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Editorial

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Volume 23, Issue 2, of *Economia agro-alimentare / Food Economy*, features six regular Articles and one Note, all written in English. The topics cover several important issues: consumer preferences and behaviour, food security, government subsidies for crop insurance, farm digitalisation, and supply chain power relationships. The range of the analysis goes from local to global and covers geographical areas in Italy, Albania, Ethiopia, Indonesia, Nigeria, and the UK.

The authors are affiliated with Institutions based in Italy, Albania, Indonesia, Nigeria, Saudi Arabia, and the UK.

In the article authored by Biagia De Devitiis, Rosaria Viscecchia, Valentina Carfora, Carla Cavallo, Gianni Cicia, Teresa Del Giudice, Concetta Menna, Gianluca Nardone, and Antonio Seccia, titled "Parents' trust in food safety and healthiness of children's diets: a TPB model explaining the role of retailers and government", the Authors use the theoretical framework of Theory of Planned Behavior. The model is extended to 'trust' to consider that perceived risks about safety can harm parents' intentions due to the subsequent food scandals that affect the reputation of this specific food industry. A survey of 223 parents was carried out. The results suggest that perceived behavioral control and attitude are the most important factors

in determining the intention in parents of giving their children fruit and vegetables. Trust has been proved to influence parents' intentions, but only related to retailers and not to the government.

In the article "Whose Salad Is Organic? An Attribute Segmentation Perspective – Evidence from Albania", Elena Kokthi, Irina Canco and Eneida Topulli focus on consumers perception of organic vegetables and fruit. A survey is made on a sample of 324 consumers in different markets in the Tirana district in Albania. The aim is to understand consumer perceptions of organic attributes and identify the attributes consumers consider when buying fruit and vegetables. By using a Contingent Valuation Method, the authors analyse consumers' willingness to pay for organic products. Here, it is estimated that consumers are willing to pay an average premium of 27.7% for organic vegetables and 28.3% for organic fruit. In addition, a Cluster Analysis is applied to classify consumers into similar segments according to their willingness to pay for organic products as well as behaviour and motivation in relation to the higher price of these products. Findings from this study also indicate that consumers are linking organic attributes with health. The majority also use price as the main indicator of the quality of the product. The authors argue that organic products may serve as a farming system to improve farmer's income in the future.

The article by Francesco Zecca and Marco D'Errico, "Food security and land use: the Ethiopian case", focuses on the impact of Large-Scale Land Acquisition (LSLA) on local food and water security", provides an in-depth analysis of the LSLA in Ethiopia. LSLA refers to land acquisition by private or public, national or international investors and agribusinesses on a long-term basis to produce agricultural commodities, mainly for export purposes. The paper provides a quantitative assessment to estimate the potential food and water appropriation of LSLA in Ethiopia. After a brief literature review, the paper explores the effect of LSLA on food and water security by a simulation analysis to predict the change in food and water supply had the entire acquired land was cropped with domestic food (i.e. staple crop), under the assumption of a balanced diet in the East African region and export-oriented LSLA. The results reveal that under the absence of LSLA, an additional 7.1 million people in Ethiopia would have access to a well-balanced diet. The paper proposes a need for stringent and binding regulations in addition to voluntary principles led by the Food and Agriculture Organization of the United Nations (FAO) and the Committee on World Food Security (CFS). Comprehensive regulations on a global basis to issue new policies for land governance on agricultural investment will have a significant impact on food security problems in many developing countries in the Global South.

In the article titled "Prevalence and correlates of food insecurity in rural Nigeria," Oluwakemi Adeola Obayelu, Emem Ime Akpan, and Ayodeji

O. Ojo, analyse the dynamics of food insecurity among households in rural Nigeria, using data from the Living Standard Measurement Survey-Integrated Survey on Agriculture (LSMS-ISA). They found that Food insecurity status tends to increase in larger households, in those with a dependency, with a female and an older household head. Male, married heads are more likely to be food secured because of their spouses also having income-generating activities.

Muhammad Yasir Yusuf, Rahmat Fadhil, T. Saiful Bahri, Hafiizh Maulana authored the article "Comparison study of agricultural insurance government subsidy and farmers' self-subsistent premium in Indonesia". The authors analyse a government-subsidised Agricultural Insurance program to support rice farmers in Indonesia, using panel data on the program participants available for the years 2016-2019. They test, through regression analysis, the moderating role of government subsidies and farmers' self-subsistent premium on the overall area under the program, and confirm that the Government's subsidy significantly increase the interested land area, while farmers' self-subsistent premium has a negative impact.

The article "Innovation in Basilicata agriculture: from tradition to digital" by Maria Assunta D'Oronzio and Carmela Sica addresses digitalisation in the agro-food sector due to cooperation between public and private actors involved in rural development policies. Focused on Basilicata, this paper analyses the eleven Operational Groups of the European Partnerships for Innovation (EIP-AGRI) – classifying them by type of partnership, composition, main innovative tool adopted, production sector to which they belong – as well as the digital innovations they transferred to Lucanian farms to foster their smart, competitive and sustainable development. The authors verified the role of Lucanian Operational Groups in stimulating the adoption of 4.0 technologies in agricultural production processes and agro-food supply chains. Although economic (high drone flights costs), cultural (poor knowledge of technologies and foreign languages) and infrastructure (lack of fast broadband in rural areas) difficulties, the main innovative applications transferred to Basilicata farms resulted in precision farming technologies (such as satellites, drones, proximity sensors), and information collection systems, software and data analysis, as well as robotics and automation. Such an analysis can inspire similar research in other regions/countries: it should be the foundation for any future policy updates or revisions regarding digitalisation in the agri-food sector.

Finally, in the Note by Malik and Hingley, titled "Consumer demand information as a re-balancing tool for power asymmetry between food retailers and suppliers" the authors present a conceptual model that analyses the balance of power between retailers and suppliers in the supply chain to reduce information asymmetry and under conditions of mutual dependence.

Based on the theories of power dependence and resource dependence, the use of demand information is conceptualised to understand how power asymmetry can be balanced for mutual benefits by drawing on consumer information (shopper demand) as a critical data set to enable suppliers to manage mutual dependence. While part of the literature postulates that power dependence is a major cause of instability in supply chain relationships, other scholars argue that the presence of a powerful partner adds stability with resources, and a weaker partner should adapt to living with the relevant arrangement. According to this study, the co-option mechanism adds stability and reduces uncertainty through the exchange of resources. Power asymmetry in relationships is found to affect sustainability, especially in times of sales promotion for both retailers and suppliers.

With the previous issue, we welcomed Maro Vlachopoulou as a new member of the Editorial Board. Unfortunately, due to other commitments, she had to resign. We thank her for the commitment and contribution in the editorial process during the past months.

The journal's Scientific Advisory Board evaluated the articles published in the journal during the year 2020. The winner of the Best Paper Award is "The technical efficiency of the Apulian winegrowing farms with different irrigation water supply systems" authored by Ruggiero Sardaro and Piermichele La Sala. The prize will be awarded during the next siea Annual Meeting that will take place in Verona, September 30-October 1, 2021.

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Prevalence and correlates of food insecurity in rural Nigeria: A panel analysis

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Abstract

The study assessed dynamics of food insecurity among households in rural Nigeria using the Living Standard Measurement Survey-Integrated Survey on Agriculture (LSMS-ISA) collected in 2010/2011 and 2015/2016. Food insecurity status of the households was constructed using Household Food Insecurity Access Scale and analysed with descriptive statistics and random effect ordered probit model. Overall, 63.10%, 26.24%, 9.53% and 1.13% of households were food secure, mildly food insecure, moderately food insecure and severely food insecure, respectively in the first panel; while 46.53%, 31.63%, 19.39% and 2.45% were food secure, mildly food insecure, moderately food insecure and severely food insecure, respectively in the second panel. Food insecurity status increased with large household size, dependency ratio, being female-headed and aging household heads. Households in south-eastern Nigeria had a higher food insecurity incidence than elsewhere. Age, age squared, female to male adult ratio, primary and tertiary education, occupation, marital status, household size, access to credit and living in North East, North West, South West, South East and South zones were the correlates of food insecurity in rural Nigeria. Based on the findings, the study recommended an increased awareness on the use of family planning methods and improved access to family

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planning services. Also, severely food insecure households should be identified and specifically targeted by the government for appropriate safety net interventions.

Introduction

Despite a steady economic growth and development in many parts of the world, a significant proportion of the global population continues to suffer from food insecurity and malnutrition (ESAF, 2007). The Sustainable Development Goal of zero hunger recognizes that hunger and food insecurity are the core afflictions of poor people and specifically sets to end all forms of hunger and malnutrition, achieve food security, improved nutrition and promote sustainable agriculture by 2030 (UNDP, 2016). Thus, this makes food insecurity a very pertinent area of research. Food insecurity is a social and economic problem of lack of food due to resource or other constraints, not voluntary fasting or dieting, or because of illness or for other reasons (National Research Council, 2006). It is experienced when there is uncertainty about future food availability and access, insufficiency in the amount and kind of food required for a healthy lifestyle or the need to use socially unacceptable ways to acquire food (Wolfe *et al*., 2003; Quandt *et al*., 2001). Food insecurity is measured as a household level concept that refers to uncertain, insufficient, or unacceptable availability, access, or utilization of food. It is associated with inadequate intake of key nutrients, risk of overweight in women and some girls, depressive symptoms in adolescents and academic and social developmental delays in children (Stormer and Harrison, 2003). It is also associated with more behavioral problems and poorer school performance (Alaimo *et al*., 2001).

