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Title: Agricultural transformation and proximity to urban centres: Exploring win-win options for youth involvement in Ethiopia.

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Abstract:

Urban centres in Africa and their surrounding hinterlands are reeling under the unprecedented influx of new migrants, the majority of who are the unemployed youth. Youth unemployment is not only a challenge threatening the economic performance of centres but a general concern to the overall economic development of the concerned national economies. The burgeoning youthful populations in such centres and associated land scarcity issues present a big challenge in promoting agricultural transformation strategies that seek to absorb the youth into the farming business. While proximity to urban centres is a challenge, this analysis holds that there are certain agricultural transformation based attributes that make certain urban centres more favourable and others less favourable to mainstreaming youth involvement into the farming business in or around urban centres. With no imminent indications of backward migration, questions of where and how actual and aspiring youthful farmers can circumvent agricultural challenges and realize better welfare outcomes need to be addressed. Using secondary data from official government's sources, this analysis evaluates the conduciveness of agricultural business for the youth in 23 Ethiopian cities. It first develops an indicator system that defines conduciveness within the context of farm proximity to urban centres. To develop such an indicator system we borrowed insights from literature on agricultural intensification and agricultural transformation. Prior to analysis we assessed our study constructs for homogeneity and dimensionality. Building on Principal Components Analysis (PCA), we then used a hierarchical segmentation based clustering approach to create unique clusters of cities that depicted different welfare outcomes for the youth involvement in farming business. The relative stability of such *clusters was assessed through the Kruskall Wallas H – one way ANOVA test. The relative importance of the welfare defining indicators which ultimately shaped the identification of what we have referred to as win-win options to youth involvement in agricultural transformation was assessed by a combination of hierarchical clustering and two-step clustering technique. The analysis reveals three distinct clusters of urban centres. One cluster relates to densely populated urban centres associated with rapid urbanization trends, with relatively little amount of unused urban land, weak land use and spatial planning policy and weak development control mechanisms. The other cluster is characterised by high urbanization trends, little amount of unused urban land but with relatively better land use and spatial planning policy and better development control. The third and final cluster is made up of small urban centres and some medium sized urban centres and is characterised by low population growth trends, with some pockets of unused land, but with constrained land governance, land use and spatial planning policy as well as weak development control. We observe that such cluster attributes when combined with data on the availability of and pricing of agricultural inputs, the market prices for the produce, the relative connectivity of farmers to markets, water harvesting and energy options for farmers, environmental integrity, the general altitude and pedology of the urban landscape and the prevailing weather conditions, win-win scenarios can be generated. The win-win scenarios generated are such that the positive welfare outcomes of involving the youth as defined by prospects of increasing returns to investment in agriculture are realized without compromising land governance, spatial planning and environmental planning requirements of the concerned urban environments. The analysis concludes with some broad policy implications of the results on the prospects of involving the youth in agricultural transformation efforts in and around urban centres of Ethiopia.*

Introduction

Rapid urbanization together with the extraordinary growth of cities has seen half of the world's population residing in urban centers (UNDESA, 2013).With much of this growth expected to occur in urban centers of Africa and Asia (Reviet al., 2014; Taylor and Peter, 2014), cities in these regions face significant adjustment pressures, as poverty becomes increasingly urbanized, demand for urban services swells, and as cities exert greater influence on peri-urban and rural livelihoods and environments (Forster and Escudero, 2014: Padgham et al., 2015). The multiplicity of challenges and uncertainties associated with the growing urban footprint are accentuated by emerging patterns of youth unemployment. Urban centres in Africa and their surrounding hinterlands are reeling under the unprecedented influx of new citizens and migrants, the majority of who are the unemployed youth. In Sub-Saharan Africa (SSA) alone, the UN estimates that the number of people living in cities has grown by 160% between 1990 and 2014 and that this number is further expected to triple to 1.3 billion people in 2050 (UN 2014). Youth unemployment is not only a challenge threatening the economic performance of centres but a general concern to the overall economic development of the concerned national economies. The burgeoning youthful populations in and around such centres and associated land scarcity issues present a big challenge in promoting growth and agricultural transformation strategies that seek to absorb the youth into the farming business.

The possibility of promoting agricultural growth and transformation development strategies in urban and peri- urban areas (UPA) has seen concerns over food security, income inequalities and youth employment gaining traction in recent years (FAO, 2012; Padgham et al., 2015). UPA resides within the current urban food security and youth unemployment discourse, and where it is viewed by some scholars as an important entry point for addressing both urban food security challenges as well as problems relating to youth unemployment (FAO, 2012; Padgham et al., 2015). While research scholarship does not seem to accumulate and converge on the precise contribution of UPA to problems of urban food security (see Crush et al., 2012 Battersby, 2013; Frayne et al., 2014), there is a general consensus that UPA plays a critical role in dealing with problems of unemployment.

While proximity to urban centres may be a critical challenge as depicted by declining per capita farm sizes around some urban centres (Josephson et al., 2014), this analysis holds that there are certain agricultural growth and transformation attributes that make certain urban centres more favourable and others less favourable to mainstreaming youth involvement into the farming business. Our contention is not misplaced as other scholars have warned against looking for universal success from UPA (Padgham et al., 2015). When embedded in a wider agricultural growth and transformation as well as the urban development strategy, there are varying degrees to the reality and potential of involving the youth in UPA – a scenario that can be attributed to variations in factor attributes associated with proximity to urban centres. Vandercasteelen et al., (2016) for instance observed that proximity to urban centres had important implications on the production behaviour of staple crop producers in Ethiopia. With no imminent indications of backward urbanization trends, questions of where and how actual and aspiring youthful farmers can circumvent agricultural challenges and realize better welfare outcomes need to be addressed.

Rising urbanization and other territorial attributes characterizing UPA presents various challenges and prospects to achieving agricultural growth and transformation and subsequently the ability of such landscapes to create employment opportunities in the agricultural sector. While UPA may indeed offer potential to mainstreaming youth involvement in agricultural growth and transformation initiatives associated with the farming business, the knowledge base to support this position and to indicate where conditions are most favourable is quite tenuous.

