agents to district traders/brokers to Regional Traders then to market vendor. The width of the arrow in the Irish potato chain indicates volume of Irish potato though the identified channel

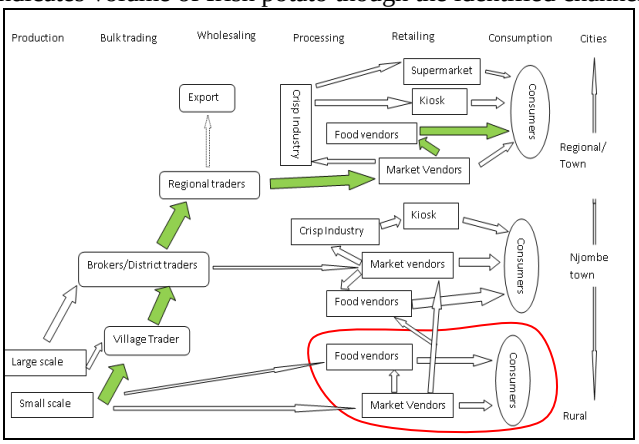

Figure 1: Irish potato value chain in Njombe region

5.2 Consumers of Irish potato

Population increase in the urban areas offers the potential market for the Irish potato, due to change of demand and preference. In the rural area there increase of the use of the Irish potato beyond the traditional uses, such as boiling of the potato. The needs for the fast food like crisp and fried chips results into increased consumption of the Irish potato in rural and urban areas. The increased of the consumption of the Irish potato in the rural area are indicated by increasing number of chips make vendor in the rural village. In the other hand the urban area increased of the consumption of the Irish potato due to the change of demand in the food. Most of population in the urban (city) area depends on the fast food where fried chips and crisp is one of them.

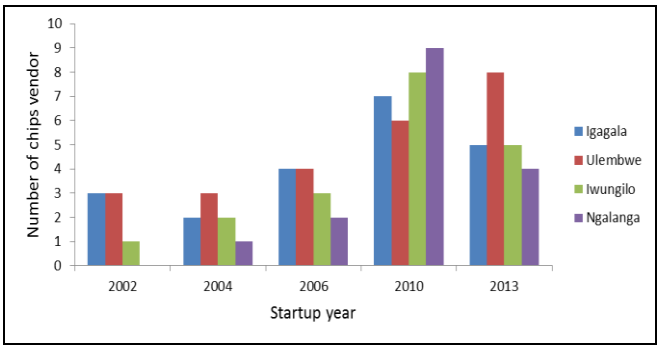

Figure 2: Startup year for chips vendor in year 2014

5.3 Irish Potato marketing at Njombe region

Form of selling of the Irish potato for the farmers are mainly depends on the spot selling of the Irish potato produced. Farmers mostly sell the produce in mainly tree options table (2). Majority (61.3%) of the farmer uses the traders at farm used in buying Irish potato from farmers. Few (6.5%) of them sell the produce to the urban market and regional market

Table 2: Marketing channel used mostly by farmers

Channel	*Frequency*	*Percentage*
Urban/Regional	28	6.5
Local Market	138	32.2
Traders at farm	263	61.3
Total	429	100

5.4 Choice for Irish potato marketing channel

A proportional odd model was fit with nine explanatory variables. Before the interpretation of results, the assumption of proportional odds was first examined, shows the results of Brant test of parallel regression (Proportional odds) assumption for the nine predictor and test for each independent variable. The Brant test of parallel regression assumption ($\lambda_9^2 = 7.32$, $(p = 0.604)$), indicating that the proportional odds assumption for the model was upheld. This suggests that the effect of explanatory variables (Sex, Age, Education level, Household size, cultivated land, Distance to Njombe, Price, Quantity sold, Mobility) was constant across separate binary models fit to the cumulative cut points.

Table 3: Brant test of parallel regression assumption

Variable	*Chi²*	*p>chi²*	*df*
All	7.32	0.604	9
Sex	0.48	0.489	1
Age	0.01	0.906	1
Education	0.03	0.866	1
Size	1.17	0.279	1
Area	0.10	0.757	1
Distance	1.67	0.197	1
Price	1.03	0.310	1
Quantity	0.63	0.428	1
Mobility	3.53	0.060	1

Thus independent variables were tested for multicollinearity using correlation coefficient analysis of the explanatory variables, prior to the estimation [31]. The results shows that there is no severe multicollineality between the explanatory variable since all correlation coefficient (r<0.8), Table (4) shows the results for the fitting model with nine explanatory variables. The log likelihood ratio chi-square test with nine degree of freedom (LR $chi^2(9)$ = 26.68, p = 0.0016), indicating that the model with nine predictor provides a better fit than the null model with no independent variables in predicting cumulative probability for Irish potato marketing.

