

Research Article

Effect of Drivers of Urban Expansion on Food Security in Moderating Role of Governance Response

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Abstract

This study examines effect of urban expansion on food security in moderating role of governance response in Addis Ababa. The purpose of the study was to create understanding regarding the nexus between drivers of urban expansion, peri-urban livelihood food security and the moderation role of the governance responses. The study design was concurrent explanatory design. It was concurrent explanatory cross sectional due to collection of both forms of data roughly at the same time. The data collected were analyzed by using structural equation model and thematic analysis. Both primary and secondary data sources were incorporated in this study for complementary and triangulation purposes. The data were collected from randomly selected exurban household heads of Limi Kura Sub-city (woreda 6 and 14) and Akaki Kality Sub-city (woreda 9 and 13). Of the total returned responses, 382 questionnaires, 52 interviewees of whom 36 for in-depth interviews and 16 for key informant interview (KII) were analyzed by using SPSS version 25, AMOS and MAXQDA 2020. The moderating role of the government abate the negative relationship between drivers of urban expansion and food security by 59%, the interview result suggests the need for strong institution framework and policy response to minimize the exposure of exurban households. Thus, the researcher suggested the strong governance intervention through institutional and policy intervention as well as revisiting alternative strategies of inclusive and sustainable development. Furthermore, the researcher also suggested the need to give attention to the issue of urban expansion swallowing of ecosystem service and posing threat to food security.

Keywords

Urban Expansion, Peri-urban, Food Security, Governance, Institution, Policy

1. Introduction

The governance of human activities and their effects on Ecosystem Services (ESS) have received less attention in research. The relationship between the natural and social systems and how humans govern Ecosystem Services is poorly understood. The simple dissemination of scientific information regarding the state of Ecosystem Services will

not be sufficient to stop the trend of ecosystems' declining conditions. To comprehend how humans regulate ecosystems, it will be required to have other types of knowledge, such as normative, traditional, and transformational knowledge [20].

The limited attention to policy implementation and governance in the ecosystem service context is surprising [20].

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Studies indicated that pure science on ecosystem emphasis on biodiversity conservation [24], which is not effective enough to change human behaviour. This reflected the need to assess how human activities, interaction and intervention affect ecosystem in order to achieve effective desired outcome, through analysing the policy implementation and analysing its practice empirically.

An integrated framework is required to assess the ecological implications of alternative urban development patterns and to develop policies to manage urban areas in the face of change. In particular, strategies for urban growth management will require such integrated knowledge to maintain ecological resilience by preventing development pressure on ecosystem services [24]. Most of the researches have applied the Shannon's Entropy model that uncontrolled expansion crossed the threshold of 0.5 entropy value [4].

Researches on Ecosystem service governance modes are geographically diversified. Decision-makers in well-studied areas can use a pool on studied arrangements, in other areas decision-makers may find limited literature to inform their decisions to maintain and strengthen ecosystem services [20]. Numerous researchers call for the consideration of the role of governance as a driver in the dynamics of the ecosystem services. They also suggested the importance of brief identify and synthesize of governance dimensions for sustainable transitions of cities in which social-ecological interaction(SEI) is prominent [19].

Interdisciplinary, landscape planning, and science-policy integration were seen as the most promising approaches to enhance Comprehensive Ecosystem (CES) policy and management. The Study result also showed that experts believe the Comprehensive Ecosystem (CES) concept is still far from being implemented in agricultural landscape policies. Therefore, to maintain such systems, they proposed better inter- and trans-disciplinary research for CES-integrative policy and decision-making [5].

Changes in land use / cover refer to changes in land features such as vegetation, soil, and climate, whereas changes in land use refer to changes in how humans use or manage land. Land cover change is caused by natural processes, but land use change is human-induced [24]. This change is responsible for many local and global effects, including biodiversity loss, habitat loss, and loss of ecosystem services [27].

Economists and policymakers have changed most of the world's land-use/land-cover in recent years [25]. To date, from the researcher's knowledge no national study has assessed the impact of Land Use Land Cover Change (LULCC) on ecosystem service values. Insufficient information result-

ed in a lack of emphasis on ecological services. So, for a long time, the issue of ecosystem services was ignored by all levels of government and the private sector. Unawareness of ecosystem services eroded the value of natural capital. Human actions, natural phenomena, and lack of strong systemic safeguard deteriorated potential sources of ecological services, posing challenges to human life [6].

Human settlements have replaced agricultural and natural ecosystems as a major component of global change [10]. By 2030, nearly half of the world's population will be living in cities according to UN report of 2018. It presents new governance challenges to manage urban green space in the context of an on-going social-ecological transition. Gathering and managing land to preserve or boost the flow of ecosystem services related to green places [9]

Many studies focus more on the physical assessment of landscapes change while paying little to no regard to the social-ecological-governance dimension from the perspective of the public policy, actors and professional viewpoints [2]. Alberti made the claim that human beings have an impact on ecosystem functions and that changes to ecosystem services also have an impact on human livelihood.

The concept of an ecosystem as a coupled human-ecological system that develops as a result of dynamic interactions between human and ecological functions is novel. Urban regions rely on ecosystems for important natural services [16]. Human well-being is impacted when ecosystems change--water bodies lose, vegetation, arable land is converted to built-up space, and so on—which causes food insecurity.

Above all the expansion of urban by consuming the neighbouring potential ecosystem service areas including agricultural land highly impacts the livelihood of agricultural dependent households. But, the impact of urban expansion on the peri-urban household livelihood either neglected or enveloped by the attention given to urban expansion initiative [3]. Therefore, these studies aim to investigate drivers of urban expansion effect on peri-urban household livelihood through moderation role of governance responses to fill gap and contribute in the world of academy.

Conceptual Framework

The study explores the impact of urban expansion drivers on peri-urban households experiencing food insecurity, with a specific focus on the moderating role of governance. The overall framework can be illustrated as follows. From this general framework, a second conceptual framework has been extracted for the purpose of this study.

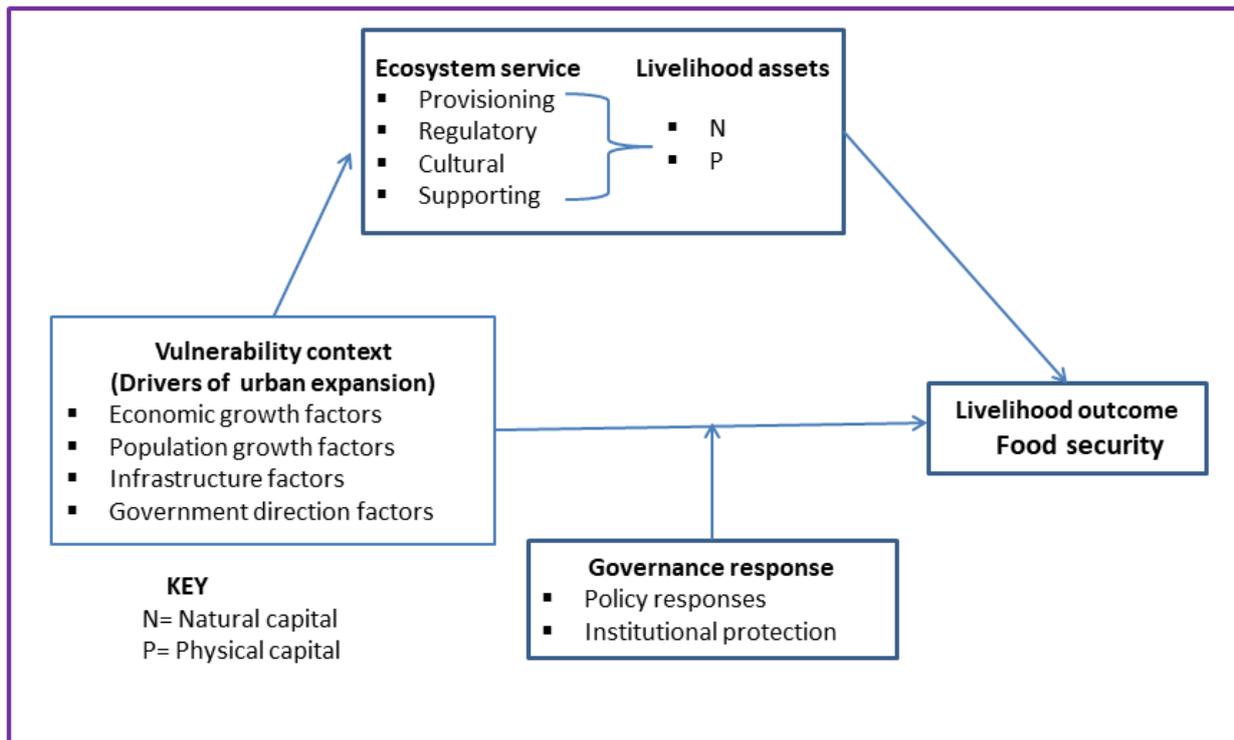


Figure 1. Conceptual framework of the study. Adapted from DFID (2000).

