THE ROLE OF THE POPULATION'S ACCESS TO BASIC NEEDS IN BUILDING RESILIENCE AND ENSURING FOOD SECURITY. CASE STUDY OF ROMANIA

Ion Raluca Andreea¹

*Corresponding author E-mail: raluca.ion@eam.ase.ro

ARTICLE INFO

Original Article

Received: 09 January 2020

Accepted: 10 March 2020

doi:10.5937/ekoPolj2002345R

UDC 314.9:338.439/.45(498)

Keywords:

resilience, stressors, food security, food supply, access to basic needs, access to water, access to sanitation

JEL: Q12

ABSTRACT

Water scarcity, climate change, price volatility, agricultural output variability, and geo-political instability have determined new stressors and situations of risks that exert pressure on agro-ecological systems, farmers, people's food security, and generally affect the well-being of the population. In recent times, resilience is seen as providing a new approach on how to analyse the effects of shocks and stressors that threaten people's well-being. The question is whether there is a relationship between the inadequate access to basic services, as stressor of people's physical access to food and food availability on the market, and food security, as an outcome of people's well-being. Statistical data have been analysed with simple regression model. The case study of Romania is discussed, using twenty-two observations. The main findings show that access to essential services, such as water and sanitation, are important in explaining household's resilience capacity. Other stressors, such as rail lines density and road density, which determine the physical access to markets, have a less significant influence on food security. The relevance of the results lies in their capacity to emphasize the role of people's access to basic needs in strengthening the resilience of individuals, families and regions, and to ensure, as a consequence, food security.

© 2020 EA. All rights reserved.

Introduction

Viewed as a strategic way to deal with stressors and a wide range of unpredictable risks that undermine well-being, resilience has emerged as a key concept for policy, program and strategy development. Resilience is a promising concept for understanding how individuals, households, and regions cope with shocks and stressors, therefore, a steady flow of scientific papers and reports has been released. Many of them focused

¹ Ion Raluca Andreea, Associate Professor, Department of Agro-food and Environmental Economics, The Bucharest University of Economic Studies, 6, Piata Romana, sector 1, Bucharest, Romania, E-mail: raluca.ion@eam.ase.ro, ORCID ID (<https://orcid.org/0000-0001-7182-5809>)

on resilience concept, stressors and shocks, but fewer on resilience measurement. There is an abundant literature on resilience pursued in a variety of fields, such as ecology (Gunderson et al., 2010), including the agro-ecological systems, engineering (Hollnagel et al., 2006), psychology (Cicchetti, 2010), and geography (Adger, 2000; Pike et al., 2010).

Referring to agro-ecological system, Milestad (et al. 2009) argued that farmers face dynamics and disturbances at the farm, induced by local, regional, national or global trends, seasonality or shocks. Under these circumstances, farmers need the ability to cope with, adapt to and shape change without losing options for future adaptability (Folke et al., 2003). It is about what is called resilience in the literature, meaning that farmers need to build farm resilience. Resilience thinking offers a framework for understanding the dynamics of complex systems (Bennet et al., 2005). Derived from system theory as being the ability of a system to bounce back or return to equilibrium following disturbance (Holling, 1973), when referring to as 'engineering resilience', the concept then evolved to a more complex approach. Resilience of systems is not simply about resistance to change and conservation of existing structures (Folke, 2006), while Berkes (et al. 2003) recognize that the ability to adapt and transform are at the origin of resilience.

As regards food security, resilience has been considered in terms of international development (Bene et al. 2016; Pelletier et al. 2016, Suweis et al. 2015; Constantin, 1999), and of maintaining agricultural production under climate change (Altieri et al. 2015). Bullock (et al. 2017) provided an original view of how food production might become more resilient and implemented a definition of resilience in terms of food security as: maintaining production of sufficient and nutritious food in the face of chronic and acute environmental perturbations. The food system resilience has been studied by Tendall (et al. 2015), who argued that it has a high potential to help cope with the shocks, complexity and uncertainty facing food systems, by using the concepts of continuous learning, flexibility and "back-up" capacity.