Table 1: Ordered logistic regression

Variables	*Coef.*	*Std.Err.*
Sex	-0.27417	0.25120
Age	-0.00808	0.00916
Education	0.00670	0.04412
Size	0.11302**	0.05731
Area	-0.17722**	0.06910
Distance	-0.01906**	0.00789
Price	0.00687***	0.00230
Quantity	3.05e-06	0.00001
Mobility	-0.18091	0.11708

Note: level of significance: *p<0.10, **p<0.05, ***p<0.000

In terms of odds ratios (OR) the land cultivated with a corresponding odds ratios ($e^{(-0.17722)} = 0.8375$) significant less than 1.0 has significant negative effects in the model. These cumulative odds are associated with a farmer being in lower marketing channel categories rather than in higher categories. For one unit increase in the land cultivated, the odds ratio of being in higher marketing categories versus lower categories was 0.8375 times lower, after controlling for the effect of other variables. However, the distance to Njombe town with a corresponding odds ratios ($e^{(-0.01906)} = 0.9811$) significant less than 1.0 has significant negative effects in the model. For one unit increase in the distance to Njombe town, the odds ratio of being in higher marketing categories versus lower categories was 0.9811 times lower, after controlling for the effect of other variables

Variables with corresponding odds ratios are significantly greater than 1.0 have significant positive effect on the response variable in the model. The household size has corresponding odds ratios ($e^{(0.11302)} = 1.1196$) had a positive effect on farmers being in higher marketing channel categories. For one unit increase in the household size, the odds ratio of being in higher marketing categories versus lower categories was 1.1196 times greater, after controlling for the effect of other variables. Whereas, the price sold has corresponding odds ratios ($e^{(0.00687)} = 1.0069$) had a positive effect on farmers being in higher marketing channel categories. For one unit increase in the price sold, the odds ratio of being in higher marketing categories versus lower categories was 1.0069 times greater, given the effect of other predictors are held constant.
The variable like mobility had corresponding odds ratios ($e^{(-0.18091)} = 0.8345$) less than 1.0, but were not statistically significant. It had a negative effect on the response variable, but these effects may be due to chance.

6. Conclusion and recommendations

Rural-urban linkages results into restructuring of the value chain at all level. Productivity and efficiency are essential in the upgrading smallholder farmer for the high value market and having positive effect in the competition in the value chain. Household need access to information on inputs and market, and leaning opportunity to change way of production to increase productivity and efficiency. In terms of the production the changes in the production of Irish potato is due to the increase of farm size, more use of the fertilizer and pesticides, use of irrigation technology

Increased production of the Irish potato in the areas and accessibility to urban and rural market creates more economic activities for the household member. Likewise it enhance in the changing of farming practices done by the household. The Irish potato transformation has improved rural incomes and livelihoods in general. It has also increased demand for labour (hired as well as family labour), land and other inputs not only for Irish potato but for maize as well the main staple crop

Transformation of Irish potato has also resulted in emergence of new actors and/or increase in number of actors that undertake specialized activities in the value chain. These include rural villagers that have specialized in harvesting (mostly women), packaging (mostly youth-boys), transporters (mostly adult men), and village agents (traders, mostly youth boys and few girls). In urban areas new actors include urban agents (mostly adult men), loading and unloading; peeling potatoes (mostly women) and retailers (women and men)

Lack of farmers group in the area make them weak to compete with the village and district/urban trader in the price of the Irish potato, despite to the rural-urban linkages they have still they face difficulties in the selling their produce direct to the urban buyer. This cause the more actors in the value chain of Irish potato hence farmers are the one who are getting losses in selling Irish potato. Formation of groups will help farmer in accessing credit and having more bargaining power, hence strengthen the market linkage within the value chain

Understanding how the value chains operate is a vital for the developing agenda for firm and policymakers. The way chains are structured has implications for the new actors in the chain. The emphasis should be in the development of appropriate partnerships between players in the Irish potato value chain. This will insure the benefit to all participating in the chain

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