In this analysis we argue that any prospects of mainstreaming youth involvement in agricultural growth and transformation are to a large extent moderated by unique characteristics of different urban and the surrounding rural spaces – attributes that we refer to as urban proximity related. Many related studies in this field has often failed fail to employ a multiple criteria based evaluation that depict complex and interrelated attributes that make certain UPA better placed for stimulating youth employment in agro-business. Variations in spatial policies, institutional and technological capabilities of different urban as well as the unique ecological fabric of each urban setting certainly create different levels of risks to agricultural transformation. Yet research and practices associated with youth, agricultural transformation and urban proximity have largely remained uninformed by appropriate territorial studies that recognize the uniqueness of different urban and surrounding rural spaces and their associated variations urbanization or urbanism induced threats to agricultural growth (Dodman et al., 2017). Existing literature and data sets do not capture adequately the way that current patterns of urban development are shaping the types and levels of risk in sub-Saharan urban areas (Potts et al., 2012; Turok and McGranahan, 2013), that ultimately have important repercussions of involving the youth in UPA.

The paper is built up as follows; the next section presents the conceptual framework and associated analytical framework and methodology utilized for gathering and interpreting the data obtained. It then introduces briefly the Ethiopian context with regards to urban land use and the Ethiopia’s

Agricultural Growth Plan (AGP). A detailed discussion of methodological issues is then given before the discussion of the main findings is made. Finally the paper will conclude by giving some concluding remarks.

City proximity, agricultural growth and transformation: emerging issues

Research scholarship on urban proximity and its impact on agriculture in Africa is relatively recent and starting to gain momentum. Existing empirical evidence suggest that creating opportunities for employment in the agricultural sector, around urban centres varies according to the extent to which related activities are in proximity to such urban environments. There is ample evidence, largely drawn from SSA, indicating that rising population trends in cities have not only led to urban sprawl but also to loss of land for agriculture and the associated decline in per capita farm sizes (Josephson et al., 2014; Vandercasteelen et al., 2016). Owing to urbanization and urbanism induced challenges and other unique factors associated with urban proximity (see Potts et al., 2012; Turok and McGranahan, 2013; Dodman et al., 2017), most research scholars and development institutions concur that employment creation in the agricultural sector of the urban hinterland can only be realized by inducing a transformation towards higher agricultural productivity levels (Wiggins 2000; World Bank 2008, Christiaensen et al. 2011, FAO 2015; von Grebmer et al. 2015). Achieving higher agricultural productivity levels will certainly require the adoption of agricultural growth and transformation strategies that tap on existing and potential technological capabilities offered by prospective farmers and support received from government agencies. This contention is not misplaced if we draw important precepts from the much touted 'Boserup hypotheses' in agriculture literature. Taking the cue from Boserup, (1956), we observe that growing population densities, and the associated increases in land pressure, is the prime cause of the need for technological change in agriculture sector.

A review of literature relating to land constraints and farming systems in Africa (see Headey and Jayne 2014, Ricker-Gilbert et al. 2014, Muyanga and Jayne 2014, Headey et al. 2014, Josephson et al. 2014) has revealed the importance of adopting agricultural growth and transformation strategies that not only build on technological change but also on agricultural intensification and host of other related drivers of transformation in the sector. Extensification as an alternative agricultural development strategy in peri-urban environments does not work owing to land scarcity challenges. This is because extensification requires large tracts of land where increased production through expansion of cultivated areas is possible (Carswell, 2000).To this end, several drivers of agricultural growth and transformation have been identified in literature. We contend in this analysis that such drivers represent factor conditions characterizing the unique circumstances that confront farming business in urban hinterlands of African cities. And that such factor conditions vary both in time and space to the extent that they result in different farming outcomes that have different consequences on the prospects of engaging the youth into the farming business. Given this, questions of where and how actual and aspiring youthful farmers can circumvent agricultural challenges and realize better welfare outcomes need to be addressed. To do this we recommend borrowing insights from vulnerability literature as extant literature on agricultural growth and transformation often begins by citing constraints and / or limitations that often leave certain geographical locations vulnerable to the absence of certain factor conditions (Dodman et ., 2017) that are responsible for stimulating growth and transformation in urban and peri-urban environments. Accepting this, allows us to distinguish between four main dimensions of vulnerability, including engineering or physical, socio-economic, governance or institutional and ecological or natural (Mose, 1998; Folke, 2006). This assumption is not misplaced as other scholars such as Folke, (2006) have noted that vulnerability as a concept, analytically embraces ecological, engineering and / or physical, political and socio-economic capacities of a given territory. This distinction is in line with the general observations made research scholars and empirical evidence relating to agricultural growth and transformation experiences in SSA. Existing agricultural literature and experiences drawn from SSA, have revealed that agricultural growth and transformation in any environment will depend on such factors as farmers' resource endowment, agro-ecological conditions, economic conditions, policies, market situation, institutions and technological options among other factors (Williams et al., 2000; Aune and Bationo, 2008). Such a distinction allows us to identify and assess the extent to which geographical settings of different peri-urban environments can be harnessed to create a win-win situation for engaging the youth in the growth and transformation strategy of the agricultural sector. Since these factors vary from one region to the next, there will not be only one trajectory for mainstreaming youth involvement in agricultural growth and transformation in peri-urban regions, but the trajectories will vary depending on the factors mentioned above.

Engineering / physical

The engineering component builds on the main theoretical concepts associated with engineering and / physical vulnerability. Taking the cue from system Johnson et al., (2016) engineering vulnerability in the context of this analysis assesses how prone a (urban) system's ability to return to steady state is after disturbance event that affect the agricultural growth and transformation integrity of that ecosystem. A stead state in this case can be thought of as 'effective agricultural transformation that does not compromise the environmental integrity of the exploited urban ecosystems while a disturbing event can be any engineering or physical planning related activity or process resulting in poor agricultural outcomes. A number of factor conditions that are indicative of physical planning and / engineering related shortcomings have been identified in agro-literature. These include a wide range of technological innovation in the agricultural sector which are critical for agricultural intensification as they help reduce the risks and keeping the cost in agricultural production to a minimum (see Aune and Bationo, 2008). Also included are technical innovations such as improved seed, improved irrigation systems, size of land cultivated and associated agricultural yields. A host of engineering variables depicting urban proximity and its challenges are also included and these include physical distance to the markets, road connectivity and associated urban infrastructures, and patterns of land informality among others.