Many attempts at assessing resilience have been proposed over the years. The Food and Agriculture Organization (FAO) of the United Nations recorded long experience in this, being the first organization which adopted the concept of resilience in a food security context (Pingali et al., 2005). In 2008, it issued a system of indicators for resilience assessment, the RIMA, proposed by Alinovi (et al., 2008), who argued that the ability of a household to adapt to new situations depends on the options available to that household to make a living: access to assets, income-generating activities, public services, formal and informal social safety nets, institutional environment and resistance capacity.

Nowadays, other authors proposed alternative systems to measure resilience. Vaitla (et al., 2012) considered natural resources, physical assets, financial assets and human and social capital as the fundamental elements of resilience, which enable households to react to stressors and to a shock, after interaction. Frankenberger (et al., 2012) focused on the causes that determine the vulnerability and seeks to understand how long-term

factors (e.g. climate change, economic, socio-political and environment factors) affect livelihood security and exposure to risk. Ignat (2019) measured resilience from the entrepreneurship point of view.

RIMA-II, as system of indicators for assessing resilience, has its roots in FAO's analytical framework (FAO, 2012). Its fundamental pillars of resilience are: access to basic services, assets, social safety nets, sensitivity, and adaptive capacity. This paper analysis the pillar access to basic needs. It measures the ability of a household to meet basic needs, by accessing and effectively using basic services, such as sending children to school, accessing water, electricity and sanitation.

The RM-TWG (2014) has defined resilience as a capacity that prevents individuals, households, communities, and regions from falling below a normatively defined level for a given development outcome (e.g., food security, poverty level, wellbeing). The cited report outlined the necessity of establishing an outcome of interest as the result of a series of interactions among the conditions, attributes and processes, and disturbances that affect well-being, in the development of resilience measurement.

Therefore, the pillar of resilience, namely access to basic needs, is analysed in connection to food security, as an outcome of interest, the objective of this paper consisting in identifying the direction and the intensity of the relationship between access to basic needs and food security. While resilience is perceived as a stand-alone outcome, the end-goal of building and measuring resilience is viewed in terms of a particular outcome, such as food security.

In the attempt to establish whether there is a relationship between the access to basic services, as pillar of resilience, and food security, as a development outcome, this piece of research answers the question what are the direction and intensity of this relationship? In pursuing this, the indicators corresponding to the variable access to basic needs (access to improved water source, access to improve sanitation, road density and rail lines density) and the indicators of food security (food supply per person) are analysed using simple regression models.

The research starts from the assumption that there is a direct relationship between access to basic services and food security, the hypothesis tested within this paper is H1: The availability or non-availability of basic services play a role in determining the risk level of households' exposure to shocks and stressors and determine the level of households' food supply.

This paper analysis the resilience as a response to stressors, such as people difficult access to services, in relation to food security. Following this first introductory section, the paper is organized into two main sections, followed by a section on conclusions. The data and methodology of assessing resilience are presented in section 2, outlining a set of general technical issues that are broadly applicable to the measurement. Section 3 presents and discusses the results of the regression models, whereas, the final section summarizes the main points of this first paper, draws the conclusions, and validates the hypotheses.

Materials and methods

Resilience comprises two parts, one direct (or descriptive) and one indirect (or inferential). The direct approach measures the Resilience Capacity Index and the Resilience Structure Matrix. The indirect approach looks at the determinants of food security loss and recovery (FAO, 2016). Within this paper, the indirect approach is used to assess resilience.