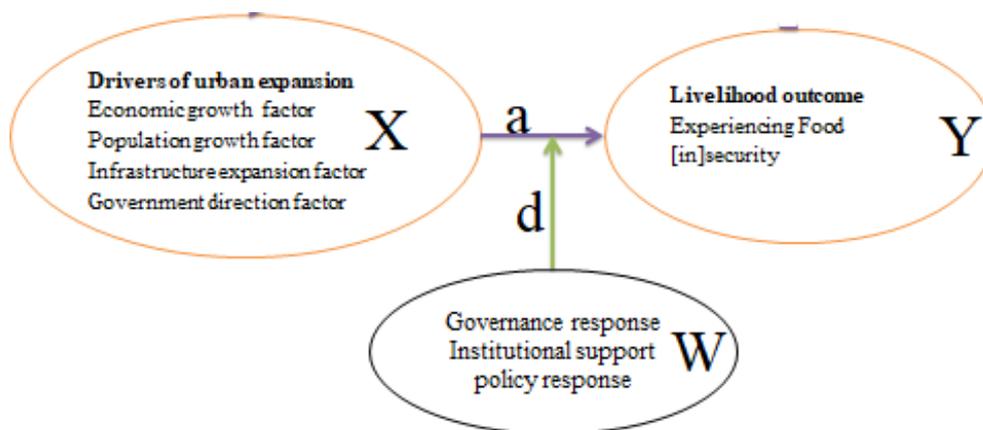


Figure 2. Model identification framework.

$$Y (FS) = \beta_0 + aX + d(X*W) + e \quad (1)$$

$$Y (FS) = \beta_0 + (DF*Gr) + e \quad (2)$$

Notice: FS= Food Security, DF=Drivers Force, Gr=Governance response

2. Methodology

This study is grounded in the philosophical framework of Pragmatism, which emphasizes a practical approach to knowledge acquisition and prioritizes the application of findings in real-world contexts. The research employs a

concurrent mixed-methods approach, integrating both qualitative and quantitative methodologies to provide a comprehensive understanding of the research problem. Specifically, the inquiry follows a non-experimental design that is suited to explore relationships and trends without manipulating variables. Abductive reasoning was utilized throughout the research process. This approach involves generating hypotheses and explanations based on the observed data, allowing for flexibility and refinement of ideas as new information emerges. Data were collected using a combination of primary and secondary sources: A structured questionnaire was administered to gather quantitative data. Qualitative insights were obtained through semi-structured interviews, facilitating a deeper exploration of participants' perspectives and expe-

riences. Field observations were conducted to gather contextual information and validate findings from other data sources. Data from existing documents and literature were reviewed to support the research findings and contextualize the primary data. Data analysis involved the application of the structural question method and iterative techniques. The structural question method enabled systematic examination of responses, while iterative techniques facilitated ongoing refinement of the analysis based on emerging patterns and themes. Through this multifaceted approach, the research aims to produce a robust and nuanced understanding of the study topic, balancing rich qualitative insights with quantitative rigor.

Drivers of urban expansion have a negative and significant effect on peri-urban households' food security through mod-

erating role of governance response,

Statistical techniques: *Moderator effect (d) = a*d*

3. Result and Discussion

3.1. Result

Composite Reliability (Indicators reliability Analysis)
KMO and Bartlett's Test

This test is necessary to measure sampling adequacy. It also helps to evaluate the sum total correlation matrix.

Table 1. KMO and Bartlett's test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.935
	Approx. Chi-Square	17803.914
Bartlett's Test of Sphericity	df	1176
	Sig.	.000

Table 2. Standardized factor loading and Critical Ratio (CR).

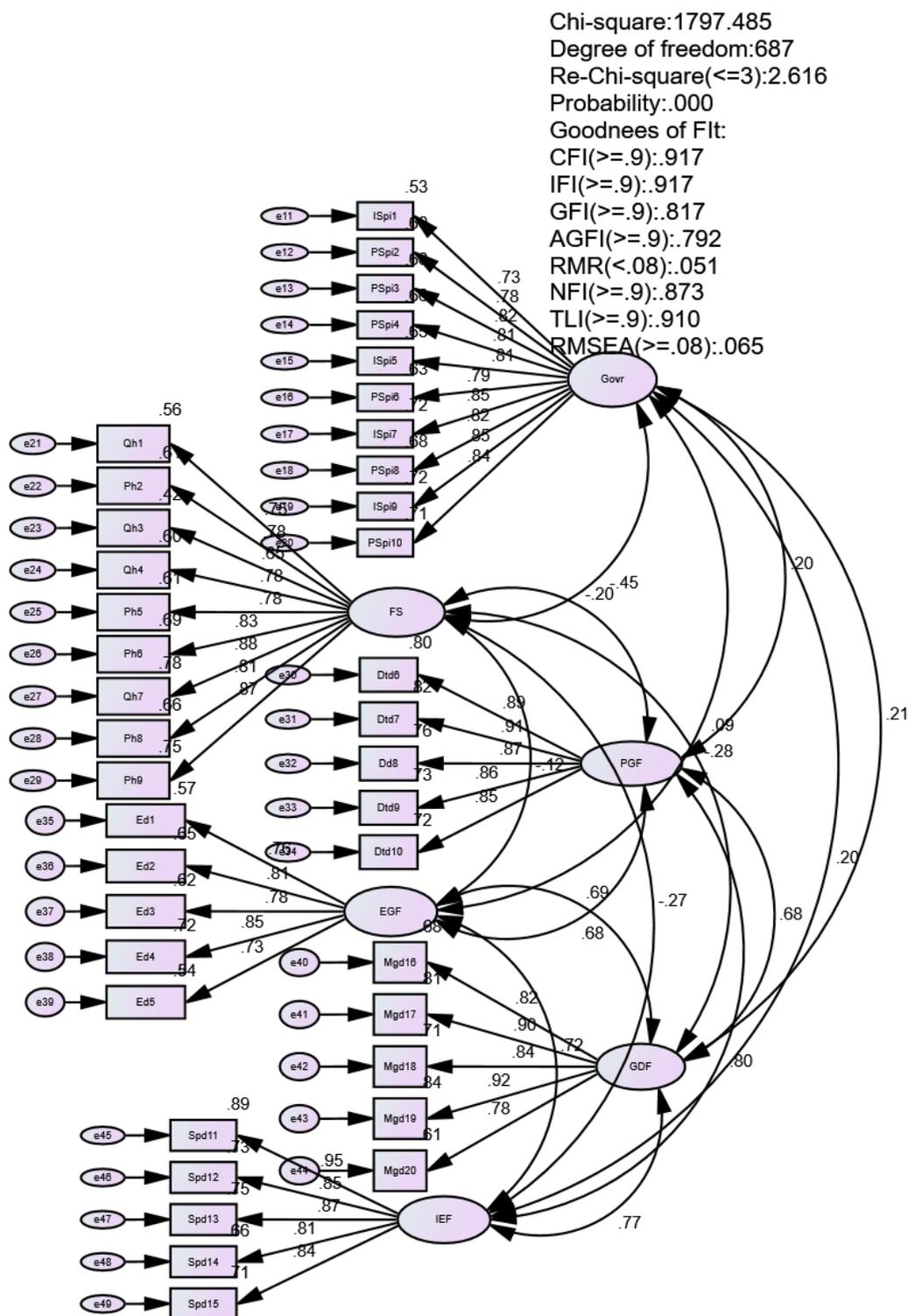
Constructs	CR	Standardized factor loadings	t-value/ Reg. Weights	P
Economic growth factor(EGF)	8.436			
Item1.		.727	*****	***
Item2.		.760	15.969	***
Item3.		.732	15.622	***
Item4.		.746	17.047	***
Item5.		.768	14.493	***
Population growth factor(PGF)	11.093			
Item1.		.797	***	
Item2.		.827	26.977	***
Item3.		.754	25.178	***
Item4.		.819	23.714	***
Item5.		.741	23.435	***
Infrastructure expansion(IEF)	12.290			
Item1.		.701	***	
Item2.		.635	26.641	***
Item3.		.718	27.813	***
Item4.		.635	23.398	***
Item5.		.697	26.027	***
Government direction factor(GDF)	9.678			