Socio-economic

Following the cue from Adger and Kelly, (1999) it can be argued that the ability of urban communities to cope with and adapt to any external stress placed on farming by urbanization and urbanism is largely a function of the socio-economic setting of that community. A multitude of socio-economic factors are therefore in principle responsible for the inability by some urban communities to withstand urban proximity related challenges on agricultural transformation and employment creation (Eidsvig et al., 2011).

One of the most documented soco-economic factor condition necessary for agricultural growth and transformation is population growth. There is ample evidence coming largely from Asia and Africa that indicates how population growth and other urbanization associated variables have induced growth and transformation in the agricultural sector. Jakovac et al., (2016) maintains that population growth in Asia and Africa has pushed traditional agriculture toward intensification. In addition to population growth, other literatures have singled out changes in market demand and public policies as other critical drivers of change in the agricultural sector (Mertz et al., 2009; Padoch, 2010). Aune and Bationo, (2008) have also noted that the adoption of a capital led agricultural development pathway requires more market integration as products will have to be sold for purchasing inputs. Such conditions are market conditions are more readily available in areas in close proximity to larger urban centres that smaller urban centres. This and other related factors makes city size a critical variable in assessing the prospects of stimulating youth employment I peri urban environments. It is argued that the intricate relationship that exist between these and other socio-economic variables and associated dynamism across spatial scales are responsible for creating a situation where some farmers exit the agro industry, or decide to replace the existing systems with other agricultural systems or go for intensification (van Vliet et al., 2012). Building on Boserup's (1965) characterization, and later that of Struik et al., (2014) this analysis defines agricultural intensification as a process of increasing input per unit of land per unit of time. Despite land scarcity in UPA environments, access to land particularly the amount of land that is still available for cultivation is an important socio-economic variable to consider (Padgham et al., 2015).

Governance / Institutional

Management and institutional requirements for agricultural intensification are extensively reviewed in Aune and Bationo, (2008). Supportive public policies are a necessary precondition for achieving agricultural transformation (Mertz et al., 2009; Padoch, 2010). Most farmers in Africa are severely constrained in terms of capital that is crucial in supporting a capital led intensification strategy. Such an agricultural transformation strategy often requires huge capital outlays that may promote more use of inputs such as fertiliser, pesticides, and agricultural equipment per unit of land (Carswell, 2000). In sustainable UPA literature, the need for sound environmental and land-use management policy that balances the demand for land for UPA and other competing uses is required. It is argued for instance that sound environmental policies that enable the quantification of ecosystem services that need to be safeguarded against urban encroachment and the rapidly increasing demand for both agricultural and non-agricultural uses of urban land and water resources (Lwasa et al., 2014; Moglia, 2014) are likely to generate a win-win scenario in which both youth employment is in UPA is promoted but not at the expense of other important urban land-uses and the general need of protecting the integrity of the environment.

Ecological / Natural

A number of studies have revealed that agricultural growth and transformation as manifested in most cases through agricultural intensification has been successful in environments where agro-ecological conditions are more favourable (Aune and Bationo, 2008). Other studies have explored the possibility of agricultural transformation in less favourable agro-ecological conditions such as those that characterise the Shel region of West Africa (see Aune and Bationo, 2008) and have come to the conclusion that more investments are needed if returns are to be maximized. Access to water resources is an important consideration that needs to be made when exploring agricultural growth and transformation pathways of different urban environments (Padgham et al., 2015).

The analytical framework

Our proposed analytical framework builds on the four vulnerability dimensions discussed in the preceding sections and a review of a host of threat assessment frameworks often used to assess vulnerability of agricultural systems to urbanization and urbanism induced risks. We developed an indicator system that could be employed in indicating where win- win options for mainstreaming you involvement in agricultural growth and transformation. Such and indicator system is shown in figure 1. As suggested in figure 1, win-win options for mainstreaming youth involvement in agricultural growth and transformation initiatives in areas that are in close proximity with urban centres are a function of intricate interactions between a host of urban proximity / transformation variables. Four important win-win outcomes are possible as described in Table 1.

Table 1. Win-Win trajectories for youth involvement

Win- Win trajectories	**Description**
Scenario one: Win-Win	Conditions for maximizing youth involvement and welfare outcomes through agricultural growth and transformation exist and so are the conditions for maintaining the land- use planning and environmental planning integrity of the urban centre.
Scenario two: Win - lose	Conditions for maximizing youth involvement and welfare outcomes through agricultural growth and transformation exist but conditions for maintaining the land- use planning and environmental planning integrity of the urban centre do not exist.
Scenario three: Lose - Win	Conditions for maximizing youth involvement and welfare outcomes through agricultural growth and transformation do not exist but conditions for maintaining the land- use planning and environmental planning integrity of the urban centre do exist.
Scenario three: Lose - lose	Conditions for both maximizing youth involvement and welfare outcomes through agricultural growth and transformation and for maintaining the land- use planning and environmental planning integrity of the urban centre do not exist.

The Ethiopian context

Ethiopia covers an area of 1,127,127 square kilometers, of which an estimated 34% is agricultural, 9.6% is arable, an estimated 3.6 is forested, and 48.9% is covered by woodlands and shrubs. Only 4.5% of arable land is irrigated. Protected areas encompass 14% of Ethiopia's land area. An estimated 15 of Ethiopia's approximately 80.7 million people live in urban areas, making it one of the least urbanized counties in the world. With eighty percent of all Ethiopians depending, either directly or indirectly, upon agricultural and livestock production for their livelihoods, this low degree of urbanization highlights the possibility and prospects of attracting the youth into UPA. Data from 2007 estimates, indicate that agriculture and allied activities comprised 43% of Ethiopia's GDP (WRI 2007; Seleshi 2010; CBD 2009; EIU 2008). Agriculture currently accounts for about 45% of GDP, approximately 90% of exports, and 85% of employment. The critical role that agriculture plays in the country makes it an ideal sector to explore ways in which the youth can have a stake in the economy in general and in agro-business in particular. Prospects of mainstream youth involvement in agriculture currently lie in crop production as this sector alone contributes to 35% of GDP. In both area and value, cereals account for approximately 80% of crop production.