Some authors proposed the Resilience in a Dynamic Context as a predictor of household food security (Ciani, 2011). The latter is measured both by the change in food expenditure between two time periods and a dummy variable describing food poverty status at time $t+1$. The resilience capacity at time t is expected to positively contribute to household's food security at time $t+1$. But this assumption is not easily replicable if resilience is estimated through RIMA-II, because it employs food security variables as indicators of the measurement model. Therefore, FAO (2016) proposed two possible options. The first is to estimate the Resilience in a Dynamic Context through RIMA-II using survey variables. The second is to use an indirect measurement of resilience which implies the use of the food security indicators (food expenditures or food consumption scores) for performing a dynamic analysis. If the purpose of resilience analysis is to establish the main drivers of a recovery from a shock, regression analysis is needed rather than survey. Therefore, the indirect approach, analysing food security indicators in relation to its determinants, is used in this paper.

The RM-TWG (2014) expressed the relationship among resilience, vulnerability, and shocks in connection with food security such as: Food security = f (vulnerability, resilience capacity, shocks). Stressors can be added to this approach, bearing in mind that they are long-term pressures that undermine the stability of a system and increase vulnerability within it (Bujones et al., 2013), as compared to shocks, which are short-term pressures (Zselezky and Yosef, 2014). Therefore, the relation becomes: Food security = f (vulnerability, resilience capacity, shocks, stressors).

This equation reveals the dependent variable, food security, and the independent variable, resilience capacity, with its shocks and stressors. Within this piece of research, the independent variable is access to basic services, as pillar of resilience, and the dependent variable is food security, viewed as an outcome of people's well-being.

The indicators corresponding to access to basic services are access to improved water sources, access to improved sanitation, access to proper road and rail lines (FAO food security indicators, FAO, 2016). The indicators access to water and sanitation have been used in previous research (Catacora Vargas, 2017, Jacobi et al., 2018, Mutea, 2018), for assessing the resilience dimension of buffer capacity. The latter refers to the capacity of a system and its properties to cushion against stresses and shocks.

The indicators corresponding to food security is food supply expressed in calories per person per day. They have been used in previous research in FAO reports (RM-TWG, 2014). Food quantity, in terms of absolute amount of production or food calories, is the usual metric of food security and thus resilience, as reported by Bullock (et al. 2017).

Access to an improved water source consists in the percentage of people with reasonable access to an adequate amount of water from an improved source: a household connection, public standpipe, borehole, protected well or spring, and rainwater collection (food security indicators databases explained, FAO, 2019). Reasonable access refers to the availability of at least 20 liters for a person per day from a source within one kilometre of the dwelling. As seen in Table 1, 98% of the Romanian population have access to improved drinking water sources in recent times, as compared to 73.9% in 1990.

Access to improved sanitation facilities represents the percentage of people with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta (food security indicators databases explained, FAO, 2019). As data in Table 1 show, 77.9% of the Romanian population have access to sanitation facilities in recent times, higher than 70.4% in 1990.

Road density refers to the number of kilometres of road per 100 square kilometres of land and rail lines density refers to the number of kilometres per 100 square km of land area. Both of them correspond to the physical access of people to food. There are 46.8 km of road per 100 square km of land area in Romania in 2011, decreasing from 64.2 in 1990 (Table 1). As regards the rail line density, there are 4.5 km per 100 square km of land area in Romania in 2001, down from 4.8 in 1990.

The indicators corresponding to the resilience capacity measure can be indexed to food security, poverty or any other well-being concept that represents a development outcome of interest (RM-TWG, 2014). Usually, food expenditure, Food Consumption Score, and caloric intake are adopted as indicators of food security. In this paper, the caloric intake (food supply expressed in kcal per person per day) is considered for analysing the relationship between access to basic needs and food security.

The food supply in Romania is, on average, 3339 kcal per person per day, higher than its level of 3127 in 1990. This value is higher compared to FAO and WHO recommendations, meaning that, on average, food security is ensured in Romania. This assumption is sustained by the value of the indicator Average dietary energy supply adequacy, which is 135% (FAO databases, 2019), higher than 100%, meaning that the supply exceeds the requirements by 35%. Although food security is ensured, on average, in Romania, previous research (Ion, 2018; Anica Popa et al. 2008) found that not all people have proper access to food, since 15.3% live on less than \$2.9 a day, while the average food consumption fits into a budget of \$3.28 a day. Thus, people earning less than \$2.9 a day have limited dietary choices.