Constructs	CR	Standardized factor loadings	t-value/ Reg. Weights	P
Item1.		.687	***	
Item2.		.724	21.954	***
Item3.		.787	19.913	***
Item4.		.795	22.898	***
Item5.		.742	17.734	***
Governance response(GR)	8.136			
Item1.		.753	****	
Item2.		.783	15.241	***
Item3.		.822	16.281	***
Item4.		.828	16.066	***
Item5.		.802	15.896	***
Item6.		.806	15.596	***
Item7.		.828	16.805	***
Item8.		.824	16.241	***
Item9.		.837	16.609	***
Item10.		.831	16.499	***
Food Security(FS)	8.418			
Item1.		.739	****	
Item2.		.786	15.809	***
Item3.		.705	12.853	***
Item4.		.761	15.791	***
Item5.		.791	15.939	***
Item6.		.821	16.864	***
Item7.		.861	17.901	***
Item8.		.805	16.512	***
Item9.		.842	17.536	***

Table 3. Normality test.

Variable	min	max	skew	c.r.	kurtosis	c.r.
Spd15	1.000	5.000	-.376	-1.002	-.153	-.610
Spd14	1.000	5.000	-.584	-1.658	.272	1.084
Spd13	2.000	5.000	-.217	-1.735	-.205	-.819
Spd12	2.000	5.000	-.460	-1.671	-.098	-.389
Spd11	2.000	5.000	-.350	-2.794	-.468	-1.867
Mgd20	1.000	5.000	-.339	-2.707	-.029	-.117
Mgd19	2.000	5.000	-.130	-1.037	-.246	-.981
Mgd18	2.000	5.000	-.010	-.080	-.288	-1.147

Variable	min	max	skew	c.r.	kurtosis	c.r.
Mgd17	2.000	5.000	-.366	-2.923	.301	1.201
Mgd16	1.000	5.000	-.079	-.630	-.140	-.561
Ed5	2.000	5.000	-.278	-2.222	-.376	-1.498
Ed4	1.000	5.000	-.078	-.619	-.816	-3.256
Ed3	2.000	5.000	-.497	-1.967	.164	.654
Ed2	2.000	5.000	-.356	-2.840	-.368	-1.469
Ed1	2.000	5.000	-.228	-1.822	-.486	-1.939
Dtd10	1.000	5.000	-.770	-1.142	-.209	-.834
Dtd9	1.000	5.000	-.651	-1.197	-.098	-.391
Dd8	1.000	5.000	-.674	-1.380	-.487	-1.943
Dtd7	1.000	5.000	-.762	-1.076	-.230	-.918
Dtd6	1.000	5.000	-.733	-1.847	-.133	-.530
Ph9	1.000	5.000	-.825	-1.580	-.681	-.716
Ph8	1.000	5.000	-1.049	-1.373	-.040	-.162
Qh7	1.000	5.000	-.873	-.964	-.481	-1.919
Ph6	1.000	5.000	-.274	-2.187	-1.189	-.742
Ph5	1.000	5.000	-.326	-2.599	.451	1.799
Qh4	1.000	5.000	-1.169	-.326	1.245	.968
Qh3	1.000	5.000	-1.266	-1.100	1.111	.434
Ph2	1.000	5.000	-.911	-1.266	-.273	-1.090
Qh1	1.000	5.000	-1.308	-1.435	1.855	.399
PSpi10	1.000	5.000	-.866	-1.906	.583	.324
ISpi9	1.000	5.000	-.845	-1.746	.293	1.169
PSpi8	1.000	5.000	-.748	-.966	.111	.444
ISpi7	1.000	5.000	-.846	-.747	.129	.514
PSpi6	1.000	5.000	-.725	-.782	-.083	-.332
ISpi5	1.000	5.000	-.804	-.419	-.187	-.746
PSpi4	1.000	5.000	-.798	-1.370	-.117	-.468
PSpi3	1.000	5.000	-.675	-1.384	-.331	-1.319
PSpi2	1.000	5.000	-.805	-1.421	.059	.234
ISpi1	1.000	5.000	-.676	-2.392	-.021	-.083
Multivariate					6.004	1.913



Source: own constructed 2023/24

Figure 3. Measurement Model.

Reliability and Validity assessment
 Construct Validity

As usual, the construct validity of moderation model with 39 items was assessed through the factor loading and with Varimax rotation using SPSS version 25 software. Sample adequacy was also established through KMO,

Convergent and discriminant validity

AVE, MSV, and CR were used to assess convergent and discriminant validity. AVE should be >0.5 and CR>AVE for convergent validity. MSV should be less than AVE for discriminant validity [18].

Table 4. Convergent and divergent validity.

Model validity measurement										
	CR	AVE	MSV	MaxR(H)	Govr	FS	PGF	EGF	GDF	IEF
Govr	0.951	0.658	0.203	0.952	0.811					
FS	0.939	0.631	0.203	0.945	-0.45	0.794				
PGF	0.943	0.768	0.637	0.945	0.203	-0.204	0.876			
EGF	0.89	0.619	0.523	0.895	0.091	-0.125	0.681	0.787		
GDF	0.931	0.73	0.592	0.941	0.208	-0.284	0.684	0.693	0.854	
IEF	0.937	0.748	0.637	0.949	0.198	-0.273	0.798	0.723	0.769	0.865
No validity concern										

Source: Field survey data, 2023

As usual the alternative discriminant validity analysis was performed by using HTMT analysis method, view [table 5](#).

Table 5. HTMT validity test method.

HTMT Analysis						
	Govr	FS	PGF	EGF	GDF	IEF
Govr						
FS	0.449					
PGF	0.198	0.216				
EGF	0.099	0.134	0.68			
GDF	0.204	0.309	0.687	0.712		
IEF	0.195	0.283	0.804	0.725	0.779	
HTMT Warnings						
There are no warnings for this HTMT analysis						

Source: field survey data, 2023

Testing either governance response moderating the relationship between drivers of urban expansion and peri-urban communities' livelihood or not.

Analyzing the moderating effect for the model with latent construct is very necessary, but complicated. The normal modeling procedure using interaction terms is not practical with latent constructs. The normal procedure causes problems with model convergence and standard errors distortion. Therefore, the researcher was applied mean centering mixed model method to evaluate whether governance response play moderating role or not. The mean values of independent variable, and moderating variable was calculated by using SPSS

version 25. After the mean obtained, the mean centered variable was created. To have had the mean centered variable, the researcher subtracted the mean center from the original variable. The new name created for the created new variable. Next the interaction variable (Dr*Gr) was created by multiplying the mean centered variable of independent original variable by the mean centered value of the moderator variable. The mixed model method includes the latent unobservable variables with the independent and dependent variables in a model, but includes a composite moderator variable along with composite interaction variable. In such a model including the composite variable (in our case interaction

variable) and unobservable variable construct, there is no true test of a full structural model. Furthermore, in order to obtain interaction variable, independent unobservable construct or latent variable and moderator latent variable must be transformed into composite variable. To do so both should be mean-centered at first stage.