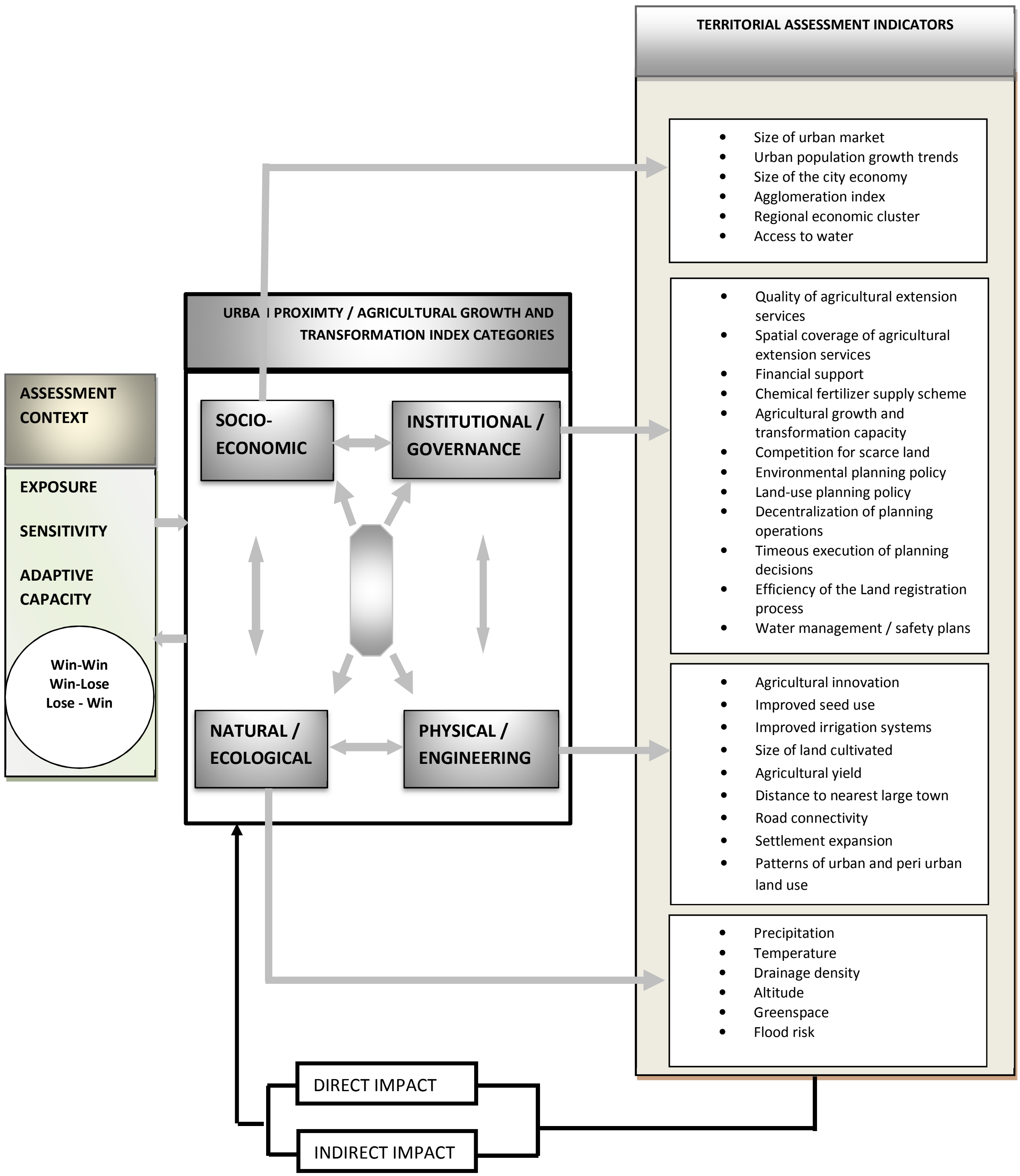


Figure 1: The proposed Assessment Framework

With support from the United Nations Development Programme (UNDP), Ethiopia instituted five year Agricultural Growth Plan (AGPI) in 2011 (Selamawit, 2017). The Country has just com[pleted the first cycle and is on the second AGP. The development objective of the Second Agricultural Growth Project for Ethiopia is to increase agricultural productivity and commercialization of small holder farmers. The plan comprises of five components, namely agricultural public support services; agricultural research, small scale irrigation, agriculture marketing and value chains; and project management, capacity building, and monitoring and evaluation.

Materials and Methods

Data on a number of agricultural growth and transformation attributes from was obtained mainly from the Ethiopia's Agricultural Growth Plan (AGPI) baseline, (2011 - 2016), Agricultural Growth Programme – Agribusiness Marketing and Development Project (AMDe), Midterm Evaluation Report, February, (2015) and the AGP II, (2017). Where statistics were missing average statistics within the neighbouring regions were used. Where city specific data was not available, averages within the region were used. Data on other important urban proximity and land use planning and environmental planning integrity variables was solicited mainly from Ethiopia's Growth and Transformation Plan II (GTP II) (2015/16-2019/20); State of Ethiopian Cities Report - SECR, (2015); Urban Waste NAMA (Nationally Appropriate Mitigation Actions) - (2016). Central Statistical Agency of Ethiopia, (2013); and the Environmental Policy Update 2012. Details on how variables were defined and measured including they respective data source are supplied in Appendix 1.