Table 1. People access to basic services and food supply in Romania, 1990-2011

Year	Percentage of population with access to improved drinking water sources (%)	Percentage of population with access to sanitation facilities (%)	Road density (km of road per 100 square km of land area)	Rail lines density (km per 100 square km of land area)	Food supply (kcal/cap/day)
1990	73.9	70.4	64.2	4.8	3127
1991	75.4	71.0	64.2	4.8	2922
1992	76.6	71.4	64.2	4.8	2835
1993	77.7	71.7	64.2	4.8	3000
1994	78.8	72.0	64.2	4.8	2931
1995	79.8	72.3	64.3	4.8	3027
1996	80.9	72.6	81.0	4.8	3056
1997	82.0	72.9	81.0	4.8	3046
1998	83.1	73.2	81.1	4.8	3068
1999	84.2	73.5	81.1	4.8	3081
2000	85.3	73.8	42.4	4.8	3141
2001	86.5	74.1	42.5	4.8	3239
2002	87.6	74.4	42.7	4.8	3319
2003	88.8	74.8	43.0	4.6	3365
2004	90.0	75.2	43.8	4.5	3354
2005	91.1	75.6	44.3	4.5	3396
2006	92.3	75.9	44.5	4.5	3430
2007	93.5	76.3	44.9	4.5	3375
2008	94.6	76.7	45.3	4.5	3402
2009	95.8	77.1	45.4	4.5	3379
2010	96.9	77.5	45.9	5.7	3325
2011	98.0	77.9	46.8	4.5	3339

Source: FAO, 2019

Results and discussions

Before rendering the models, the variables are tested using E-Views program. Firstly, the variables have been tested for normality (Figure 1a). The variable food supply reported the value 0.326 for the probability, higher than 0.05, meaning that the distribution is normal. Kurtosis value is 1.763 indicating a normal distribution and the Skewness value is negative, showing a tendency towards left, and its value is closed to -0.5, signaling, anew, that the distribution is normal.

The variable access to improved drinking water (Figure 1b) reported the value 0.444 for the probability, higher than 0.05, meaning that the distribution is normal. Kurtosis value is 1.754

indicating a normal distribution and the Skewness value is negative, showing a tendency towards left, and its value is not between -0.5 and +0.5, signaling a limit of the research.

The variable access to improved sanitation (Figure 1c) reported the value 0.486 for the probability, higher than 0.05, meaning that the distribution is normal. Kurtosis value is 1.846 indicating a normal distribution and the Skewness value is positive, showing a tendency towards right, and its value is between -0.5 and +0.5, signaling, anew, that the distribution is normal.

Figure 1. Normality test for food supply (a), access to improved drinking water (b), and access to improved sanitation (c)

Source: Results of the tests

The graphical rendering is tested, in order to have a better perspective over the variables. The graph for the variables food supply and access to improved water sources is presented in Figure 2. It can be noticed that the two variables have registered a likely trajectory. The current dataset has a positive trend, indicating a direct influence of access to improved water sources over the food supply.

The graphs for the variables food supply and access to improved sanitation is presented in Figure 3. It can be noticed that the two variables have registered a likely trajectory. The current dataset has a positive trend, indicating a direct influence of access to improved sanitation over the food supply.

Figure 2. Correlations between food supply and access to improved drinking water

Source: Results of the tests

Figure 3. Correlations between food supply and access to improved sanitation

Source: Results of the tests

Then, the stationarity of variables using Dickey-Fuller test and the causality between variables using the Granger Test have been tested. The results show that the data are stationary and there is not any pre-existent causality between variables.