Subsequently, the researcher need to identify the path of interest where the moderator variable to be assessed. After identification of the path of interest, the particular path would be constrained with parameter=1 and made constrained model. The aim was to estimate two separated models: constrained and unconstrained model. There was a procedure the researcher follows as steps to work on this. The first step was splitting the data into two groups based on the moderator variable tested. The researcher recodes indifferent the moderator variable by calculating its mean average. The value above mean average into high (coded_2) and the value below mean average into low (coded_1). Next to that the researcher sorts the splinted data ascending and created two categories of datasets (dataset_1 and dataset-2). Next, the researcher created two models (Model-1 and Model_2) by using AMOS version 24. Then, the researcher named model_1 as constrained model and model_2 as unconstrained model. In unconstrained model the relationship in the path of interest did not constrained (left free of path estimate=1).

Following this step by using the two data sets turn by turn for both models the constrained and unconstrained models were estimated to calculate or obtain the chi-square result. Obtaining the result was help to know the difference between constrained and unconstrained models chi-square value. If the difference of the chi-square value between constrained and unconstrained model greater than 3.84, then we can decided that the moderation occurs in that path [23]. This the necessary prerequisite step before testing the moderation or interaction effects between the two variables (predictor and outcome variable).

In this study the researcher modeling the effect of the drivers of urban expansion (EGF, PGF, IEF, and GDF) on peri-urban household food insecurity dimension adapted from FAO experiencing food insecurity scale). One of the objectives for this study was to examine the moderation effects of governance responses (policy, institutional, regulation...) in the relationship path between drivers' urban expansion and peri-urban livelihood (from the angle of food security). Following the mentioned steps, the researcher conducted the test to ensure whither governance response moderate the relationship between drivers of urban expansion and peri-urban household food insecurity as a precondition. Accordingly:

Step 1: Low governance response: the output for constrained model

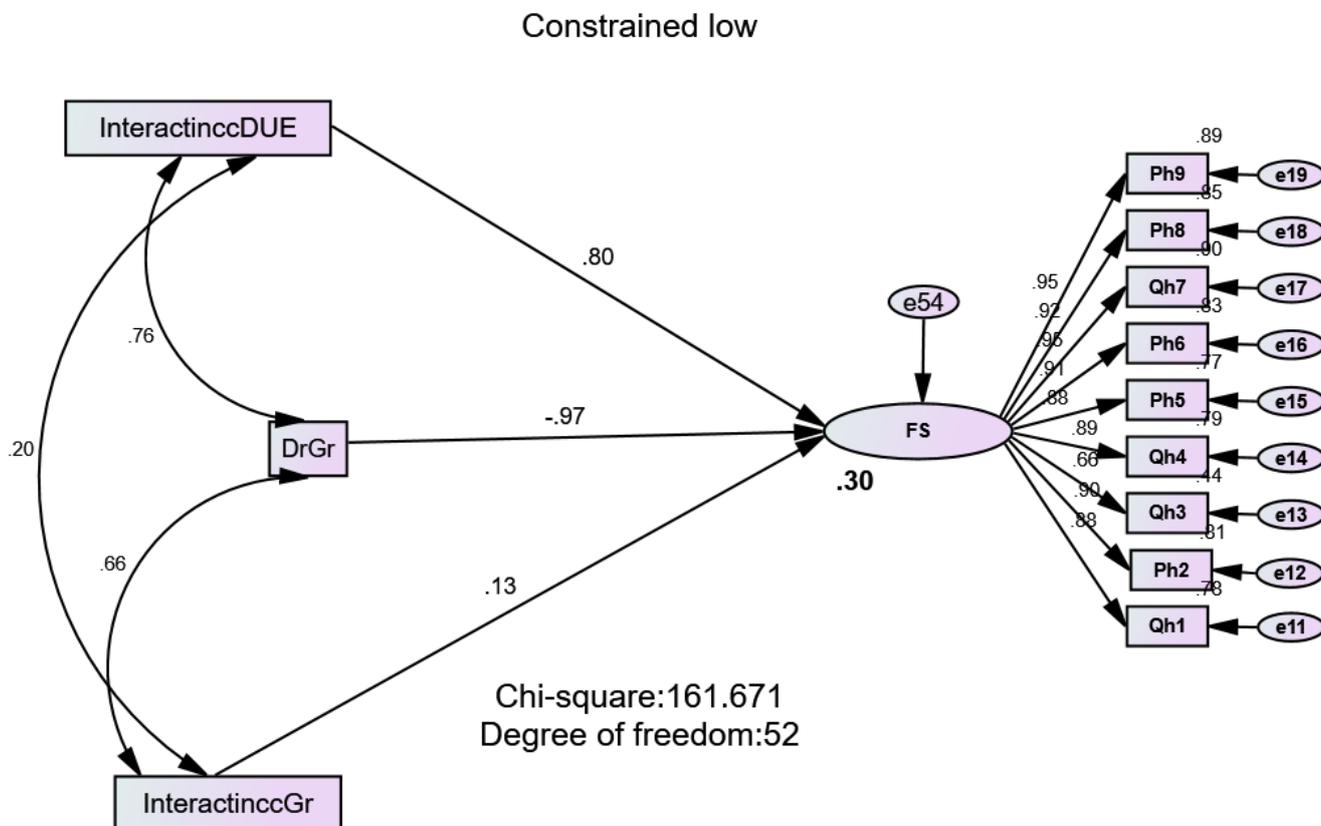


Figure 4. Constrained low governance.

Step 2: Low governance response: the output for unconstrained model

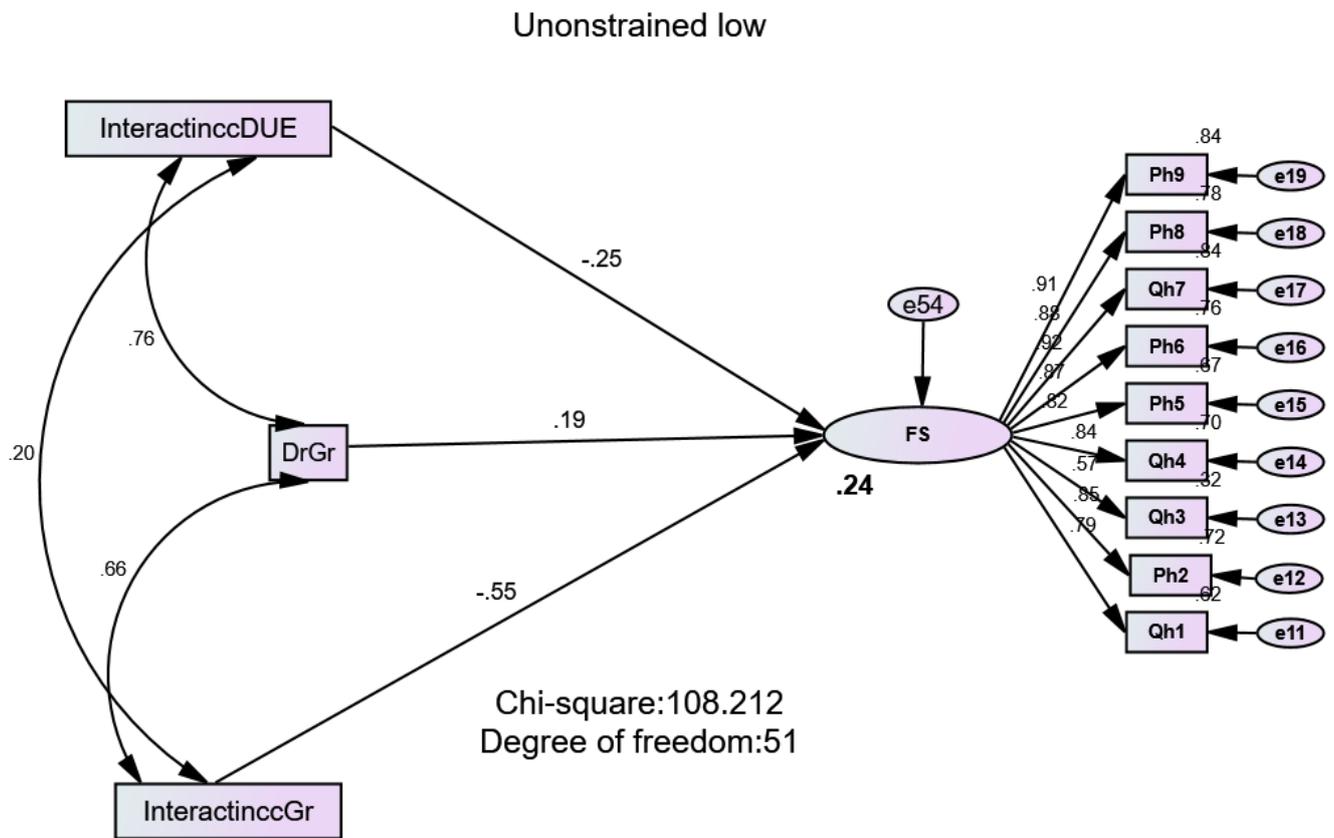


Figure 5. Unstrained low governance.