The prevalence of poverty and hunger is more pronounced in the rural areas of Nigeria where up to 80% of the population survive on less than a US dollar per day (Food Security Portal, 2014). Particularly, rural households have become even more vulnerable to malnutrition, erratic supply of food items, unaffordable food costs, low quality foods and sometimes complete lack of food (Akinyele, 2009). The International Fund for Agricultural Development (2012), rated Nigeria as the number one producer of yam, cassava and cowpea in the world. Nigeria is also the second highest producer of sweet potatoes in the world (Rolando, 2017; FAO, 2020). Despite these indices, Nigeria remains a food insecure nation and relies heavily on food importation. Majority of the rural populace engage in subsistent farming on small plots of land to feed their households and rely on seasonal rainfall

(Omorogiuwa *et al*., 2014). This suggests that rural households experience consistent food insecurity.

Although Nigeria prides itself as the giant of Africa with its economy becoming the largest in 2014, Not less than 70% of the Nigerian population survives on less than a dollar per day while food insecurity prevalence in rural areas stands at 71% (Akerele *et al*., 2013; Omorogiuwa *et al*., 2014)). According to FAO (2015) report, despite Nigeria having achieved a reduction of undernourishment of the population by more than half, from 19.3% in 1990 to 8.5% in 2010, the number of undernourished in Nigeria increased from about 10 million to almost 13 million from 2010 to 2012. Nigeria was also ranked 93^{rdt} out of a total of 117 countries on the 2019 Global Hunger Index and 15^{8th} out of a total of 189countries on the 2019 UNDP Human Development Index (Grebmer, 2019; UNDP, 2019).

Several studies had been carried out in different parts of Nigeria on household food insecurity using micro data (Akerele *et al.,* 2013; Agbola, 2014, Ahmed *et al*., 2015, Irohibe and Agwu, 2014, Ibrahim *et al.,* 2016). Further, previous studies had estimated food insecurity status using Foster, *et al*. (1984) food poverty index (Akerele *et al*., 2013), Cost of Calories (Agbola, 2014; Ahmed *et al*., 2015), Coping Strategies Index (Ibrahim *et al*., 2016), Household Dietary Diversity Scale (Ogundari, 2017), Food consumption score (Owoo, 2018), Food energy intake (Ayantoye *et al*., 2011) and USDA approach (Obayelu, 2012) to estimate food security. However, Ogundari (2017) used a nationally representative data to group households into different levels of food insecurity using food expenditure and dietary diversity score. This study however deviates from these studies by using a panel data to estimate correlates of food insecurity in rural Nigeria. Panel data suggest that households are heterogeneous and there is the risk of obtaining biased results if heterogeneity is not controlled (Baltagi, 2005). Therefore, panel data analyses are able to control for time invariant variables as well as identify and measure effects that are simply not detectable in pure cross-sections or pure time-series data. Panel data thus provide more informative result with more variability, less colinearity among the variables, more degrees of freedom and more efficiency (Blundell & Matyas, 1992). The panel models allow us to construct and test more complicated behavioural models than purely cross-sectional or time-series data. The study therefore contributes to the growing body of literature on panel data analyses of household food insecurity in developing countries, especially Nigeria. The prevalence and determinants of rural household food insecurity were therefore assessed overtime.

1. Methodology

The General Household Survey-Panel data was collected by the National Bureau of Statistics (NBS) in conjunction with the World Bank. Data from two waves, 2010/2011 (wave 1) and 2015/2016 (wave 3) were employed for the study and each wave consists of two seasons, post-planting and post-harvest. This study employed primarily the post-harvest data that was collected between July and August, however, missing information including educational status, remittances and other socioeconomic information was updated using the post-planting round that was collected between January and February. Data for the GHS panel survey was collected from 3,347 rural households and 1,569 urban households for wave 1 and from 3,114 rural households and 1,468 urban households for wave 3. The difference between the sample sizes of the two waves is because of non-response from households and also a change of location of some households. Therefore, due to incomplete information from some households and the panel nature of the study, data from 3,022 rural households constituted the sample size and were used for this study.

The Household Food Insecurity Access Scale (HFIAS) is a household food security survey instrument developed by the Food and Nutrition Technical Assistance program at the United States Agency for International Development (USAID, 2007). The choice of Household Food Insecurity Access Scale is based on the fact that the experience of food insecurity causes predictable reactions and responses that can be captured, quantified and summarized in a scale (Coates *et al*., 2007). The questionnaire consists nine Likert scale questions on various household responses to food access within the previous four weeks. The ranked responses to the nine HFIAS questions can be summed and presented as a scaled score to represent household food access insecurity (called the Household Food Insecure Access Scale Score or the HFIASS). In the HFIASS, higher values represent worse household food access. The HFIAS can be used as a continuous measure of the degree of food insecurity (access) in the household. A HFIAS score variable is calculated for each household by summing the codes (between 0 and 3) for each frequency-of-occurrence question. The maximum score for a household is 27 (the response of the household was 'often' to all 9 questions, coded with 3) and the minimum score is 0 (the household responded 'no' to all occurrence questions, and therefore the frequency-of-occurrence questions could be skipped). Food insecurity increases with the scores. According to this classification method, food secure households ≤ 1; Mildly food insecure households scored 2 to 8; Moderately food insecure households scored 9 to 16; and severely food insecure households scored 17 to 27.

The basis for random effects model is that the individual-specific difference across entities is expected to be a stochastic variable that is uncorrelated with the explanatory variables. The structural model of the random effects ordered probit model is presented as a latent variable model where the observed ordinal responses Y_{it} are generated from the latent continuous responses (Greene, 2012). Our model is given by:

$$Y_{it} = X_{it}\beta + vi + \varepsilon \quad (1)$$

Where, Y_{it} is a latent variable (food Insecurity statuses) ranging from 1 to 4; i is the observation; X is a vector of explanatory variables; β is a vector of unknown parameters to be estimated; v is the time-invariant random variable assumed to be unrelated to any independent variable; and ε is the error term assumed to be independent and distributed as standard normal with mean zero and variance one.

The individual's error term is not correlated with the predictors which allows for time invariant variables to play a role as explanatory variables by specifying the intercept parameters α_i to consist of a fixed part that represents the population average ($\bar{\alpha}$) and a random individual difference from the population average, e_{it}, this is broken down as: $\alpha_i = \bar{\alpha} + e_{it}$. The random individual differences e_{it} called the random effects, are analogous to random error terms, and it is assumed that they have zero mean, are uncorrelated across individuals and they also are assumed to have constant variance, σ^2 e, so that; E(e*i*) = 0, cov(e*i* *ej*) = 0 and var(e*i*)= $\sigma^2 e$, then

$$Y_{it} = \bar{\alpha} + e_{it} + \beta X_{it} + u_{it} \quad (2)$$

Rearranging,

$$Yit = \bar{\alpha} + \beta xit + vit \quad (3)$$

vit is the combined error term and this model is often referred to as error component model.

The measurement model for ordered outcomes was obtained by expanding the measurement model for binary outcomes by dividing the latent variable into four ordinal categories:

$$Y_{\text{it}} = m_i \; if \; m_{i-1} < y_{\text{it}} < \tau_m$$

Therefore, the latent variable could be measured as

$$Y_{it}\begin{cases} 1 - \text{Food secure} & \text{if } \tau_0 = {}_1 \le y_{it} \le \tau_1 \\ 2 - \text{Mildly food insecure} & \text{if } \tau_1 = \tau_1 \le y_{it} \le \tau_2 \\ 3 - \text{Moderately food insecure} & \text{if } \tau_2 = \tau_2 \le y_{it} \le \tau_3 \\ 4 - \text{Severely food insecure} & \text{if } \tau_3 = \tau_3 \le y_{it} \le \tau_{4=4} \end{cases}$$

X_i = ith explanatory variable (i = 1, 2, 3, … n)
β_i = coefficients ith explanatory variable (i = 1, 2, 3, … n)
ε = error term

This model was run using Stata/SE version14.1.

The Wald test is one of three classical approaches to hypothesis testing, together with the Lagrange multiplier and the likelihood-ratio test. It is based on the asymptotic normality of the estimator, specifically in that it tests whether the difference between the unrestricted parameter estimate and the hypothesized value is statistically significant. An advantage of the Wald test is that it only requires the estimation of the unrestricted model, which lowers the computational burden when compared to the likelihood-ratio test. Under the Wald statistical test, the maximum likelihood estimate of the parameter of interest is compared with the proposed value, with the assumption that the difference between the two will be approximately normally distributed. Typically, the square of the difference is compared to the chi-square distribution. In the standard form, the Wald test is used to test linear hypotheses that can be represented by a single matrix. The hypothesis for the test a non-linearity is:

$H_0 : c(\theta) = 0$
$H_1 : c(\theta) \neq 0$

The model was then subjected to the Hausman test (Wooldridge, 2003) to choose between the fixed or the random effect. The null hypothesis states that if the individual effects are random, there would be no significant difference between the estimators because they are consistent. However, the estimators differ in the alternative hypothesis.