Statistical procedures

Prior to resolving the indicators, raw data were processed for "homogenization" and "non-dimensionality" which is a standard requirement as there can then be questions of examining the homogeneity across sites of the distribution of the scaled values (Hall, 2003). Study constructs were first tested for normality. Building on the centrality of the study constructs, Eco hydrological indicator variables were explored for reliability and validity through Exploratory Factor Analysis (EFA) using the Principal Component Analysis (PCA) method with varimax rotation. Important measures of reliability and validity were computed, including Cronbach's alpha, Composite reliability and the Average Variance Extracted (VE). Reliability was tested using Cronbach Alpha and the Composite reliability statistic. Both statistical measures sought to estimate internal consistency associated with the scores derived from the data scales (Hair et al, 2009). Composite reliability (CR) was calculated using the following formula provided by Raykov, (1997);

$$CR = \frac{\left(\sum \lambda_i\right)^2}{\left(\sum \lambda_i\right)^2 + \left(\sum \epsilon_i\right)}$$

Whereby, λ (lambda) is the standardized factor loading for item *i* and ε is the respective error variance for item *i*. The error variance (ε) is estimated based on the value of the standardized loading (λ) as:

$$\epsilon_i = 1 - \lambda_i^2$$

The item r-square value is the percent of the variance of item *i,* explained by the latent variable. It is estimated based on the value of the standardized loading (λ) as:

$$r^2 = \lambda_i^2 = 1 - \epsilon_i$$

To evaluate discriminant validity, the average variance extracted (AVE) was used. The AVE is a measure of the amount of variance that is captured by a construct in relation to the amount of variance due to measurement error (Voorhees et al., 2015). The AVE was calculated as follows;

$$AVE = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum_i \mathrm{var}(\varepsilon_i)}$$

Where λ is the factor loading of item *i* and Var(ε) the variance of the error of item

The number of urban proximity / agricultural growth and transformation indicator variables to include in the final analysis was determined through Exploratory Factor Analysis (EFA). The EFA method employed used the basic assumptions underlying common factor models to determine which indicators or measured variables were associated with urban / proximity / agricultural transformation as the overall study construct.

Hierarchical Cluster Analysis

Hierarchical Cluster Analysis (HCA) was performed on the normalized data set, the analysis denotes prospects of mainstreaming youth involvement associated with variable i in town j as Yij. This outcome is represented in equation one as a function of the individual urban proximity / agricultural transformation characteristics, Xqij, and a model error rij (Bryk & Raudenbush, 1992).

$$\mathbf{Y_{ij} = \beta_{0j} + \beta_{1j}X_{1ij} + \beta_{2j}X_{2ij} + \ldots + \beta_{nj}X_{nij} + r_{ij}} \qquad \textbf{(Equation one)}$$

where $\mathbf{r_{ij} \sim N(0, \sigma^2)}$.

Cluster analysis (CA) allowed us to reduce the large number Ethiopian towns (23 in this case) into a small number of homogeneous groups, classified according to common urban proximity / agricultural growth and transformation attributes that depicted different win-win trajectories. The analysis adopted ‘Euclidean distance’, as a standard metric to calculate distances (interpreted as the similarity) between all objects in a data matrix. This was done on the basis that those objects (i.e. Ethiopian cities and towns) closer together are more alike than those objects further apart. To promote a more rigorous analytical approach, testing of alternative linkage and distance measures is advocated for (Mouchet et al., 2008; Hennig et al., 2015). For this reason, linkage algorithm options were explored, including comparison of distance based (e.g. single, average and complete) and variance based algorithms- (e.g.Ward) and evaluated (see Saraçli et al., 2013). An acceptable solution was achieved using Ward (minimum variance) distances. The basic Euclidean distance formula was used as there were no theoretical reasons to prefer a more complex formula, and other formulas did not produce substantially different or more interesting results. The adopted Ward's minimum variance method (which essentially minimizes the squared Euclidean distance) led to a decrease in variance for the cluster being merged. At each step, the pair of clusters merged was based on the optimal value of the error sum of squares as defined in equation 2.

$$d_{ij}= d(\{X_i\}, \{X_j\}) = || X_i- X_j||^2). \qquad \textbf{(Equation Two)}$$

where $\mathbf{d_{ij}}$ is the squared Euclidean distance between $\mathbf{x_i}$ and $\mathbf{x_j}$.

The results of hierarchical clustering were also visualized using a tree-like structure known as a ***dendrogram***. To guage the relative importance of predictors used for clustering the analysis used a two-step clustering process.

Results

For data analysis, the developed indicator system was first tested for validity and reliability in order to identify the extent to which study variables obtaining in the empirical environment really measured the proposed agricultural transformation and urban proximity study constructs. The construct presented, overall, adequate reliability and convergent validity. The discriminant validity was analysed by comparing the average variance extracted (AVE) to the square correlation between the constructs (see Table 2). Study constructs showed a higher AVE than the square correlation, which also indicates adequate discriminant validity (Fornell & Larcker, 1981).

Table 2: Normality, reliability and validity of study constructs

Study Construct	Construct Code	Number of items	Cronbach's alpha (>=0.6)	Composite reliability (>=0.6)	Average variance extracted (>=0.5)
Engineering/ physical	ENG	5	0.747	0.911	0.6720
Socio-economic	SE	4	0.744	0.897	0.7319
Institutional	INST	8	0.747	0.949	0.7356
Natural / ecological	NAT	4	0.555*	0.876	0.6411

Note: levels of acceptance according to Hair et al. (2009).

Since the independent variables are not constituted of constructs that have already been developed and validated in the literature, they were analysed by exploratory factor analysis (EFA). The EFA approach was considered useful as it would allow possible renaming of study constructs to cater for variables of overlapping nature. Data was explored using the Principal Component Method (PCA). PCA requires that the number of ***n*** **-**observation (in this case 23 Ethiopian towns) is greater than the number of ***p*****-**dimensions or variables under investigation (Mundfrom et al., 2005). Since in this analysis we investigated 21 study variables, this condition was satisfied. The matrix rotated by the Varimax method retained a latent data structure (see table 3) that can be compared to the basic elements of urban proximity / agricultural transformation that have been discussed in the preceding literature.

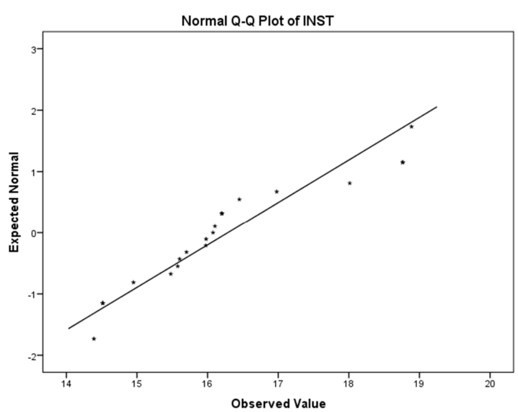
Table3. Rotated Component Matrix[a]