Step 3: The moderation test for low governance response moderation

Table 6. Moderation result of low governance.

	Constrained model	Unconstrained model	Chi-square difference	Result in moderation	Result on hypothesis
Chi- square	161.67	108.21	53.46	Greater than 3.84 and significant	Supported
Df	52	51	1		

The hypothesis statement:

Ha: Governance response moderates the relationship between drivers of urban expansion and peri-urban household food insecurity.

Source: field survey data

Step1: High governance response: the output for constrained model

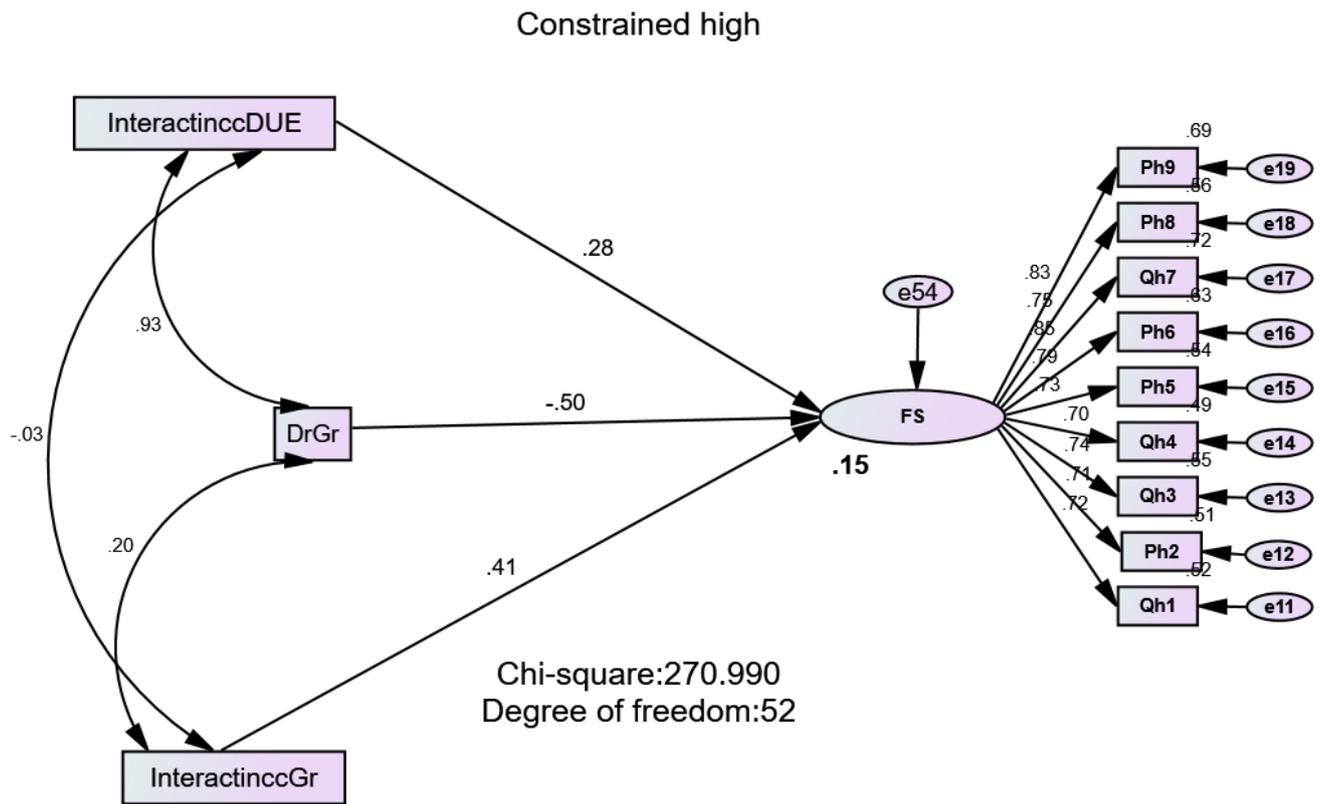


Figure 6. Constrained high governance.

Step 2: high governance response unconstrained model:

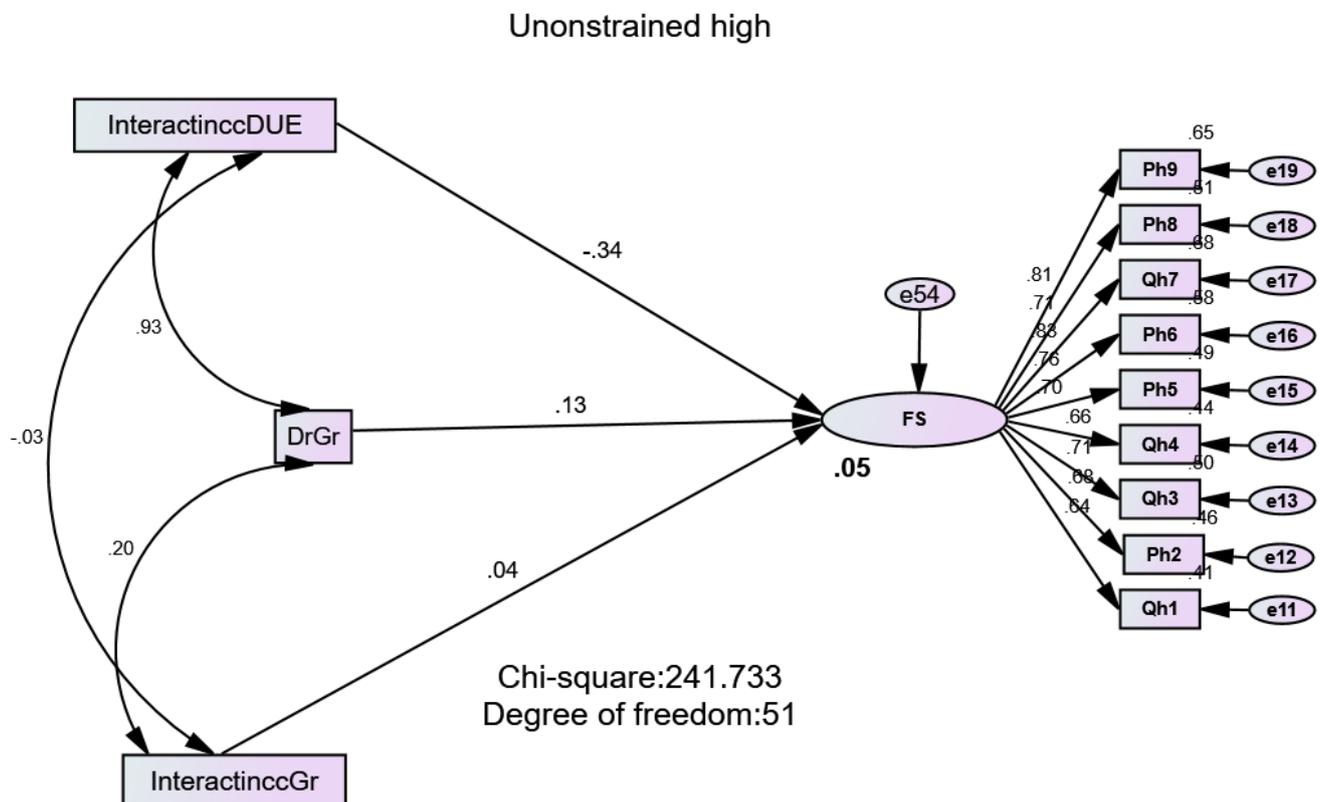


Figure 7. Unconstrained high governance.