2. Results and Discussion

2.1. *Food insecurity profile by households' demographic characteristics*

The study defined a household head as the leader of a group of people living together under the same roof, sharing meals and taking decisions together. About 26.2% of the rural households were mildly food insecure,

9.5% were moderately food insecure and 1.1% were severely food insecure in the first panel, while food insecurity status worsened in the second panel to 31.6%, 19.4% and 2.5% mildly, moderately and severely food insecure households respectively (Table 1). Overall, the incidence of food insecurity increased from 36.9% in the first panel to 53.5% in the second panel suggesting a movement of rural households into food insecurity in the second panel. This movement into food insecurity may be as a result of limited economic and physical capacities as well as environmental and economic shocks (Edeh & Brempong, 2015) and agrees with the findings of Ribar and Hamrick (2003) that rural households move into and out of a state of food insecurity and malnutrition. In addition, there was a persistent increase in the prices of food items between 2014 and 2017 across Nigeria, which reduced the economic access of the Nigerian households to food items (FAO, 2019). The prevalence of rising food insecurity therefore has different consequences for the individual, society, and government (Daneshi-Maskooni *et al*., 2017). Moreover, the incidences of food insecurity increased among female-headed households but decreased among their male counterparts in the second panel (Table 1). Overall, the incidence of food security reduced from 66.3% to 49.7% and 41.6% to 32.7% of all the male-headed and female-headed households, respectively. Notably, there was a 46.2% increase in female-headed households in the second panel probably owing to death of spouse or divorce. Male-headed households were thus more food secure than their female counterparts. This conforms to the findings of Ahmed *et al*. (2015) that female-headed households usually have limited access to productive assets and are usually saddled with the responsibility of home keeping and raising children which usually limit their involvement in income generating activities.

Households with younger household (≤ 30 years old) heads were the least food secure, while those in 31-40 and 41-50 year cohorts constituted 49.3% of the food secure group in almost equal proportion in the first panel. Food insecurity for this age group also decreased from 20.59% in the first wave to 17.57% in the second wave. This may be because they are in the productive age group and would be able to make a meaningful impact in agricultural production and as well participate in non-farm activities for improved food security (Agada & Igbokwe, 2014). Incidence of severe food insecurity also increased by 15.4% among the aged (> 60 years), while food security incidence increased by 37.7% among them. This suggests that that older household heads are more likely to move into food insecurity because they may not have adequate resources to curb food insecurity owing to reduced income from fragile health and morbidity (Quddus & Bauer, 2014).

Moreover, households with married heads experienced the highest level of food security in the both panels, while food insecurity indices of the widowed households increased in the second panel. Thus, joint efforts by

couples to provide for the food requirement of the household improves the chances of being food secure. Married households are likely to be more food secure owing to the fact that they are likely to have larger households with members engage in income generating activities and contribute to household income (Yusuf *et al*., 2015).

Table 1 - Food insecurity profile by household demographic characteristics

Demographic characteristics	2010/2011				2015/2016			
	Food Secure (n=1,907)	Mildly Food Insecure (n=793)	Moderately Food Insecure (n=288)	Severely Food Insecure (n=34)	Food Secure (n=1,406)	Mildly Food Insecure (n=956)	Moderately Food Insecure (n=586)	Severely Food Insecure (n=74)
Gender								
Male	1,746 (91.56)	645 (81.34)	220 (76.39)	24 (70.59)	1,221 (86.84)	761 (79.60)	429 (73.21)	45 (60.81)
Female	161 (8.44)	148 (18.66)	68 (23.61)	10 (29.41)	185 (13.16)	195 (20.40)	157 (26.79)	29 (39.19)
Age of household head								
≤ 20	13 (0.68)	3 (0.38)	0 (0.00)	0 (0.00)	7 (0.50)	5 (0.52)	2 (0.34)	0 (0.00)
21-30	213 (11.17)	67 (8.45)	19 (6.60)	3 (8.82)	64 (4.55)	36 (3.77)	25 (4.27)	3 (4.05)
31-40	472 (24.75)	148 (18.66)	55 (19.10)	7 (20.59)	253 (17.99)	177 (18.51)	73 (12.46)	13 (17.57)
41-50	468 (24.54)	188 (23.71)	64 (22.22)	6 (17.65)	376 (26.74)	245 (25.63)	121 (20.65)	14 (18.92)
51-60	361 (18.93)	164 (20.68)	60 (20.83)	9 (26.47)	320 (22.76)	197 (20.61)	169 (28.84)	13 (17.57)
> 60	380 (19.93)	223 (28.12)	90 (31.25)	9 (26.47)	386 (27.45)	296 (30.96)	196 (33.45)	31 (41.89)
Marital status								
Single	38 (1.99)	21 (2.65)	5 (1.74)	1 (2.94)	34 (2.42)	17 (1.78)	24 (4.10)	2 (2.70)
Married	1,686 (88.41)	610 (76.92)	208 (72.22)	23 (67.65)	1,159 (82.43)	725 (75.84)	390 (66.55)	35 (47.30)
Divorced	9 (0.47)	6 (0.76)	4 (1.39)	1 (2.94)	8 (0.57)	7 (0.73)	9 (1.54)	2 (2.70)
Separated	22 (1.15)	21 (2.65)	9 (3.13)	1 (2.94)	27 (1.92)	21 (2.20)	8 (1.37)	4 (5.41)
Widowed	152 (7.97)	135 (17.02)	62 (21.53)	8 (23.53)	178 (12.66)	186 (19.46)	155 (26.45)	31 (41.89)

** Figures in parentheses represent percentages of the distribution

2.2. *Food insecurity profile by household composition*

Households with three to six members were the most food secure group (44.4%) in the first panel but decreases to 32.9 in the second panel (Table 2). Households with more than 10 members were the least food secure in both panels. Incidences of food insecurity increased among households with more than six members in the second panel but decreased among those with less than seven members. Food insecurity thus increased with household size because large household size tends to exert more pressure on consumption, especially where there are many dependants, particularly children and elderly people (Omonona & Agoi, 2007; Agada & Igbokwe, 2014). Moreover,

Table 2 - Food insecurity profile by households' composition

Variables	2010/2011				2015/2016			
	Food Secure (n=1,907)	**Mildly Food Insecure (n=793)**	**Moderately Food Insecure (n=288)**	**Severely Food Insecure (n=34)**	**Food Secure (n=1,406)**	**Mildly Food Insecure (n=956)**	**Moderately Food Insecure (n=586)**	**Severely Food Insecure (n=74)**
Household Size								
< 3	219 (11.48)	102 (12.86)	36 (12.50)	6 (17.65)	84 (5.97)	74 (7.74)	47 (8.02)	12 (16.22)
3-6	846 (44.36)	405 (51.07)	146 (50.69)	18 (52.94)	463 (32.93)	338 (35.36)	221 (37.71)	23 (31.08)
7-10	622 (32.62)	226 (28.50)	91 (31.60)	9 (26.47)	536 (38.12)	369 (38.60)	235 (40.10)	29 (39.19)
Above 10	220 (11.54)	60 (7.57)	15 (5.21)	1 (2.94)	323 (22.97)	175 (18.31)	83 (14.16)	10 (13.51)
Dependency ratio								
< 1	1,249 (65.50)	469 (59.14)	170 (59.03)	24 (70.59)	1,051 (74.75)	713 (74.58)	424 (72.35)	54 (72.97)
1	311 (16.31)	129 (16.27)	51 (17.71)	5 (14.71)	161 (11.45)	111 (11.61)	70 (11.95)	12 (16.22)
> 1	347 (18.20)	195 (24.59)	67 (23.26)	5 (14.71)	194 (13.80)	132 (13.81)	92 (15.70)	8 (10.81)
Female to male adult ratio								
≤ 2	1,803 (94.55)	742 (93.57)	267 (92.71)	32 (94.12)	1,237 (87.98)	829 (86.72)	513 (87.54)	65 (87.84)
2.1-5.0	103 (5.40)	50 (6.31)	20 (6.94)	2 (5.88)	163 (11.59)	121 (12.66)	65 (11.09)	9 (12.16)
> 5	1 (0.05)	1 (0.13)	1 (0.35)	0 (0.00)	6 (0.43)	6 (0.63)	8 (1.37)	0 (0.00)

** Figures in parentheses represent percentages of the distribution

dependency ratio was measured as the ratio of number of dependents in the household to the number of working household members. Households with lower dependency ratio were more food secure as 65.5% and 74.8% of households with dependency ratio of less than one were food secure in the first and second panels respectively (Table 2). Food insecurity increased in the second panel for households with dependency ratio of less than one but decreased for households with a dependency ratio of one and above. Furthermore, food insecurity increased as the female to male adult ratio increased. Female to male adult ratio gives the ratio of adult female members of a household to the adult male members. About 94.6% and 87.9% of households with female to male adult ratio of less than or equal to 2 were food secure in the first and second panels respectively while households with female to male adult ratio of above five were the least food secure as only 0.05% and 0.4% of these households were food secure. Food insecurity status increased across the panel for households with female to male ratio of above two and decreased across the panel for households with female to male adult ratio of below two. This suggested that households with a higher number of adult females were more food insecure than households having less adult female members.

2.3. *Food insecurity profile by households' economic characteristics*

Most household heads in rural Nigeria had no formal education and (Table 3). About 51.6% and 58.9% of households whose heads had no formal education were food secure in the first and second panels respectively while 10.0% and 11.7% of households whose heads had tertiary education were food secure in the respective panels. Food insecurity was least among households whose heads had tertiary education as 2.9% and 4.1% were severely food insecure in both waves while households with no formal education were the most food insecure as 50% and 67.6% were food insecure in both waves. This is because the level of formal education attained could impact positively on household production and nutrition decisions thereby incidence of food insecurity (Kumba, 2015; Ayantoye & Amao, 2017).