The following step is to set up the linear model of simple regression. The model explaining the relationship between food security and access to improved water sources is: $\text{food_supply} = 0.882 \times \text{access_to_improved_water_sources}$, showing that 1 unit change in the level of access to improved water sources will lead to 0.882 changes in the level of food supply. The model explaining the relationship between food security and access to improved sanitation is: $\text{food_supply} = 0.866 \times \text{access_to_improved_sanitation}$, showing that 1 unit change in the level of access to improved sanitation will lead to 0.866 changes in the level of food supply.

The models are valid since the values of Sig are below 0.05 (Table 2). The values of R Square are 0.779 and 0.750, showing that the relationship between food supply and its determinants, access to improved water sources and access to improved sanitation, are strong and direct, the variables being positively correlated.

Table 2. The influence of access to improved water sources and access to improved sanitation upon food security

Variable	R Square	Coefficients of regression function	Sig.
Access to improved water sources	0.779	0.882	0.000
Access to improved sanitation	0.750	0.866	0.000

Source: Results of the regression models

The same results have been reported by other authors arguing that the best way to help farmers and improve their resilience is by maintaining good access to human capital, natural resources, infrastructure and financial resources (Atkociniene et al. 2015; Kwasek and Cvijanovic, 2013), and by safeguarding their access to markets and credit (Ashkenazy et al. 2018). Hecht (et al. 2018) observed that infrastructure and location, and service providers are among of the 10 factors that may contribute to organization-level resilience. The results are similar to those found by Alinovi (et al., 2008), arguing that resilience, viewed as the ability of a household to adapt to new situations, depends on the options available to that household to make a living, including access to assets, capital etc.

The variables road density and rail lines density reported invalid results. Otherwise, only observing the primary data presented in Table 1, the contradictory trends of these indicators and food supply can be noticed. While food supply values increased over the period under analysis, the values of road density and rail lines density decreased, signaling lower physical access of people to transportation and markets, both for producers to sell their products and for consumers to buy agro-food stuff. Considering this trends, the relationship between food supply, as an outcome of well-being, and inadequate access to roads and rail lines, as stressors and features of resilience capacity, has not been analysed.

Conclusions

This paper investigated the relationship between food security, as an outcome of people's well-being, and access to basic needs, as a pillar of resilience. The main findings show that access to essential services, such as water and sanitation, are important in explaining household's resilience capacity. Moreover, the availability or non-availability of such services play a role in determining the risk level of households' exposure to shocks and stressors, validating, as such, the hypothesis established.

The results are similar to those found by FAO (2018), arguing that access to essential services, such as water and sanitation, is an important determinant of households' resilience capacity.

The results are important to understand how farmers face dynamics and disturbances at the farm, induced shocks and stressors and how they cope with, adapt to and shape changes. The findings show that stressors such as people's access to basic needs, water and sanitation, are important in understanding the farmers' resilience capacity, because their availability determines the risk level of households' exposure to shocks and stressors.

The research has its limitations. The indicators access to roads and rail line revealed less significant influence on food security, although they correspond to basic services. This can be justified by the fact that there are two general approaches, one based on a theoretical understanding of relationships and one based on statistical relationships (Adger et al., 2004). Therefore, the indicators could theoretically be valid, but be statistically irrelevant or not usable. Likewise, the indicators showing people access to roads and rail lines, theoretically, they are valid and influence food supply availability and access, but they are statistically irrelevant.

Acknowledgements

This work was supported by a grant of the Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P4-ID-PCCF-2016-0166, within the PNCDI III project "ReGrowEU - Advancing ground-breaking research in regional growth and development theories, through a resilience approach: towards a convergent, balanced and sustainable European Union".

Conflict of interests

The author declares no conflict of interest.

References

1. Altieri, M.A., Nicholls, C.I., Henao, A., & Lana, M.A. (2015). Agroecology and the design of climate change-resilient farming systems. *Agronomy for Sustainable Development*, 35, 869-890.