Step 3: The moderation test for high governance response moderation

Table 7. Moderation test result of high governance.

	Constrained model	Unconstrained model	Chi-square difference	Result in moderation	Result on hypothesis
Chi- square	270.99	241.73	29.26	Greater than 3.84 and significant	Supported
Df	52	51	1		

The hypothesis statement:

Ha: Governance response moderates the relationship between drivers of urban expansion and peri-urban household food insecurity.

Interaction effect analysis

Researchers use two steps method of interaction variable effect analysis [14, 15]. At the first step they assess the standard deviation unit of change in the absence of interaction variable that alter the relationship between independent and dependent variables. At the second step they add interaction variables that alter the relationship between the inde-

pendent and dependent variables. The result depicted in the graph indicated the change of values both on the path coefficient as well as the coefficient determination without and with the interaction variable. For more clarity, view the diagram below.

Step 1: Without interaction variable

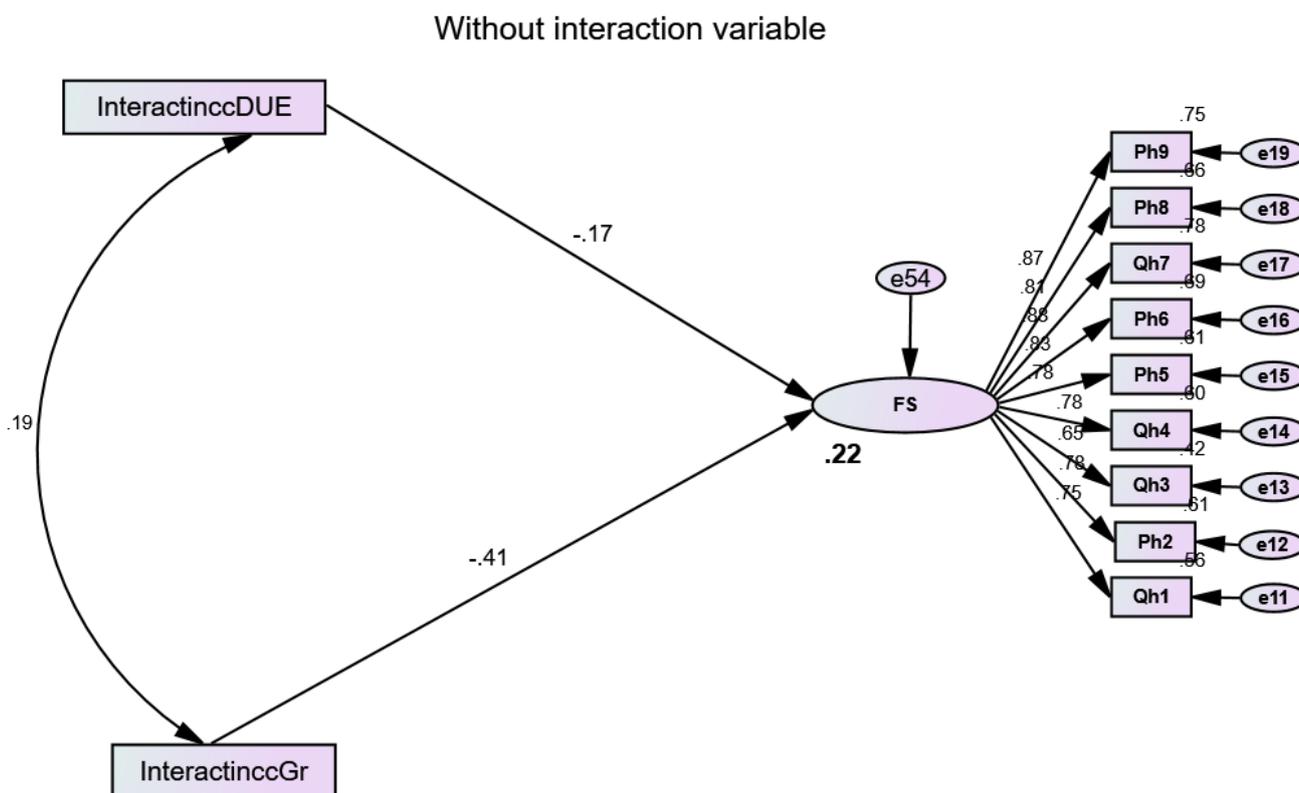


Figure 8. Interaction effects without interaction variable.

Step 1 without interaction variable

Step 2: With interaction Variable

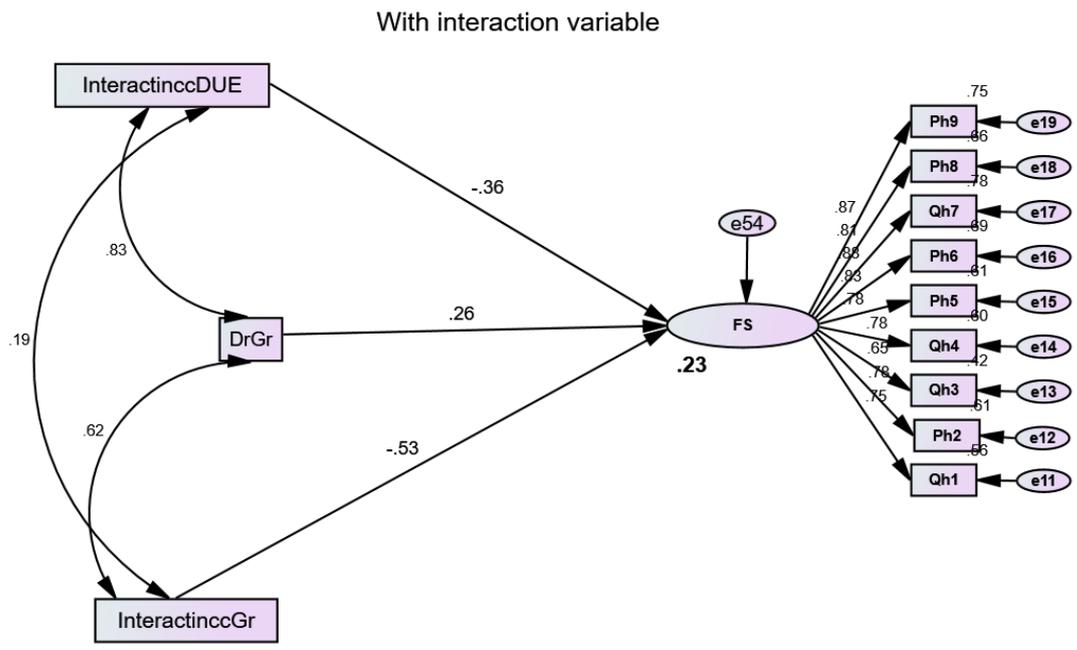


Figure 9. Interaction effects with interaction variable.

Step 2 with interaction variable

The difference of coefficient of determination (Chi square)

Table 8. The difference of coefficient of determination (Chi square).

The difference of coefficient of determination(Chi square)			
Step 1(without interaction variable)	Step2(With interaction variable)	difference	Moderation effect
.22	.23	0.1	Yes

As it was mentioned, the independent variable is the one whose relationship with the dependent is being moderated. In our context the interactincc DUE represented independent variable which was the composite of drivers of urban expansion, FS represent dependent variable i.e., food security, interactinccGr represents the moderator and it's the

composit of governance response and DrGr stands for the interaction term or product variable. By using the stats tools package, at 3 intercept/constant and unstandardized estimate values, the researcher attempted to evaluate the moderation effect, results are indicated in the following figure.

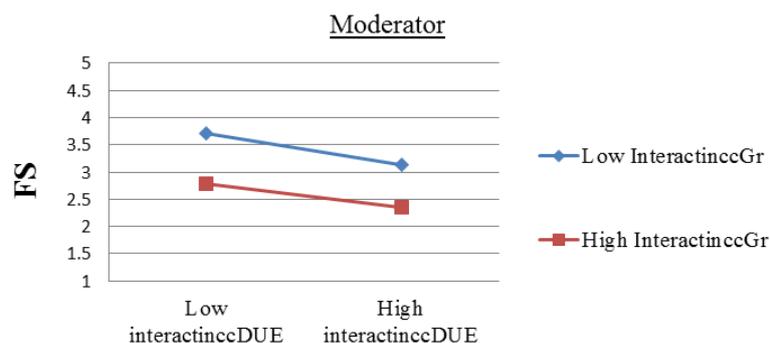


Figure 10. Moderation effect.