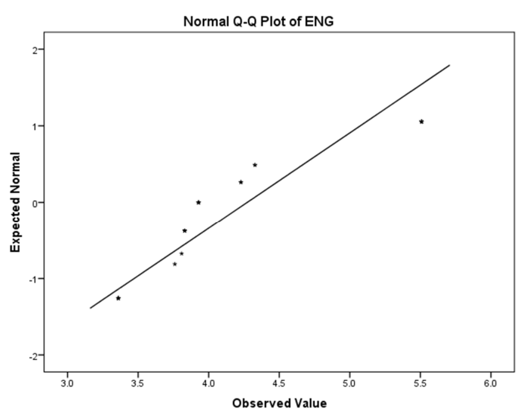
Variable Code	Study variables	Component			
		1	2	3	4
INST1	Spatial coverage of extension services	.960			
INST2	Chemical fertiliser support scheme	.890			
INST3	Financial support	.862		-.452	
INST4	Agricultural growth capacity	.717			.678
INST5	Competition over scarce land	-.617			
INST6	Quality of extension services	.557			
ENG1	Improved irrigation		.895		
ENG1	Distance to nearest large town		.876		
ENG3	Improved seed use	-.441	.837		
ENG4	Size of land cultivated		.740		
ENG5	Agriculture yield	.502	.737		
SE1	Agglomeration index			.885	
SE2	Access to water			.860	
SE3	Size of urban markets			.847	
SE4	Size of city economy			.711	
INST7	Environmental management policy				.918
INST8	Market potential				.894
INST9	Water quality management	.422			.833

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Before cluster analysis was performed, study constructs were explored for normality. As indicated in figure 2, there were no serious problems with regards to normality. The data obtained followed significantly a normal distribution.





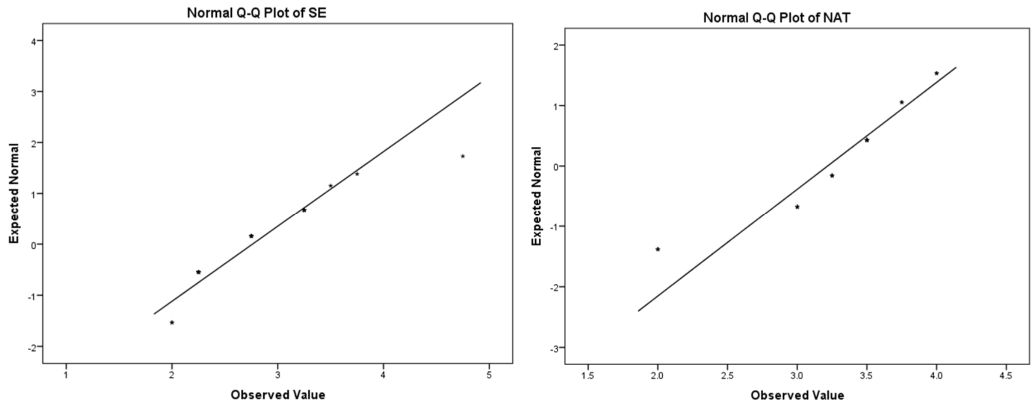


Figure 2. Test for normality.

We used HCA to determine unique clusters depicting different urban proximity / agricultural transformation outcomes with regards to prospects of creating viable employment for the youth in the sector. We first normalized our data since all clustering algorithms use a distance measure of some sort that is naturally affected by the scale of the variables (Cameron et al., 2008). The diverse scale variables used in this analysis were standardised using z scores. The computed agglomeration curve (see figure 3) indicates that we should consider using a three cluster solution.

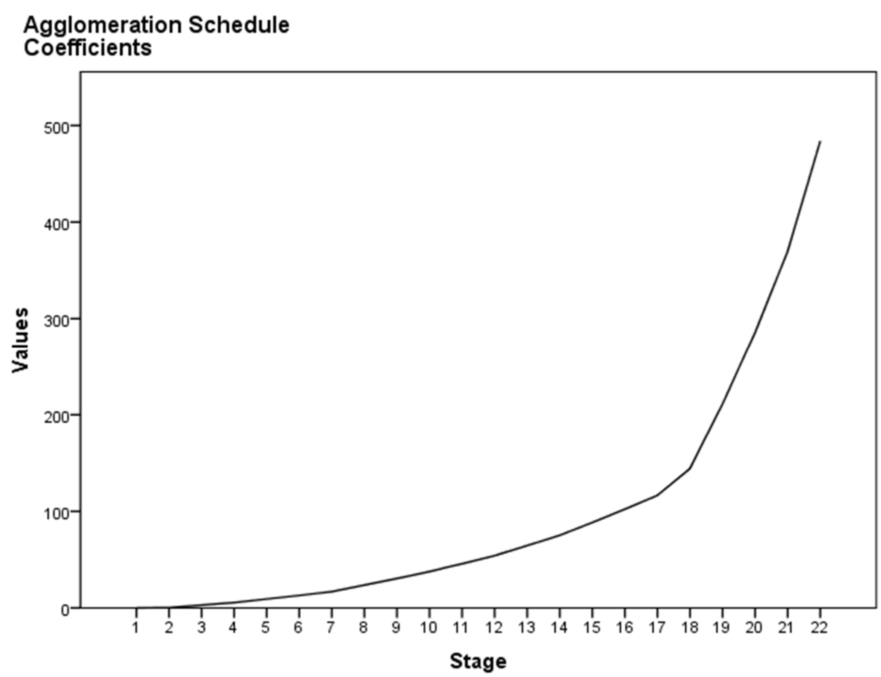


Figure 2: Agglomeration curve: Since the 'step of elbow' appears to be at case number 19, a three cluster solution should be used (i.e. 23 – 19 = 3).

The total number of cities/towns in each cluster is shown in table 4. Since the correlation structure in HCA is based on the assumption that data is correlated with a group/cluster, but independent between groups/clusters (Cameron et al., 2008), Bootstrapping was carried out to check the relative stability of the clusters created .