Households whose heads were primarily engaged in farming were more food secure than their non-farming counterparts in the both panels. However, the incidences of food insecurity decreased among non-farming households in the second panel. Farming households however experienced an increase in food insecurity incidence in the second panel. The higher food insecurity status of primarily farming households could be attributed to fact that agriculture is characterized by seasonal variations in production as well as long production cycles. This agrees with the findings of Agbola (2014) being

Table 3 - Food insecurity profile by economic characteristics

Economic characteristics	2010/2011				2015/2016			
	Food Secure (n=1,907)	Mildly Food Insecure (n=793)	Moderately Food Insecure (n=288)	Severely Food Insecure (n=34)	Food Secure (n=1,406)	Mildly Food Insecure (n=956)	Moderately Food Insecure (n=586)	Severely Food Insecure (n=74)
Educational status of household head								
No formal Education	983 (51.55)	305 (38.46)	87 (30.21)	17 (50.00)	828 (58.89)	609 (63.70)	306 (52.22)	50 (67.57)
Primary Education	434 (22.76)	261 (32.91)	128 (44.44)	14 (41.18)	210 (14.94)	163 (17.05)	148 (25.26)	14 (18.92)
Secondary Education	299 (15.68)	157 (19.80)	57 (19.79)	2 (5.88)	204 (14.51)	125 (13.08)	85 (14.51)	7 (9.46)
Tertiary Education	191 (10.02)	70 (8.83)	16 (5.56)	1 (2.94)	164 (11.66)	59 (6.17)	47 (8.02)	3 (4.05)
Primary Occupation								
Farming	1,160 (60.83)	451 (56.87)	162 (56.25)	24 (70.59)	1,256 (89.33)	871 (91.11)	535 (91.30)	70 (94.59)
Non Farming	747 (39.17)	342 (43.13)	126 (43.75)	10 (29.41)	150 (10.67)	85 (8.89)	51 (8.70)	4 (5.41)
Farm size (Hectares)								
< 1	980 (51.39)	546 (68.85)	225 (78.13)	25 (73.53)	702 (49.93)	562 (58.79)	473 (80.72)	63 (85.14)
1-2	369 (19.35)	93 (11.73)	28 (9.72)	3 (8.82)	305 (21.69)	190 (19.87)	56 (9.56)	7 (9.46)
> 2	558 (29.26)	154 (19.42)	35 (12.15)	6 (17.65)	399 (28.38)	204 (21.34)	57 (9.73)	4 (5.41)
Land Ownership								
Owned land	562 (29.47)	166 (20.93)	62 (21.53)	11 (32.35)	263 (18.71)	239 (25.00)	117 (19.97)	22 (29.73)
Did not own land	1,345 (70.53)	627 (79.07)	226 (78.47)	23 (67.65)	1,143 (81.29)	717 (75.00)	469 (80.03)	52 (70.27)
Access to credit								
Yes	532 (27.90)	270 (34.05)	85 (29.51)	12 (35.29)	464 (33.00)	374 (39.12)	247 (42.15)	34 (45.95)
No	1,375 (72.10)	523 (65.95)	203 (70.49)	22 (64.71)	942 (67.00)	582 (60.88)	339 (57.85)	40 (54.05)
Access to remittances								
Yes	13 (0.68)	9 (1.13)	4 (1.39)	0 (0.00)	45 (3.20)	16 (1.67)	14 (2.39)	0 (0.00)
No	1,894 (99.32)	784 (98.87)	284 (98.61)	34 (100.00)	1,361 (96.80)	940 (98.33)	572 (97.61)	74 (100.00)

** Figures in parentheses represent percentages of the distribution

engaged primarily in farming increases the probability of the household being food insecure in Nigeria. This is expected, as agriculture in the rural areas of Nigeria is largely characterized by low capital involvement, use of crude implements, poor infrastructural facilities and drudgery which would lead to low earnings and subsequently inability to meet household food requirements (Adepoju & Adejare, 2013).

Furthermore, 51.4% and 49.9% of smallholder farming households, with less than a hectare of farmland, were food secure in the first and second panels, respectively. Lower proportions of households with one to two hectares (19.4% and 21.7%) and those with more than two hectares (29.3% and 28.4%) were food secure in the first and second panels, respectively. However, the incidences of food insecurity increased in the second panel for all categories. However, Severe food insecurity was highest among smallholder farming households (73.5%) with less than a hectare of farmland and increased to 85.14% in the second panel. Farm size is a reflection of own food production ability and it is believed that increase in farm size would result in increased food production and ultimately, increased likelihood of household food security (Ahmed *et al*., 2015).

About 72.1% and 67% of households that had no access to credit were food secure in the first and second panels respectively while 27.9% and 33% of households that had access to credit were food secure in the respective panels. Also, food insecurity is seen to decrease across the panel for households that had no access to credit as 64.71% were severely food insecure in the first panel and decreased to 54.1% in the second panel while it increased in households that had access to credit as 35.3% were severely food insecure in the first panel and increased to 46.0% in the second panel. This could be because a majority of household heads in rural Nigeria have low level of education and may not be able to properly manage credit. Thus, having access to credit may not improve food insecurity status of rural households.

Moreover, 29.5% and 18.7% of households that owned lands were food secure in the first and second panels respectively while 70.53% and 81.29% of households that did not own lands were food secure in the respective panels. Conversely, the incidence of severe food insecurity was however highest (67.65%) in households that did not own lands in the first panel and increased to 70.27% in the second panel. Although access to land rights is low in rural Nigeria and it may not have a significant effect on enhancing household food security in rural Nigeria. This is because an efficient use of land resources, rather than its ownership, would translate to more income and improved food security. Similarly, the majority (99.3% and 96.8%) of households that had no access to remittance were food secure, while 0.7%% and 3.2% of those with access to remittance were food secure in the first and second panels respectively. Although households with no access to remittance had

a higher proportion of food secure members, they also represented a higher percentage of food insecure households. This could be attributed to the fact that remittance contributes to household income which would lead to increase in per capita consumption and consequently improved food security (Adepoju & Adejare, 2013).

2.4. *Food Insecurity Profile by Share of Non-food Expenditure and zones of residence*

Share of non-food expenditure is obtained by dividing the expenditure on non-food items by the total expenditure of the household. A larger percentage of the households spent less than ten percent of their income on non-food expenditure, while less than one percent of the households with

Table 4 - Food insecurity profile by share of non-food expenditure and zones of residence

Variables	2010/2011				2015/2016			
	Food Secure (n=1,907)	**Mildly Food Insecure (n=793)**	**Moderately Food Insecure (n=288)**	**Severely Food Insecure (n=34)**	**Food Secure (n=1,406)**	**Mildly Food Insecure (n=956)**	**Moderately Food Insecure (n=586)**	**Severely Food Insecure (n=74)**
Share of Non-food Expenditure								
0	312 (16.36)	96 (12.11)	48 (16.67)	5 (14.71)	239 (17.00)	150 (15.69)	62 (10.58)	13 (17.57)
0.1-0.9	1,594 (83.59)	696 (87.77)	240 (83.33)	29 (85.29)	1,163 (82.72)	804 (84.10)	523 (89.25)	60 (81.08)
1	1 (0.05)	1 (0.13)	0 (0.00)	0 (0.00)	4 (0.28)	2 (0.21)	1 (0.17)	1 (1.35)
Geo-political zones								
North Central	389 (20.40)	120 (15.13)	40 (13.89)	6 (17.65)	373 (26.53)	135 (14.12)	41 (7.00)	6 (8.11)
North East	404 (21.19)	111 (14.00)	5 (1.74)	0 (0.00)	248 (17.64)	210 (21.97)	57 (9.73)	5 (6.76)
North West	658 (34.50)	41 (5.17)	6 (2.08)	9 (26.47)	428 (30.44)	232 (24.27)	52 (8.87)	2 (2.70)
South East	162 (8.50)	253 (31.90)	119 (41.32)	10 (29.41)	65 (4.62)	143 (14.96)	296 (50.51)	40 (54.05)
South South	180 (9.44)	204 (25.73)	92 (31.94)	9 (26.47)	166 (11.81)	176 (18.41)	123 (20.99)	20 (27.03)
South West	114 (5.98)	64 (8.07)	26 (9.03)	0 (0.00)	126 (8.96)	60 (6.28)	17 (2.90)	1 (1.35)

** Figures in parentheses represent percentages of the distribution

50% non-food expenditure. This suggested that most of the households had low welfare and were food insecure. However, food secure households with less than ten percent share of non-food expenditure were more than those that spent all their income on food were food secure in both waves. This is consistent with Engel's law that a poorer households spend the greater proportion of its total expenditure on the provision of food. Furthermore, about a fifth (20.40%) and a quarter (26.53%) of rural households in the North-Central; 21.19% and 17.64% in the North East; 34.5% and 30.4% in the North-West; 8.5% and 4.62% in the South-East; 9.44% and 11.81% in the South-South and 5.98% and 8.96% in the South-West were food secure. Across the six geopolitical zones, rural households in the South-East recorded the highest level of food insecurity.

2.5. *Determinants of Food Insecurity in Rural Nigeria*

The fixed effect and random effect models were conducted to ascertain the most suitable model for the analysis. The Hausman test was carried out to determine the most suitable model and it had a chi square value of 229.33 and was insignificant (Appendices II and III) suggesting that the random effects model was a more suitable model than the fixed effect model. The model had an overall chi-square value of 1076.97 with a log likelihood of –5568.8335, which was significantly different from zero, indicating goodness of fit of the model (Table 5). Further, the global Wald test of simple and composite linear hypothesis was applied to find out if the explanatory variables in the model are a significant improvement to the model. The P-value was less than 0.05 so the null hypothesis was rejected that the explanatory variables were simultaneously equal to zero (Appendix IV) implying that the explanatory variables were not zero and should be included in the model. The estimated cut-off points (μ) satisfied the conditions that $\mu 1 < \mu 2 < \mu 3$. This implies that these categories were ranked in an ordered way (Knight *et al*., 2005). Age, age squared, female to male adult ratio, marital status, primary education, occupation, household size and access to credit had positive coefficient, while marital status, tertiary education and being resident in North west were negative.