Moderation effect

From the graphic presentation, the result demonstrated InteractinccGr (governance response) dampens the negative relationship between interactinccDUE (drivers/factors of urban expansion) and FS (food security).

Covariance and Correlations

Examining and interpreting variance output in AMOS is necessary to ensure the structural equation model reliability and validity by addressing the problem related to Heywood

negative variances cases. Negative variance estimate in AMOS are considered inadmissible and indicate issues with the model, leading to unreliable results <https://www.ibm.com/support/3/23/2024; 4:47 PM>). The researcher checked the issue and found that there was no problem with Heywood related variance cases and the AMOS output result were presented in the [table 9](#).

Correlations and covariance

Table 1. Covariance and Correlations.

	Covariance	Correlations	S.E.	C.R.	P	Description
DrGr<-->InteractinccGr	2.562	.615	.251	10.228	***	+ and sign
DrGr<-->InteractinccDUE	4.080	.829	.327	12.458	***	+ and sign
InteractinccGr<-->InteractinccDUE	.162	.191	.044	3.664	***	+ and sign

The researcher was performed maximum likelihood estimates to assess modification effect. To decide the existence of moderation effect among two requirements or criteria at least one should be fulfilled. The first is the independent (exogenous variable), dependent (endogenous variable), interaction variable (product variable) should be significant or, second option independent not significant, but the rest mentioned two variables should be significant. If interaction var-

iables and the rest two variables, it is not permissible to say there is moderation effect. Similarly, if moderation variable and interaction variables were not significant and the independent variable is not significant in the same manner the existence of moderation effect is not accepted. Based on this postulation:

Moderation effect

Table 10. Unstandardized and standardized estimates.

	Estimate		S.E.	C.R.	P	Moderation effect
	Unstandardized	Standardized				
FS<---DrGr	.036	.257	.028	1.99	.048	yes
FS<---InteractinccGr	-.429	-.528	.072	-5.929	***	yes
FS<---InteractinccDUE	-.248	-.361	.084	-2.955	.003	yes

The statistical significance of the interaction variable (DrGr), exogenous variable (InteractinccDUE) and Moderator variable (InteractinccGr) depicted the presence of moderation effect. Therefore, it can be concluded that governance response is moderating between drivers/factors of urban expansion and peri-urban household food insecurity (FS).

Method 2: The path model the researcher demonstrated which includes moderating effect can be expressed by using formula:

$$Y_2 = (p_1 + p_3 * M) * Y_1 * M \tag{3}$$

Y2 stands for exogeneous variable i.e. in our case FS; P3 stands for the product of moderator and exogenous variable or intraction variable coefficient (in our case interactinccDUE*interactinccDr); M stands for moderator(in our case interactinccDr); p1 the coefficient of Y1(interactinDUE) effect on Y2(FS); Y1 stands for exogenous variable (in our context interactinccDUE).

To understand how a moderator can be interacted in a path model, the mentioned formula rewritten as follows:

$$Y_2 = P_1 * y_1 + p_2 * M + p_3 * (Y_1 * M) \quad (4)$$

It necessary to identify the specified coefficient in moderation effect: the effect of exogenous variable = $P_1 * y_1$; the effect of moderator variable = $p_2 * M$; interaction (product) term = $p_3 * (Y_1 * M)$. As a result, makes easy to understand how the coefficient p_3 express how the effect P_1 changes when moderator variable "M" (interactinccGr in our case) is

increased or decreased by one standard deviation unit [11, 21]. Accordingly,

$$Y_2 = P_1 * y_1 + p_2 * M + p_3 * (Y_1 * M) \quad (5)$$

$F_s = -.37 + -.49 + .27 \dots$ by substituting the coefficient value of the cross ponding and respective variable in the formula, view 11.

$F_s = -0.59$, this express when moderator (Gr) increased by one standard deviation unit, the effect of drivers/factors of urban expansion decreased by .59 standard deviation.

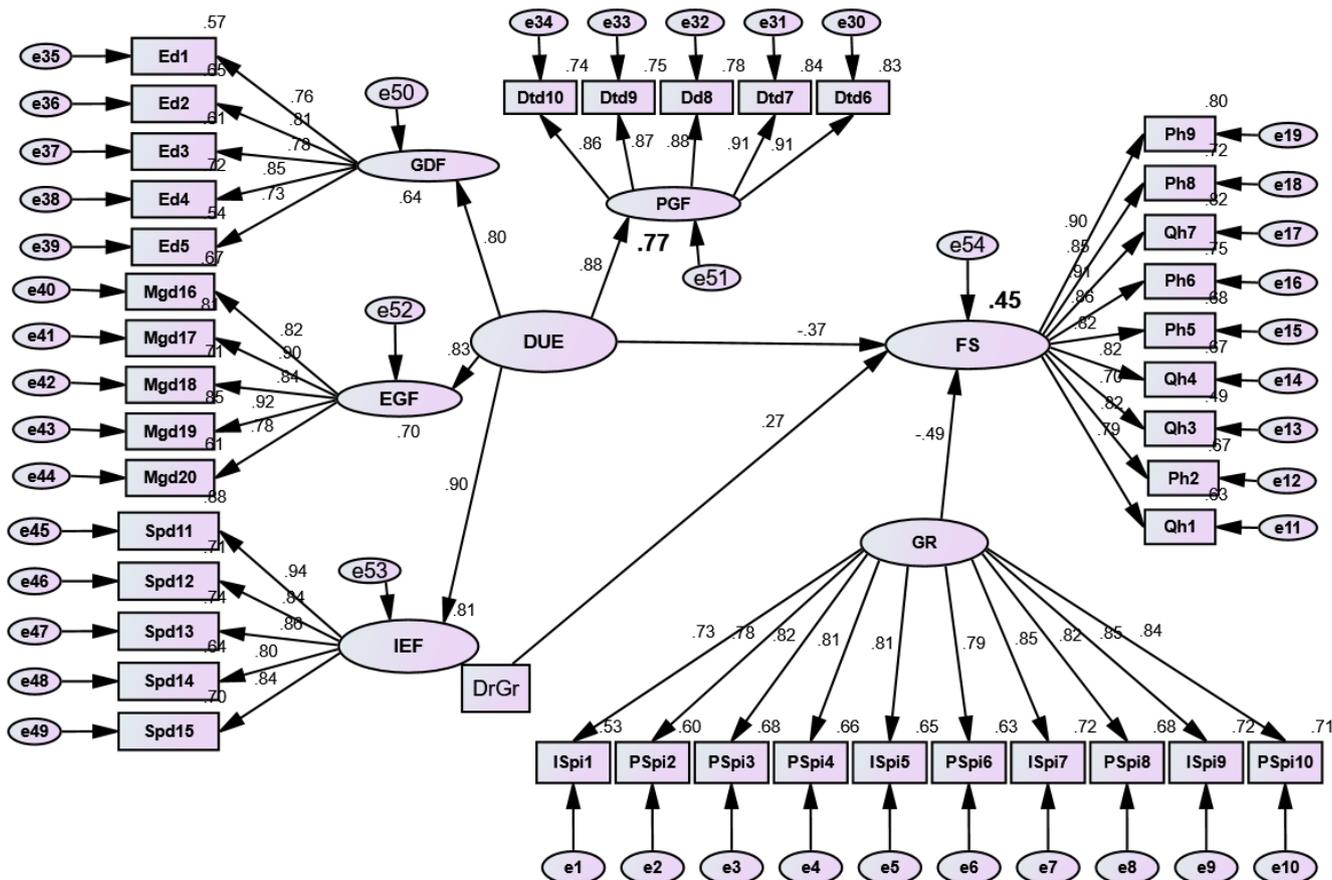


Figure 11. Non-Vary moderation path diagram moderation path coefficient result.

Table 11. Unstandardized and standardized estimate.