Table 4: Number of cities and / or towns occupying each cluster type

Cluster type	Number of cities / towns	Percent	Valid Percent	Cumulative Percent	Bootstrap for Percent[a]			
					Bias	Std. Error	BCa 95% Confidence Interval	
							Lower	Upper
1	9	39.1	39.1	39.1	.6	9.9	26.1	56.5
2	9	39.1	39.1	78.3	-.6	10.2	21.7	56.5
3	5	21.7	21.7	100.0	-.1	8.7	8.7	34.8
Total	23	100.0	100.0		.0	.0	.	.

a. Bootstrap results are based on 1000 bootstrap samples

Bootstrapping results revealed a relatively stable cluster system. A **Kruskal-Wallis** H - **test** revealed that the distribution of mean rank scores across all urban proximity/agricultural transformation attributes was not the same across all clusters and that such differences were significant ($\chi^2 = 22$; df = 2; P-value < 0.001). The **Kruskal**-**Wallis** H **test** (sometimes also called the "one-way **ANOVA** on ranks") is a rank-based non-parametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. The same test was used to make a pairwise comparison of individual clusters. Results revealed no serious cases of cluster overlap (see Table 5)

Table 4: Pairwise comparison of Clusters base on Kruskal-Wallis Test ANOVA test results

Pair description Cluster *a* - Cluster *b*	Test Statistic (χ^2)	Std. Error	Standardized Test Statistic	P-value
Cluster 1 – Cluster 2	-9.000	2.985	-4.051	.008
Cluster 1 – Cluster 3	-16.000	3.532	-4.530	.000
Cluster 2 – Cluster 3	-7000	3.532	-1.982	.047

Each row tests the null hypothesis that Cluster *a* and Cluster *b* distributions are the same. Asymptotic significances (2 sided tests) are displayed. The significance level is .05. Specific cluster membership is shown in figure 3.

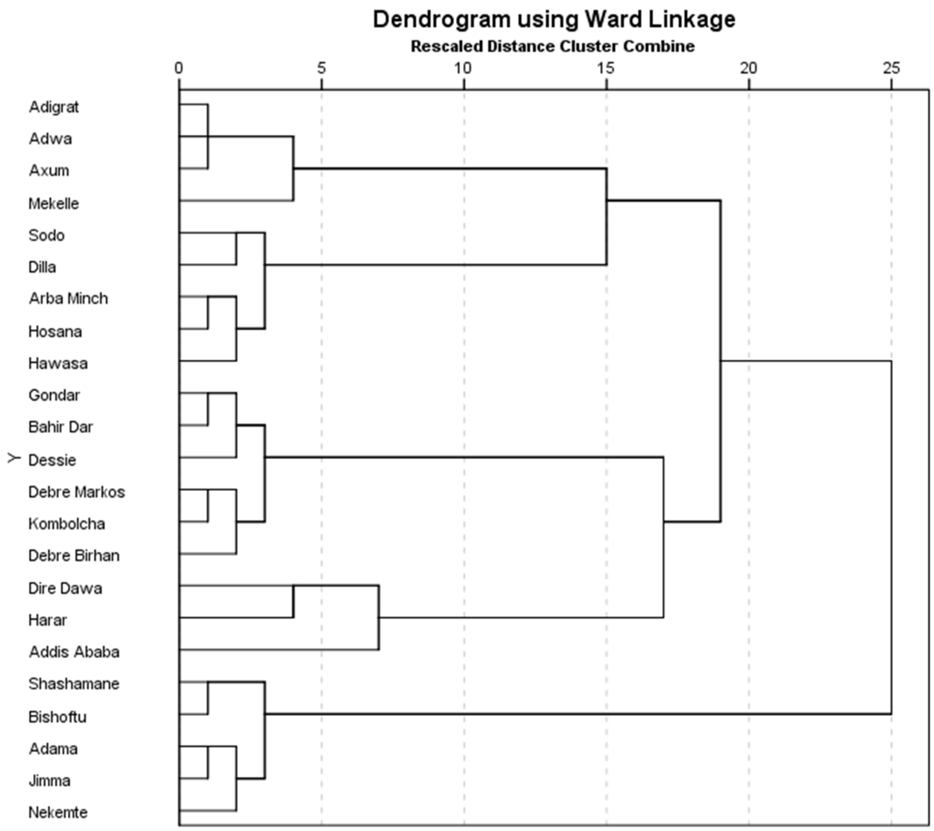


Figure 3. Specific cluster membership

Cluster description

Table 5 gives a brief description of each cluster based on the system assessment indicators used.

Table 5. Cluster Description.

Cluster Type	*Assessment indicator system*				
	Cities / Towns	*Engineering / Physical*	*Institutional / Governance*	*Soceo-Economic*	Natural / Ecological
1	Addis Ababa; Dire Dawa; Godar; Bar Hirda; Dessie; Harar; Debre Markos; Debre Birhan; Kombolcha	These towns are performing fairly on engineering attributes as they relate to offering better opportunities for agricultural growth and transformation. A fair number of innovative practices are already noticeable on the ground. Depending on the relative size of the town and the quality of urban infrastructure on the ground, heavy investments in agricultural infrastructure and related inputs in such areas as improved seed and improved irrigation systems may result in win – win options for youth involvement in agriculture.	These towns are fairly performing better than other towns in terms of supportive institutional structures and process targeted at boosting the agricultural growth and transformation drive. Agricultural growth and transformation is likely to be responsive to any institutional engineering and / institutional innovations that recognize the other unique characteristics of each town / city. Compared to cluster 3 towns, they are also relatively better placed in terms sound planning and environmental management, making such towns more capable of resisting the negative pressures associated with urbanization and urbanism.	These have the best soceo-economic fabric that that is responsible for the size of the market they offer for agricultural products.	They have the most favourable agro-ecological conditions that make the urban spaces conducing to agricultural business.
2	Mekelle; Hawassa; Sodo; Arba Minch; Hosana; Adigrat; Adwa; Axum; Dilla	These towns are performing better than all other clusters in terms of engineering attributes and in general offer in relative terms and	These towns are performing better than all other towns in terms of supportive institutional structures and process targeted at boosting	Though not at a scale of cluster 1 cities, this category also offer relatively better best socio-economic fabric that is responsible for the	They have a fairly favourable agro-ecological conditions that make the urban spaces to be fairly