An additional year in the age of the household head would the probability of the household being mildly food insecure, moderately and severely food insecure marginally by 0.0008, 0.0001 and 0.0002 units, respectively. A similar increase would reduce the probability of the household being food secure by 0.20 unit. Following the life-cycle hypothesis, being aged would reduce the probability of being food secure than reducing the probability of being mildly food insecure, moderately and severely food insecure in the

Table 5 - Determinants of Food Insecurity (Random Effects)

		Food secure	Mildly food insecure	Moderately food insecure	Severely food insecure
Variables	**Coefficient**	**dy/dx**	**dy/dx**	**dy/dx**	**dy/dx**
Age	0.0609***	–0.0020*	0.0008*	0.0001*	0.0002*
	(0.0036)	(0.0012)	(0.0002)	(0.0006)	(0.0001)
Age squared	–1.05e-06**	3.47e-07**	-1.37e-07**	–1.70e-07**	–4.02e-08**
	(6.93e-07)	(2.13e-07)	(1.12e-07)	(1.08e-07)	(7.06e-08)
Gender	–0.2611	0.0863	–0.0341	–0.0422	–0.0099
	(0.0792)	(0.0263)	(0.0235)	(0.0029)	(0.0069)
Female to Male adult ratio	0.3151*	–0.0104*	0.0041*	0.0051*	0.0012*
	(0.0170)	(0.0056)	(0.0024)	(0.0028)	(0.0007)
Marital Status	–0.2771***	0.0916***	–0.0362***	–0.0448***	–0.0106***
	(0.0755)	(0.0249)	(0.0099)	(0.0122)	(0.0030)
Primary Education	0.0717*	–0.0237*	0.0094*	–0.0116*	0.0127***
	(0.0429)	(0.0141)	(0.0056)	(0.0075)	(0.0019)
Secondary Education	–0.0741	0.0245	–0.0097	–0.0119	0.0028
	(0.0503)	(0.0178)	(0.0066)	(0.0081)	(0.0019)
Tertiary Education	–0.3140***	0.1037***	–0.0410***	–0.0507***	0.0120***
	(0.6548)	(0.0216)	(0.0086)	(0.0106)	(0.0027)
Occupation	0.1184***	–0.0391***	0.0410***	0.0507***	0.00120***
	(0.6510)	(0.0216)	(0.0086)	(0.0106)	(0.0027)
Household size	0.0021***	–0.0069***	0.0027***	0.0034***	0.0008***
	(0.0054)	(0.0018)	(0.0007)	(0.0009)	(0.0002)
Dependency Ratio	0.2423	–0.0043	0.0017	0.0022	0.0005
	(0.1735)	(0.0062)	(0.0024)	(0.0031)	(0.0007)
Share of non-food Exp.	0.2092	–0.0691	0.0273	0.0338	0.080
	(0.1859)	(0.0661)	(0.0243)	(0.0301)	(0.0072)
Farm size	–0.0004	0.0001	–5.0e-05	–0.0001	–1.40e-05
	(0.0002)	(0.0001)	(3.0e-05)	(0.00004)	(8.32e-06)
Access to Credit	0.1323***	–0.0437***	0.0170***	0.0214***	0.0073***
	(0.0339)	(0.0111)	(0.0044)	(0.0055)	(0.0015)
Access to Remittance	0.1058	–0.0350	0.0138	0.1709	0.040
	(0.4614)	(0.1524)	(0.0603)	(0.0745)	(0.0017)
Land Ownership	0.5569	–0.0184	–0.0073	0.0899	–0.0213
	(0.5275)	(0.1741)	(0.0069)	(0.0085)	(0.2023)
North East	0.0955*	–0.3362*	0.0203*	0.0124*	0.0010*
	(0.0559)	(0.0197)	(0.0119)	(0.0073)	(0.0006)
North West	–0.2512***	0.0814***	–0.0537***	–0.0258***	–0.0016***
	(0.5487)	(0.0178)	(0.0117)	(0.0058)	(0.0004)
South East	1.2964***	–0.4609***	0.1190***	0.2765***	0.0646***
	(0.0586)	(0.0174)	(0.0096)	(0.1245)	(0.0063)

Table 5 - continued

		Food secure	Mildly food insecure	Moderately food insecure	Severely food insecure
Variables	**Coefficient**	**dy/dx**	**dy/dx**	**dy/dx**	**dy/dx**
South South	0.8799***	–0.3268***	0.1309***	0.1698***	0.2608***
	(0.0057)	(0.0194)	(0.0092)	(0.1141)	(0.0033)
South West	0.2317***	–0.0835***	0.0479***	0.0327***	0.0028***
	(0.0739)	(0.0270)	(0.0149)	(0.0011)	(0.0011)
Age-gender	–0.0051*	0.0017*	–0.0007*	–0.0008*	–0.0002*
	(0.0029)	(0.0010)	(0.0004)	(0.0005)	(0.0001)
Marital Status-occupation	–0.0246	0.0081	–0.0032	–0.0039	–0.0009
	(0.0209)	(0.0069)	(0.0027)	(0.0034)	(0.0008)
Farm size-household size	2.62e-05	–8.65e-06	3.42e-06	4.23e-06	1.00e-06
	(1.94e-05)	(6.43e-06)	(2.53e-06)	(3.15e-06)	(7.51e-07)
Remittance-land ownership	0.2971	–0.0982	0.0388	0.0480	.01136
	(0.2658)	(0.0877)	(0.0347)	(0.0429)	(0.0102)
Cut 1	1.3778	(1.08313)			
Cut 2	2.4318	(1.0844)			
Cut 3	3.7574	(1.0867)			
Number of observations	6044				
Log likelihood	–5568.8355				
Wald chi^2 (25)	1076.98				
Prob > chi^2	0.0000				
$Sigma^2$_u	0.0449				

Note: ***, ** & * indicate significant levels at 1%, 5% and 10% respectively
Figures in parentheses represent the standard errors

long-run. This suggested that rural household heads were more vulnerable to food insecurity in old age. This is because as household heads advance in age, they approach retirement and subsequently have a reduced income and are susceptible to being food insecure (Omonona & Agoi, 2007).

Being a male-headed household reduced the probability of being mildly, moderately or severely food insecure but increased probability of being food secure than their female counterparts. This may be owing to lower dependency ratios observed in male-headed households where both the head and their spouse were engaged in income generating activities. This is consistent with findings of Smith *et al.* (2017) that women had a higher probability of experiencing severe food insecurity than their male counterparts in Latin America and the Caribbean. Male-headed households have a higher probability of being food secure than the female-headed households probably because the

latter are usually saddled with the responsibilities of home keeping and raising children, which limit their involvement in income generating activities (Ahmed *et al*., 2015). Similarly, a unit increase in adult female to male ratio would increase the probability of being mildly food insecure, moderately food insecure and severely food insecure by 0.0041, 0.0051 and 0.0012 units, respectively but decrease the probability of being food secure by 0.0104 unit. Being a married head reduced the probability of a household being mildly, moderately and severely food insecure but increased the probability of being food secure. This is similar to the findings of Yusuf *et al*. (2015) that households in Ibadan, Nigeria, with married heads were more likely to be food secured owing to the fact that they were likely to have spouses with income generating activities and contribute to household income. Thus, the joint efforts to provide for the food requirement of the household improves the chances of being food secure.

Furthermore, an increase in household heads with primary education would reduce the probability of the household being food secure and moderately food insecure but increased that mild and severe food insecurity incidence. However, a similar increase in household heads with tertiary education would increase the probability of being food secure but decrease the probability of the household being mildly and moderately food insecure. This implies that low levels of education promote food insecurity, while a higher level of formal education could impact positively on the household production and nutrition decision, thereby reducing food insecurity (Ahmed *et al*., 2015; Smith *et al*., 2017). The probabilities of a household being mildly, moderately and severely food insecure were exacerbated with its head being primarily engaged in farming. This could be attributed to the fact that agriculture is characterized by seasonal variations in production and which consequently results in irregular income and a high probability of being food insecure (Adepoju & Adejare, 2013). This buttressed the findings of Ayantoye *et al*., (2011) that household heads engaging in farming activities were more food insecure in southwestern Nigeria.

Contrary to a priori expectation, food insecurity status of rural households increased with access to credit. This may be because the households were not able to efficiently manage credit made available to them. The study controlled for interaction effects and regional differences by creating dummies for geopolitical zones and interaction between variables as carried out by Mahmood *et al*. (2019). In terms of interaction effect, a combination of age and male gender had a positive relationship with a household being food secure and a negative relationship with the household being mildly, moderately or severely food insecure. This can be linked to the gender considerations in allocating productive resources to people in Nigeria. The regional effect revealed that living in North East, South East, South South and South west, Nigeria increases the chances of a household being food secure and decrease the chances of a household being mildly, moderately

or severely food insecure. Conversely, a negative relationship exists between living in North West, Nigeria and the probability of a household being food secure and increases the chances of a household being mildly, moderately and severely food insecure.