	Estimate		S.E.	C.R.	P	Interpretation
	Unstandardized	Standardized				
FS<---DUE	-.255	-.370	.079	-3.250	.001	-and sign
FS<---GR	-.557	-.488	.095	-5.883	***	-and sign
FS<---DrGr	.043	.267	.021	2.011	.044	+ and sign

Qualitative data: Interview and observation result

the interview result demonstrated that:

“.....Although regulations exist, they are not always enforced. For instance, constructions often occur on the riverbank (by violating the set standard distance 16-25 meters), swamp area, and forest area. Buildings and waste obstruct the channel of water and floods, and green areas are turned into built-up spaces (planner u. l., 2023). Most of the time such unplanned activities were emanate from lack of commitment (planner, 2023).

This explain that the river source pollution affected the downstream as well as the reverside vegetation. This affect the benefit obtained from the vegetation and led to agricultural potential area degradation.

“...before the prevalence of the informal settlement and land grab the government should take prevention initiative, whereas most of the time measure taken after development. (from interview with land management and transfer exp, 2023).”

Furthermore, the interview result also indicated that:

“...Ethiopia’s integrated policy responses led to expansion of unplanned olds style of development. Particularly, regularization of the former informal (unplanned) developed incorporating surrounding area in urban boundary is the good indicator” (planer expt, 2023).

Field observational data desplayed the government approach to sustain peri-urban livelihood through diary and fattening activities is wondering. However, farmers compain about ensufficiency of space, water accessability and animal food including grass. If the problem on the area resolved, this can be seen as alternative ways of solving household food insecurity, by generating means of income.



Figure 12. Typical livestock fattening and diary activities.

Photo by Zerihun, Akaki sub-city and Zinash, Lami Kura sub-city, 2023



Figure 13. Typical milk production and production.

There were also 180 micro-enterprises of expropriated farmers housed within the Center for Livestock Development and Excellence Center. The facility promoted excellence, created jobs, and developed livestock. This suggests that the government is strategically intervening to support peri-urban inhabitants' livelihoods, particularly those of farmers.

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This was an indication for government response reduction of the negative relationship between urban expansion and peri-urban household food insecurity. Litratue also indicated that Food security in developing countries is depends on the sustainable uses of natural resources. Since currently, following climatic change, rapid urbanization pose challenges to natural resources such as land loss, household relied on natural and physical capital highly vulnerable.

3.2. Discussion

In this study, the researcher attempted to examine the effect of drivers/factors of urban expansion on peri-urban households' food insecurity in moderating role of governance response. The result demonstrated that governance response (InteractinccGr) dampens the negative relationship between drivers/factors of urban expansion (interactinccDUE) and peri-urban experiencing of food insecurity (FS). To confirm this, the researcher performed additional evaluation and has obtained that when moderator(Gr) increased by one standard deviation unit, the effect of drivers/factors of urban expansion decreased by .59 standadard deviation. This express the essence of governance response or action or intervention in reducing the negative relationship between drivers/factors of urban expansion and food security. The role of governmanet in reducing the adverse effect of urban epansion on ecosystem services, thereby food security is significant. Scholars also suggested that in the era of urban encroachment, enhancing ecosystem service governance is critical [12, 20]. The interaction of the government responses(through policy, regulation, strategy,) between the urban expansion effects on food security deminishes the streangth of the negative relationship between the two.

The interview result revealed the gap on institutional and policy intervention to regulate the impact of urban expansion. However, insstitutional framework and policy response paly essential role. In the pervious litratue it is also confirmed that in peri-urban regions government policies can influence food security by regulating land use, promoting sustainable agricultural practice, and ensuring access to food sources [7].

In addition to this, other scholar also stated that government intervention is essential to mangage the impact of urban sprawl, and implement policies like urban growth boundaries to control excessive horizontal expansion [22]. The effiecient land use in most part of the world had been emphesis on compact and vertical urban growth to save sacrece agricultural land [1, 13]. In addition to structural, land use and landmangement approach, the government

institutional framework and policy support for sustainable agriculture need to consider urban agriculture as an alternative to overcome food security. Urban agriculture contribute to food security, stability and sustainability of primarily agricultural livelihood style. Most of the time the full displacement and expropriation of the primarily agricultural dependent household prone them to food insecurity, instability and poverty in general. The interview response indicated the essentiality of the role of governance to minimizing the effects urban expansion on ecosystem service. It was also asserted that the need for integrated planning approach and strong governance intervention mechanism. As a good model, some raised about the infant Addis Ababa farmers' and agricultural commission beginning to encourage urban agriculture considered as a good being to ensure food security and sustain farmers. However, it is not get institutional and policy support in preserving open spaces and limited to garden vegetation [26].

It is clear that ecosystem service directly or indirectly supports food security through provision of ecosystem services that facilitate the production [22]. The quantity of food production decreased as land seized by buildup. This affects the availability of household food as usual producing from the field. The study result shows that the population growth as driver of urban expansion affects food security through pressurizing and deteriorating ecosystem services (natural and physical capital). Therefore, corresponding to incorporating the agriculture into urban, rethinking about the unique nature of the peri-urban area is critical point [17]. In similar manner, the previous study suggests the need to preserve ecosystem services through strong institutional framework and land management (Kremer et al., 2016). However, the transitional zone has dual nature of rural-urban interweave and still lack unique policy approach different from the usual dichotomy approach: rural and urban.

In Ethiopia the legal document provided or gave full authority to government's centralized ownership of land [8]. In addition to this, Ethiopia proclamation No. 1161/2019 declared that any landholder can be expropriated and displaced by receiving "Displacement Compensation". But at the same time give room for the priority right to develop as per requested by the plan. The interviewed appreciate the priority provided, and complain about its implementation from its precondition of "showing capacity". Showing capacity may be in finance, skill and knowledge. Whereas the practical evidence not getting attention for its feasibility was that the displaced people were farmers and unskilled as well as financially incapable as per the requirement. Therefore, the interviewed persons claim either financial support scheme or the right to be shareholder with capable developers.

4. Conclusion

This study highlights the significant impact of urban expansion drivers on food insecurity among peri-urban households, underscoring the crucial moderating role of governance

responses. The findings reveal that effective governance can mitigate the negative effects of urban expansion on food security, as demonstrated by a decrease of 0.59 standard deviations in the adverse impact when governance is strengthened. While current institutional frameworks and policy interventions show promise, gaps remain in regulating the effects of urban growth. Existing literature supports the notion that government policies can enhance food security by managing land use, promoting sustainable agricultural practices, and implementing urban growth boundaries. The results also emphasize the potential of urban agriculture as a vital component for increasing food stability and sustainability. A governance response aimed at integrating farming into urban planning and policy frameworks is essential for sustaining traditional and indigenous livelihoods, as well as ensuring food security for urban residents. However, the lack of adequate institutional and policy support continues to hinder efforts to preserve agricultural land and ecosystems. As urbanization intensifies, a need for integrated planning approaches and robust governance mechanisms becomes imperative. Given Ethiopia's centralized land ownership and expropriation policies, there is a pressing need for reforms that ensure fair compensation and support for displaced households. The findings suggest that governance institutions and policy approaches are crucial for mitigating the impacts of urban expansion on food security challenges. This study highlights the detrimental side effects of urban expansion, despite its contributions to modernization, and underscores the necessity of implementing effective governance strategies to mitigate these adverse effects. Furthermore, the application of Structural Equation Modeling (SEM) offers valuable insights into the complex and interrelated relationships among the latent variables involved in this dynamic. This study has limitations in that it does not address all dimensions of food security assessment. Given this limitation, it is crucial to address these issues in order to improve food security and safeguard ecosystem services in urban expansion era.

Abbreviations

LULCC	Land Use Land Cover Change
HTMT	Heterotrait-Monotrait ratio of correlations
UN	United Nation

Author Contributions

Chali Etefa Taye: Formal Analysis, Investigation, Methodology, Resources, Software, Visualization, Writing – original draft, Writing – review & editing

Dereje Teklemariam: Conceptualization, Data curation, Resources, Supervision, Validation, Writing – review & editing

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Conflicts of Interest

The authors declare no conflicts of interest.

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