2. Anica Popa, I., Istudor, N., & Anica Popa, L. (2008). Using business intelligence techniques in agro-food domain, *Multifunctional Agriculture and Rural Development (III) – rural development and (un) limited resources*, Belgrad, 04-05 December 2008, 385-389.
3. Ashkenazy, A., Chebach, T.C., Knickel, K., Peter, S., Horovitz, B., & Offenbach, R. (2018). Operationalising resilience in farms and rural regions – Findings from fourteen case studies. *Journal of Rural Studies*, 59, 211-221.
4. Atkociniene, V., Aleksandravicius, A., Zemeckis, R., Vitunskiene, V., Dautarte, A., Spruogis, V., Blockyte, L., Baltusiene, J., & Serv, E. (2015). *Resilient Farming Systems and Market Differentiation: Challenges and Opportunities in Farmers' Markets (Lithuania)*. RETHINK Case Study Report. Aleksandras Stulginskis University, Kaunas, Lithuania.
5. Adger W. (2006). Vulnerability. *Global environmental change*, 16, 268-281.
6. Adger, W., Brooks, N., Bentham, G., Agnew, M., & Eriksen, S. (2004). *New indicators of vulnerability and adaptive capacity*. Norwich, UK. Tyndall Centre for Climate Change Research.
7. Alinovi, L., Mane, E. & Romano, D. (2008). *Measuring household resilience to food insecurity: application to palestinian households. Agricultural Survey Methods*. Chichester, UK. John Wiley & Sons.
8. Bene, C., Headey, D., Haddad, L. & von Grebmer, K. (2016). Is resilience a useful concept in the context of food security and nutrition programmes? Some conceptual and practical considerations. *Food Security*, 8, 123-138.
9. Bennet, E. M., Cumming, G. S., & Peterson, G. D. (2005). A systems model approach to determining resilience surrogates for case studies. *Ecosystems*, 8, 945-957.
10. Berkes, F., Colding, J., & Folke, C. (2003). *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge University Press: Cambridge.
11. Bullock, J.M., Dhanjal-Adams, K.L., Milne, A., Oliver, T.H., Lindsay, T.C., Whitmore, A., P., & Richard, P., F. (2017). Resilience and food security: rethinking an ecological concept. *Journal of Ecology*, 105 (4). 880-884.
12. Bujones, A., Jaskiewicz, K., Linakis, L., & McGirr, M. (2013). *A Framework for Analyzing Resilience In Fragile and Conflict-Affected Situations*. USAID Final Report. Columbia University SIPA 2013.
13. Catacora Vargas, G. (2017). *Seguridad Alimentaria y Derecho a la Alimentación Resultados de una Evaluación Exploratoria entre Actores de Sistemas Alimentarios Agroecológico, Indígena y Agroindustrial en el Departamento de Santa Cruz, Bolivia*. Agruco, Cochabamba.
14. Cicchetti, D. (2010). Resilience under conditions of extreme stress: a multi-level perspective. *World Psychiatry*, 3, 145-154.