3. Conclusion and recommendations

The study examined food insecurity status of rural households in Nigeria. However, the secondary panel data used for the study has small sample size and thus policy makers should take caution in generalizing the results of this study to a wider context of rural households in developing countries. Food insecurity was prominent among households which had older household heads and also among female headed households. Households with heads having tertiary education were less food insecure compared to other households showing that a higher level of formal education could impact positively on household nutrition decisions, thereby reducing food insecurity. An increase in household size and consequently dependency ratio was seen to increase food insecurity levels of households. Also, households that engaged in farming as their occupation was seen to be more food insecure than other households and this was attributed to seasonal variations in production, long production cycles and consequently irregular income. Food security among rural farming households will improve as smallholder farmers move to efficient subsistence farming, and consequently develop the rural economies (Auerbach, 2018). Based on the foregoing, increased awareness on the use of birth control practices and improved access to family planning services, led by government and development partners, would enhance household food insecurity in rural Nigeria. Furthermore, households with elderly, widowed and female-headed households should be specifically targeted for safety net such as subsidized food prices, distribution of food crops relief materials, special nutrition programme, provision of free meals for malnourished households as well as improved access to credit facilities.

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Appendix 1 – *A priori Expectation for Determinants of Food Insecurity in Rural Nigeria*

Variable	Description	Expected sign	Reference
X1	Age of Household Head	+/–	Ibrahim *et al*., 2016
X2	Gender of Household head	+/–	Ahmed *et al*., 2015, Adepoju & Adejare 2013
X3	Marital status of Household head	+/–	Adepoju & Adejare 2013
X4	Primary Education of Household head	+/–	Ahmed *et al*., 2015, Amao and Ayantoye 2015
X5	Secondary Education of Household head	+/–	Adepoju & Adejare 2013, Ahmed *et al*., 2015
X6	Tertiary Education of Household head	+/–	Adepoju & Adejare 2013, Ahmed *et al*., 2015
X7	Occupation	+/–	Amao and Ayantoye 2017
X8	Household size	+/–	Agbola 2014
X9	Dependency ratio	+/–	Adepoju & Adejare 2013, Ibrahim *et al*., 2016,
X10	Farm size	+/–	Ahmed *et al*., 2015, Ibrahim *et al*., 2016
X11	Share of nonfood expenditure	+/–	Adepoju and Adejare 2013
X12	Access to credit	+/–	Adepoju & Adejare 2013, Ibrahim *et al*., 2016
X13	Land ownership	+/–	Amao and Ayantoye 2017
X14	Access to remittance	+/–	Agbola 2014, Adepoju & Adejare 2013

Appendix 2 – *Fixed effects Model and Random effects Model*

Variable	Fixed effects Model	Random effects Model
	Coef. (SE)	Coef. (SE)
Age	0.0051*** (0.0016)	0.0052* (0.0007)
Age squared	6.81e-07 (5.61e-07)	1.12e-06*** (4.41e-07)
Gender	0.0885 (0.0847)	–0.13244*** (0.0475)
Female to Male adult ratio	0.0175 (0.0188)	0.0321** (0.0113)
Marital Status	–0.1531** (0.0672)	0.2496*** (0.0434)
Primary Education	–0.0355 (0.0419)	0.2028*** (0.0257)
Secondary Education	0.0555 (0.0557)	0.1541 (0.0311)
Tertiary Education	–0.0245 (0.0805)	0.0212 (0.0399)
Occupation	0.1179 (0.0319)	0.1111*** (0.0243)
Household size	0.0821*** (0.0093)	0.0033 (0.0034)
Dependency Ratio	–0.00304 (0.0149)	0.0076 (0.0108)
Share of non-food Exp.	–0.2699* (0.1491)	0.2406** (0.1176)
Farm size	0.0000 (0.0001)	–0.0002 (0.000)
Access to Credit	0.1481*** (0.0277)	0.1149*** (0.0210)
Access to Remittance	–0.0862** (0.1045)	–0.0925 (0.0770)
Land Ownership	0.0453*** (0.0314)	0.0350 (0.0231)
_Cons	0.6697 (0.1106)	1.4125***(0.0579)
Sigma_u	0.6957	0.3332
Sigma_e	0.6768	0.6768
Rho	0.51374	0.1951

Appendix 3 – *Hausman Test*

Variable	Fixed	Random	Difference	S.E
Age	0.0110	0.0052	0.0057	0.0023
Age squared	1.11e-06	1.12e-06	–4.31e-09	
Gender	–0.4451	–0.1324	0.3126	0.1111
Female to Male adult ratio	0.03239	0.0321	–0.0002	
Marital Status	–0.3073	–0.2496	0.0577	0.0594
Primary Education	0.2025	0.0203	–0.0004	0.0227
Secondary Education	0.1534	0.1541	–0.0008	
Tertiary Education	0.0147	0.0212	–0.0065	0.0013
Occupation	0.0271	0.1111	–0.0840- 0.0355	0.0325
Household size	0.0027	0.0033	–0.0576	0.0227
Dependency Ratio	0.0063	0.0076	–0.0014	0.0007
Share of non-food Exp.	0.2442	0.2406	0.0035	
Farm size	–0.0002	–0.0000	–0.0002	0.0001
Access to Credit	0.1128	00.1150	–0.0022	
Access to Remittance	0.5226	0.0925	0.6151	0.2285
Land Ownership	0.6733	–0.0350	0.7084	0.3307

Chi^2 = (b–B)'[(V_b–V_B)^(–1)](b–B) = 19.39
Prob > chi2 = 0.1505

Appendix 4 – *Specification Test*

Wald Test of Simple and Composite Linear Hypothesis
[Food Security]Age of Household head = 0
[Food Security]Household size = 0
[Food Security]Dependency ratio = 0
[Food Security]Farm size = 0
[Food Security]Age square = 0
[Food Security]Female to Male Adult ratio = 0
[Food Security]Share of non-food Expenditure = 0
[Food Security]Gender of Household head= 0
[Food Security]Marital status of Household head = 0
[Food Security]Primary Education = 0
[Food Security]Secondary Education = 0
[Food Security]Tertiary Education = 0
[Food Security]Occupation of Household head = 0
[Food Security]Access to Remittance = 0
[Food Security]Land Ownership = 0
[Food Security]Access to Credit = 0
[Food Security]North East = 0
[Food Security]North West = 0
[Food Security]South East = 0
[Food Security]South West = 0
[Food Security]South South= 0
[Food Security]Age-gender= 0
[Food Security]Remitance-landownership= 0
[Food Security]Farmsize-householdsize= 0
[Food Security]Maritalstatus-occupation= 0
chi2(25) = 1719.15
Prob > chi2 = 0.0000

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Parents' trust in food safety and healthiness of children's diets: A TPB model explaining the role of retailers and government

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Abstract

This study started from the assumption that children's healthy diets are primarily determined by their parents and their intentions towards serving fruit and vegetables. Although it is widely known that a significant share in fruits and vegetables in children's diets has several advantages, there are some safety issues that can act as barriers in promoting fruit and vegetable consumption.
Therefore, we investigated parents' determinants in giving fruits and vegetables to their children taking into account that the trust in actors who minimize the presence of risks could be instrumental to understand the whole story. Due to the incidence of childhood obesity, Southern Italy is a suitable case study. An extended Theory of Planned Behavior (TPB) model including trust towards government and retailers has been set up. Results suggested that parental intention to give to their children fruits and vegetables in primarily determined by their perceived behavioral control, then by their attitude and by subjective norm. Trust has been proved to influence parents' intentions, but only related to retailers and not to government. Furthermore, the model positively explained childrens' behavior reported by parents.

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Introduction

According to WHO (2018), non-communicable diseases are the leading causes of death, disease and disability in Europe. The reason behind has been identified in an excessive intake of calories mainly due to increased consumption of processed food accompanied by an inadequate consumption of vegetables, fruits and whole grains (WHO, 2018).

In this context, children represent the most sensitive group of consumers, the WHO suggests, in future, this situation will get worse, with one in three children aged 6-9 years being overweight or obese. This tendency is higher in southern Europe countries, as: Italy Greece and Spain (WHO, 2014). Children tend to consume less than the recommended daily servings of fruits and vegetables, while consuming more sweetened beverages than recommended (Ogden *et al.*, 2002). A study on eating habits on infants and toddlers found that most of Italian children have a wrong nutrients intake through their everyday diet (Verduci *et al.*, 2019). One of the main causes of wrong diets is identified in a constant decline in the intake of vegetables-based food (Tognon *et al.*, 2014).

Given the scope of the problem, a large number of intervention efforts and campaigns have been implemented in Europe. Some campaigns were basically founded on the simplified message of suggesting five portions of fruits and vegetables per day (Hawkes, *et al.*, 2015), while others aimed at introducing fruit and vegetables among children in school (European Commission, 2016). Among the several experiences, it has been found that successful programs, mostly were based upon the role of family and parental involvement as instrumental in promoting healthy eating habits (Bere *et al.*, 2008; Rekhy & McConchie, 2014).

Despite the increased awareness of the health benefits that act as driver for fruit and vegetable consumption, the impact of these policy interventions remains at best, modest to low (Bere *et al.*, 2010; Methner *et al.*, 2017). Several barriers have been identified, including the consumer concerns related to food safety issues in fresh produce (Kahlor *et al.*, 2011; Rekhy & McConchie, 2014; Tallant *et al.*, 2018). In fact, the overall trend of fruits and vegetable consumption shows a decrease from 2006 to 2013 (Baselice *et al.*, 2017). A reason can be found in a growing consumer awareness concerning food safety (Alegbeleye *et al.*, 2018; Garcia & Teixeira, 2017). In the EU, in 2009 and 2010, respectively 4.4% and 10% of the foodborne verified outbreaks were linked with the consumption of vegetables and fruits, berries, juices (and products thereof) (EFSA, 2018).