		from an engineering perspective the best opportunities for agricultural growth and transformation. Heavy investments in agricultural infrastructure and related inputs in such areas as improved seed and improved irrigation systems are more likely to yield win – win options for youth involvement in agriculture.	the agricultural growth and transformation drive. Agricultural growth and transformation is likely to be more responsive to any institutional engineering and / institutional innovations that recognizes the other unique characteristics of town / city. They are also relatively better placed in terms sound planning and environmental management, making such towns more capable of resisting the negative pressures associated with urbanization and urbanism.	fairly good size of the market they offer for agricultural products.	conducive to agricultural business.
3	Adama; Jimma; Shashamane; Bishoftu; Nekemte	These towns are performing worse than all other clusters in terms of engineering attributes and in general offer in relative terms and from an engineering perspective the least opportunities for agricultural growth and transformation. Heavy investments in agricultural infrastructure and related inputs in such areas as improved seed and improved irrigation systems may not assist in generating win-win options for youth	These towns are least performing than all other towns in terms of supportive institutional structures and process targeted at boosting the agricultural growth and transformation drive. Given the current state, agricultural growth and transformation is less likely to be responsive to any institutional engineering and / institutional innovations that recognizes the other unique characteristics of the concerned town / city. They are also lagging behind in terms	These are severely concerned in certain demographics such as the number of farmers who have access to water. They are also constrained demographically (except Jimma and Adama) economically.	They have the least favourable agro-ecological conditions that make their urban spaces less conducing to agricultural business. Exception however do exist.

		involvement.	sound planning and environmental management, making such towns more vulnerable to negative pressures associated with urbanization and urbanism.		

While existing literature on agricultural growth and transformation maintains the general importance of promoting innovations in agricultural infrastructure, inputs, policies, market situation, institutions and technological options (Williams et al., 2000), at a meso-scale level, our analysis has also underscored the value of natural and / ecological factor conditions. A two-step clustering process to predict the relative importance of each predictor variable, revealed a relatively high ranking for ecological factors, followed by socio-economic urban settings, the institutional arrangements and lastly the engineering attributes. Such results are summarised in figure 4. With climate change high on the agenda, the high value attached to natural factors such as precipitation, temperature and flood events, should be of serious concern in future agricultural efforts that seek to align agricultural growth plans with employment creation.

Figure

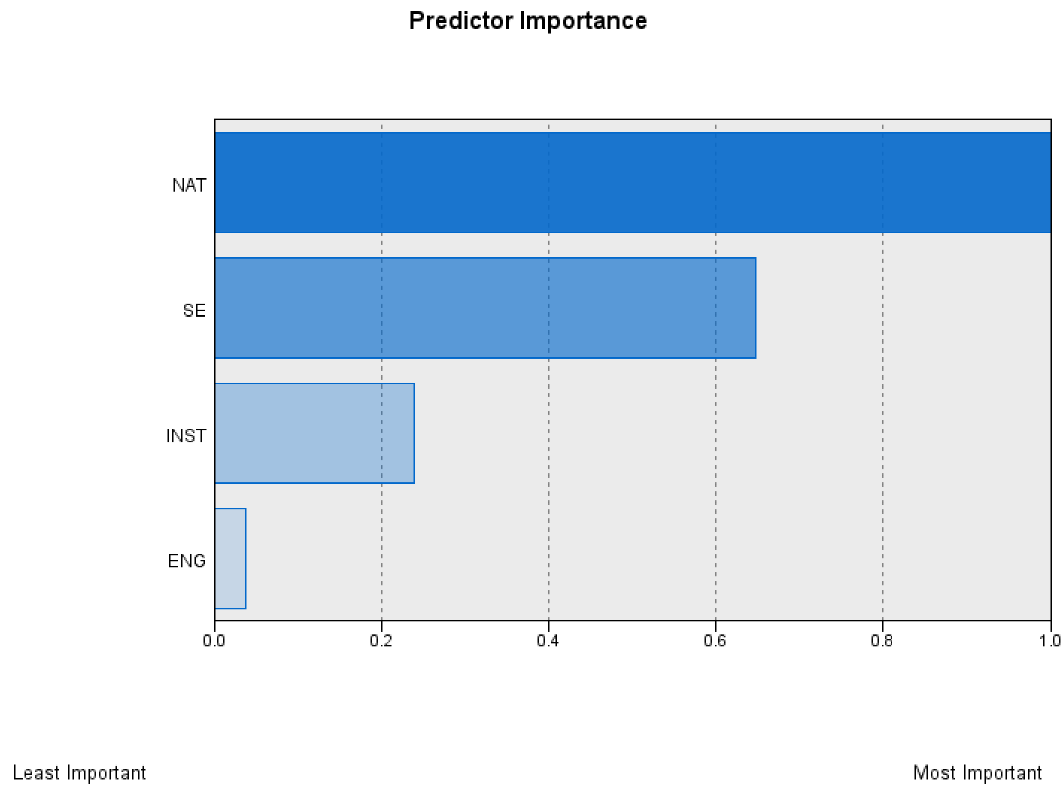


Figure 4: Predictor importance.

Concluding remarks

This analysis argued that urbanization and urbanism associated with cities and towns of Ethiopia presents various risks, threats and challenges that constrain any prospects of mainstreaming youth involvement in agricultural growth and transformation initiatives of the Ethiopian government. We have also argued that any efforts targeted at exploring ways in which to engage the youth into the farming should to a large extent be moderated by unique characteristics of different urban spaces – an attribute that we summed up as urban proximity characteristics. Despite the existence of a few studies that recognized urban proximity and its implications on agricultural growth and transformation, we have offered a unique and novel approach has employed a multiple criteria based cluster evaluation models in depicting how the complex and often interrelated territorial factors inherently associated with 23 Ethiopian towns and / or cities results in different agricultural growth and transformation trajectories leading into various outcomes in terms of prospects of involving the youth into urban and peri-urban agriculture. While such urban development trajectories might vary according to numerous other factors beyond the scope of this analysis, our work has taken a much more global and spatial perspective that will allow, policy makers prioritise agricultural growth and transformation initiatives on the basis of where action should take place. The assessment framework we presented has underscored the importance of considering urban proximity attributes using a vulnerability or a threat assessment lens that allows policy makers and development practitioners to target the most promising territories in terms of youth employment creation in the agro-industry. The need to incorporate the sustainability dimension in the urban development discourse has also been stressed in our approach as we emphasised on striking a balance between agriculture growth and transformation objectives and restoring the environmental integrity of the concerned urban ecosystems.

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