15. Ciani, F. (2011). *A Resilience-based approach to food insecurity: the impact of hurricane Mitch on rural household in Nicaragua*. PhD working paper. Florence, Italy. University of Florence.
16. Constantin, D.L. (1999). *Regional competition in Romania: Determinants and policies*, Louvain-la-Neuve: European Regional Science Association (ERSA).
17. FAO. (2018). *Resilience analysis in Karamoja, Uganda*. Rome: FAO.
18. FAO. (2016). *Analysing Resilience for better targeting and action. Resilience Index Measurement and Analysis – II*. Rome: FAO, Available at: <http://www.fao.org/3/a-i5665e.pdf>
19. FAO. (2012). *Resilience Index Measurement and Analysis (RIMA)*. Available at www.fao.org/3/ai4102e.pdf.
20. Folke, C. (2006). *Resilience: the emergence of a perspective for social-ecological systems analyses*. *Global Environmental Change*, 16(3), 253–267.
21. Frankenberger, T., Spangler, T., Nelson, S., & Langworthy, M. (2012). *Enhancing Resilience to Food Security Shocks in Africa*. Discussion Paper. Available at www.fsnnetwork.org/sites/default/files/discussion_paper_usaid_dfid_wb_nov_8_2012.pdf.
22. Gunderson, L., Allen, C., & Holling, C. (2010). *Foundations of ecological resilience* (eds.). London: Island Press.
23. Hecht, A.A., Biehl, E., Barnett, D.J., & Neff, R.A. (2018). Urban Food Supply Chain Resilience for Crises Threatening Food Security: A Qualitative Study. *Acad Nutr Diet*, 119(2), 211-224. doi: 10.1016/j.jand.2018.09.001.
24. Holling CS. (1973). Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics*, 4, 2 –23.
25. Hollnagel E., Woods D.D., & Leveson N.G. eds. 2006. *Resilience Engineering: Concepts and Precepts*. Burlington, VT: Ashgate Publishing.
26. Ignat, R. (2019). Romanian entrepreneurship and resilience from the modern business structures perspectives: A conceptual approach, *Quality-Access to Success*, 20(S2), 319-321.
27. Ion, R.A. (2018). Beyond Macroeconomics of Food and Nutrition Security. *International Journal of Sustainable Economies Management*, 7(1), 13-22, doi: 10.4018/IJSEM.2018010102
28. Jacobi, J., Mukhovi, S., Llanque, A., Augstburger, H., Käser, F., Pozoc, C., Peter, M., N., Delgado, H., M., F., Kiteme, B., P., Rist, S., & Speranza, C., I. (2018). Operationalizing food system resilience: An indicator-based assessment in agroindustrial, smallholder farming, and agroecological contexts in Bolivia and Kenya. *Land Use Policy*, 79, 433-446, <https://doi.org/10.1016/j.landusepol.2018.08.044>
29. Kwasek, M., & Cvijanovic, D. (2013). Threats To Food Security And Common Agricultural Policy. *Economics of Agriculture*, 59(4). Doi: 10.22004/ag.econ.143167.

30. Mutea, E. (2018). Livelihood-related drivers of food insecurity, poverty, and inequality in Northwest and Southwest Mount Kenya. unpublished. *Food Sec.*
31. Pelletier, B., Hickey, G.M., Bothi, K.L., & Mude, A. (2016). Linking rural livelihood resilience and food security: an international challenge. *Food Security*, 8, 469-476.
32. Pike A., Dawley S., & Tomaney J. (2010). Resilience, adaptation and adaptability. Cambridge Journal of Regions, *Economy and Society*, 3, 59-70.
33. Pingali, P., Alinovi, L., & Sutton, J. (2005). Food security in complex emergencies: enhancing food system resilience. *Disaster*, 29(S1), 5-24.
34. RM-TWG (Resilience Measurement Technical Working Group). (2014). *Resilience Measurement Principles - Toward an Agenda for Measurement Design*. 1. Available at www.fsincop.net/resource-centre/detail/en/c/213177
35. Suweis, S., Carr, J.A., Maritan, A., Rinaldo, A., & D'Odorico, P. (2015). *Resilience and reactivity of global food security*. Proceedings of the National Academy of Sciences of the United States of America, 112, 6902-6907.
36. Tendall, D.M., Joerin, J., Kopainsky, B., Edwards, P., Shreck, A., Le, Q.B., Kruetli, P., Grant, & Six, J. (2015). Food system resilience: Defining the concept. *Global Food Security*, 6, 17-23.
37. Vaitla, B., Tesfary, G., Rounseville, M., & Maxwell, D. (2012). *Resilience and Livelihoods Change in Tigray, Ethiopia*. Somerville (MA), USA. Feinstein International Center, Tufts University.
38. Zselezky, L., & Yosef, S. (2014). *Are shocks really increasing? A selective review of the global frequency, severity, scope and impact of five types of shocks*. 2020 Conference Paper 5. May 2014. Washington, D.C.: International Food Policy Research Institute.