Other food safety issues such as pesticide residues, antimicrobial resistance, wax coatings, nanomaterials and genetically modified organisms

are increasingly becoming a concern for the consumer (Magnuson *et al.*, 2011; Methner *et al.*, 2017; Tait & Bruce, 2001). There are evidences of diseases risk linked to pesticides exposure (Gold *et al.*, 2001; Sabarwal *et al.*, 2018). This can shapes preferences, for instance, García *et al.* (2005) reviewed the food habits of a Spanish population and found that about the 35% of respondents regularly avoided pesticide-treated fruits and vegetables to prevent cancer. Another study reported that organic food buyers estimated the risk of mortality from consuming conventionally grown food to be at a level nearly as great as the annual lung cancer risk for a smoker of one pack or more of cigarettes per day (Hammitt, 1990).

Furthermore, consumers highly concerned with the risks of food consumption tend frequently to share their worries with their peers and through social media, generating a negative word-of-mouth (Hilverda & Kuttschreuter, 2018). This is likely to lead, in extreme cases, to food scandals that are able to harm the performance of the entire sector (Cembalo *et al.*, 2019; Charlebois *et al.*, 2016). To the point that consumers' perceptions can outweigh the real risks and even privilege processed or animal foods. Actually, the real risks have been estimated in only 10 cancer cases per year from pesticide residues on fruits and vegetables consumed, versus 20.000 cases per year that can be actually prevented with an increased intake of fruit and vegetables (Reiss *et al.*, 2012).

Trust in the products' characteristics and in the entire supply chain appears to be crucial for consumers' choices (V. Carfora *et al.*, 2019; Hammitt, 1990). The safety of fruits and vegetables is a credence attribute (Darby & Karni, 1973; Del Giudice *et al.*, 2018), therefore it can lead directly to consumers' intention to purchase (Giampietri *et al.*, 2018; Pivato *et al.*, 2007). In fact, lacking real evidences, trust makes consumers convinced that the other party took all the measures needed to minimize the causes of risks (Hobbs & Goddard, 2015; Nuttavuthisit & Thøgersen, 2017; Wang & Tsai, 2019).

Therefore, this study aims to investigate the determinants of the parents' intention in inserting fruit and vegetables in their children's diets. The theoretical framework of Theory of Planned Behavior (TPB) will be used to explain the parents' role as health promoters for children. This theory will be extended to include trust, as it is believed to play a major role in this mechanism. Trust could remove the barrier of food safety concerns and act as driver of the parents' intention to provide fruit and vegetables. To the Authors' knowledge, in previous literature no study used an extended TPB framework to investigate the role of parents in determining the healthiness of their children's diets.

The theory of planned behavior for explaining fruit and vegetable intake

The role of parents in the development of healthy eating habits of their children occurs through mechanisms such as role modeling, availability and accessibility of foods at home and the development of attitudes, values and preferences (Patrick & Nicklas, 2005; Story *et al*., 2008; van der Horst *et al*., 2006). These mechanisms play a role interacting with the personal tendencies of children, that, in early age are particularly involved by the fluctuating levels of neophobia (Cavallo & Materia, 2018).

The current study proposed the Theory of Planned Behavior (Ajzen, 1991) as a theoretical framework to deepen the factors that predict parents' roles in facilitating fruit and vegetable consumption. It was chosen to identify the substantive elements that can drive a healthy eating behavior (Carfora *et al*., 2016a; Conner *et al*., 2016).

This theory indicates that intentions are proximal determinants of behaviors, which in turn are predicted by attitudes, subjective norms and perceived behavioral control (PBC). Attitude refers to beliefs towards the perceived likelihood that a specific behavior could determine a particular outcome. Subjective norm represents the individual's perceptions of whether the other references want that a certain behavior is performed or not and the individual motivation to comply their expectations. PBC is based on the perception that there are available resources and opportunities to perform the behavior successfully, where these facilitations are considerated on the basis of their perceived power to facilitate or inhibit the behavior performance.

In recent years several studies applied TPB model to predict different healthy eating behaviors (Armitage & Conner, 2001; McEachan *et al*., 2011) and specifically fruit and vegetable intake (Brookie *et al*., 2017; Kothe *et al*., 2012; Wilson *et al*., 2016). For example, Caso *et al.* (2016) showed that TPB predictors were useful factors for explaining fruit and vegetable consumption among teenagers. Moreover, a review reported that TPB predictors explained 30% to 57% of the variance in intentions and 6% to 32% of the variance in fruit and vegetable intake (Guillaumie *et al*., 2010).

Trust in food safety

Several food safety issues in fresh produce interrupted trust relationships between consumers and fruits and vegetables (Van Boxstael *et al*., 2013). Rebuilding trust is therefore one of the main challenges of modern marketing strategies, in fact, it appears to be more profitable than investing in consumer information (Wobker *et al*., 2015).

Shifting towards healthier and more sustainable diets will not be possible without sufficient levels of consumer's trust in the food chain actors, being food characteristics the outcome of all stages of supply chain from production to the consumption (Macready *et al.*, 2020). This implies that the consumer trusts the food characteristics if she feels trusts different institutions and market actors in the food system (de Jonge *et al.*, 2008; Meijboom *et al.*, 2006; Meyer *et al.*, 2012; Sapp *et al.*, 2010).

However, recent food scandals have contributed to a decline in the confidence of consumers towards regulatory agencies in their ability to deal with these food safety issues. In modern distribution channels, retailers are the first contact with consumers. Trust in retailers appears as the main strategy to reduce the uncertainty of consumers food choices (Khare & Pandey, 2017). By ensuring product quality dimensions as healthiness, sustainability, authenticity and safety, food retailers give consumers an indicator of the reliability and confidence (Khare & Pandey, 2017; Ladwein & Sánchez Romero, 2021). These credence characteristics need to be communicated by credible quality signals managed by reliable actors (Fernqvist & Ekelund, 2014).

In order to rebuild the interrupted trust between consumers and food system, several entities have developed private standards (Henson & Reardon, 2005). Their specific role is to ensure food quality in a sense that goes beyond what is assured by public standards. Retailers are the main instigators for private standards (Fearne *et al.*, 2001; Ganesan *et al.*, 2009; Kotsanopoulos & Arvanitoyannis, 2017). Furthermore, they are the actors with most interactions with the consumer and they leverage this closeness on a psychological level in order to reach satisfaction and loyalty, the reason why consumers feel this closeness it because retailers assess consumers' preferences and translate it into orders (Aschemann-Witzel *et al.*, 2016; Schultz *et al.*, 2016).

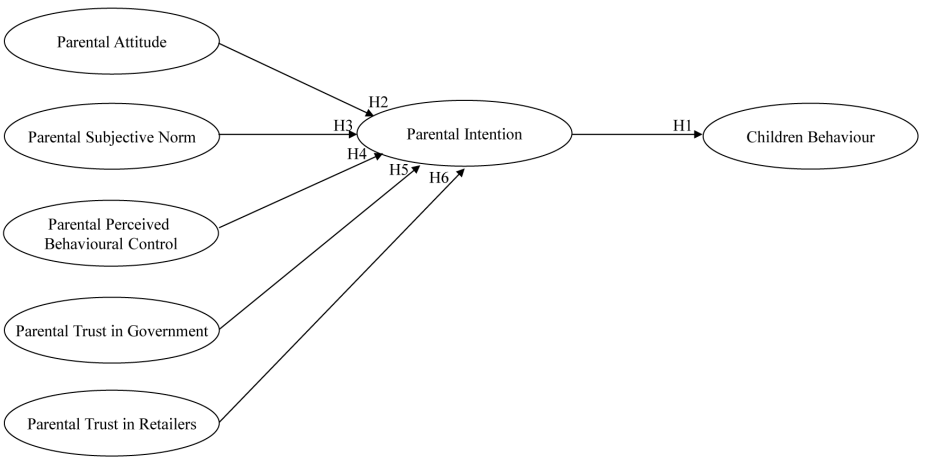
While the role of governments in food safety discloses in establishing policies and enforcing legislation about food safety, they also have the role of ensuring that producers follow the imposed rules through training and inspection. They also have the role of making sure that the imposed public standards are effective and sufficient to ensure the society safe food and avoid safety issues and scandals among the population (Kotsanopoulos & Arvanitoyannis, 2017; Reilly *et al.*, 2010).

Producers, obviously, have a role in determining desirable attributes of products as food safety, but in this case, they have been excluded from the model, as often in the majority of Italian grocery stores it is not possible to know who the producer is (Biénabe *et al.*, 2007).

Conceptual framework

The current study analyzed whether the TPB constructs (attitude, subjective norm and PBC) explain the parents' role as health promoters for children, predicting their intentions to feed children with fruit and vegetable. In line with previous researches, we proposed that parental intentions influence fruit and vegetables consumption of their children. Importantly, trust in food safety was added as additional factor because it could remove the barrier of food safety concerns and facilitate parents' roles in facilitating fruit and vegetable consumption. So, the aim is to verify if the inclusion of trust is able to increase the predictive validity of the TPB (Fig. 1).

Figure 1 - Conceptual model



Predicting children's fruit and vegetable consumption through parental intentions

Different findings suggested that parental practices to provide fruit and vegetable to children increase their actual consumption (Pearson *et al.*, 2009; Trofholz *et al.*, 2016). While, Melbye *et al.* (2012), supported the role of parents in monitoring, child control and modeling, for explaining children's consumption of fruit and vegetables. According to the TPB, these parental practices should be predicted by their intention to perform those actions (Ajzen, 1991).

Therefore, we hypothesized that:

H1: Parental intention to give their children fruit and vegetables is able to predict children's fruit and vegetables intake.

TPB predictors of parental intentions

Previous studies analyzed the role of parents in providing accessibility at home for fruit and vegetables and analyzed the impact of different domains of parental feeding practices (Bere & Klepp, 2004; Kratt *et al*., 2000; Melbye *et al*., 2012). However, they did not verify which cognitive factors could drive parents to adopt or not the intention. This consideration supports the need to provide further investigation to find which predictors could influence parental intentions.

Some studies applied the TPB model for understanding which factors are involved in the parental intentions to promote healthy behaviors in their children. In detail, it has been shown that TPB factors are able to explain caregivers' intentions for their child to walk to school (Schuster *et al*., 2016). Specifically, considering healthy eating behavior, Andrews *et al*. (2010) found that attitudes, subjective norms, and PBC are able to explain behavioral intentions, which in turn can predict parents' tracking behavior of their children's food intake. Besides, Riebl *et al*. (2016) tested the effectiveness of the TPB in predicting parents' and adolescents' sugar-sweetened beverages consumption, evaluating whether adolescents' beverage choices are influenced by parents' reactions to their beverage choices. Results indicated that adolescents' intention to limit sugar-sweetened beverages consumption moderated the relationship between parents' reactions encouraging sugar-sweetened beverages and adolescents' predicted consumption.

Therefore, stemming from the aforementioned literature we hypothesized that:

H2: Parental attitudes towards fruit and vegetables intake of their children could predict the intention to give them fruit and vegetables;

H3: Parental subjective norm in relation to fruit and vegetables intake of their children could predict intention to give them fruit and vegetables;

H4: Parental PBC towards fruit and vegetables intake of their children could predict intention to give them fruit and vegetables.

Additional factors: parental trust in government and in retailers

In this study we have chosen to analyze consumers' trust towards two actors that have a responsibility for guaranteeing food safety: government and retailers

(Carfora *et al.*, 2019). We suppose it can depend upon their perception on the actor pro-active behavior in preventing food risks (Van Kleef *et al.*, 2007). Among actors of supply chain, previous studies proved that the role of the government is instrumental in the perception that public welfare is granted, also for food safety (de Jonge *et al.*, 2008). Then, the retailers too can be a target for trust because they are the leading part of the supply chain, having power over sourcing partners and being who handles the availability of foods and its visibility in the store environment (Bimbo *et al.*, 2015; Fearne *et al.*, 2001). In turn, trust can also foster loyalty towards the products, especially fresh products and the ones with private labels (Baselice *et al.*, 2014; Calvo Porral & Levy-Mangin, 2016; Nandi *et al.*, 2017). Their role has been framed as fundamental in re-establishing trust after food scares and food scandals (Jackson, 2010). Moreover, they are receiving increased attention as an "environment" that is strategic in order to prevent obesity (Bonanno *et al.*, 2017).

Therefore, we hypothesized that:

H5: Parental trust in government could predict intentions to give children fruit and vegetables.

H6: Parental trust in retailers could predict intentions to give children fruit and vegetables.

1. Materials and Methods

1.1. *Participants and procedures*

The survey was carried out in 27 classes of 2 primary schools in Southern Italy. This area of Italy provides an interesting case study since the percentage of overweight or obese children is higher than in the rest of Italy (Gallus *et al.*, 2013). The two schools were randomly chosen and are representative of sub urban schools in southern Italian cities.

School boards were approached by mail and telephone and invited to take part in the study. After receiving the consent of the school boards, the parents of young children between the ages of 6-11 were invited to participate in the study through an informative document that disclosed all the details and the purposes of the study. Questionnaires were distributed and collected by the teachers.

A total of 223 parents completed the questionnaire. The questionnaire was organized into three main sections: the first part collected children's eating habits and their anthropometric measures; the second part measured the TPB constructs plus trust; the last part collected sociodemographic information of parents.

2.2. *Measures*

The questionnaire included measures of TPB factors, and children behavior in relation to the consumption of fruit and vegetables, plus trust in government and retailers, and, in the end, the gender and age of the parents. The measurements of TPB predictors were adapted from previous studies (Carfora *et al.*, 2016b). All TPB items were ranked on 7-points Likert scale.

Self-reported behavior. Children's consumption of fruit and vegetables was measured with the following two items (scale from 0 = "never" to 5 = "everyday):

- How many times did your child had five portions of fruits a day in the last week (FRUIT);
- How many times did your child had five portions of vegetables a day in the last weeks (VEGETABLE).

The two-items scale (M = 1.51; SD = 0.58) yielded an α coefficient of .64.

Parental Intention. Behavioral intention was assessed through three items that asked parents if they intended to provide fruits and vegetables to their children. Respondents indicated their agreement (1 = "strongly disagree"; 7 = "strongly agree") answering to the following three items:

- I intend to give my child at least five servings of fruit and vegetables each day (INT1);
- I plan to give my child at least five servings of fruit and vegetables each day (INT2);
- I want to give my child at least five servings of fruit and vegetables each day (INT3).

The three-items scale (M = 5.11; SD = 1.48) yielded an α coefficient of 0.87.

Attitude. Attitude was assessed through six items that asked the parents' position on providing children fruit and vegetables:

- My giving my child five servings of fruit and vegetables each day to keep them healthy is very important (ATT1);
- My giving my child five servings of fruit and vegetables each day to keep them healthy is very good (ATT2);
- My giving my child five servings of fruit and vegetables each day to keep them healthy is very important positive (ATT3);
- My giving my child five servings of fruit and vegetables each day to keep them healthy is very wise (ATT4);
- My giving my child five servings of fruit and vegetables each day to keep them healthy is very favorable (ATT5);
- My giving my child five servings of fruits and vegetables each day to keep them healthy is very salutary (ATT6).

Participants were asked to indicate their agreement using a response scale from 1 = "strongly disagree" to 7 = "strongly agree". The six-items (M = 5.89; SD = 2.17) scale yielded an α coefficient of 0.79.

Subjective Norm. Subjective norm was assessed through three items that asked parents about the opinion of the people who were important to them about this issue. Specifically, participants were invited to indicate their agreement (1 = "strongly disagree"; 7 = "strongly agree") with the following three items:

- Most people who are important to me think that I should give my child five servings of fruit and vegetables each day (SN1);
- Most people who are important to me would approve if I give my child five servings of fruit and vegetables each day (SN2);
- Most people who are important to me want that I give my child five servings of fruit and vegetables each day (SN3).

The three-items scale (M = 4.63; SD = 1.33) yielded an α coefficient of 0.69.

PBC. PBC was assessed through three items that asked parents if they felt able to provide fruit and vegetables, indicating their agreement (1 = "strongly disagree"; 7 = "strongly agree") with the following three items:

- I am able to make my child eat 5 servings of fruit and vegetables each day (PBC1);
- If I give my child five portions of fruit and vegetables each day is entirely up to me (PBC2);
- I have the possibility to give my child five portions of fruit and vegetables each day (PBC3).

The three-item scale (M = 4.66; SD = 1.73) yielded an α coefficient of 0.71.

Trust in government. Trust in government scale was adapted by the research of de Jonge *et al.* (2008). The six items rated on 5-point Likert scales (1 = "strongly disagree"; 5 = "strongly agree") were:

- Government takes good care of the safety of our food (GOV1);
- Government gives special attention to the safety of food (GOV2);
- Government has the competence to control the safety of food (GOV3);
- Government has sufficient knowledge to guarantee the safety of food products (GOV4);
- Government is honest about the safety of food (GOV5);
- Government is sufficiently open regarding the safety of food (GOV6).

The six-items scale (M = 4.88; SD = 1.63) yielded an α coefficient of 0.99.

Trust in retailers. Trust in retailers scale was adapted by the research of de Jonge *et al.* (2008). Participants answered to the following six items rated on 5-point Likert scale (1 = "strongly disagree"; 5 = "strongly agree"):

- Retailers have the competence to control the safety of food (RET1);
- Retailers take good care of the safety of our food (RET2);
- Retailers give special attention to the safety of food (RET3);

- Retailers have sufficient knowledge to guarantee the safety of food products (RET4);
- Retailers are honest about the safety of food (RET5);
- Retailers are sufficiently open regarding the safety of food (RET6).

The six-items (M = 4.76; SD = 1.85) scale yielded an α coefficient of 0.99.

2.3. *Data analysis*

The means and correlations were performed using SPSS 23. The hypothesized models were tested using maximum likelihood method of structural equation modelling (SEM) by MPLUS7. SEM findings are based on the correlation of co-variance matrix and maximum likelihood estimator is performed to gain the best linear unbiased estimator. This guarantee to have a robust model even if we measured out variables using responses with different scales. The purpose was to test a nested comparison of a traditional TPB model and an extended TPB model, which included trust towards government and trust toward retailers as additional predictors of parents' intentions. For verifying the models goodness of fit, we controlled the values of the following fit indices: Chi-square test (non-significant value for confirming the goodness of the model (Browne & Cudeck, 1992; Iacobucci, 2010); RMSEA SRMR (Hu & Bentler, 1999), CFI and TLI (Bentler, 1990; Mcdonald, 1989).

The following statistical procedure was used to test the hierarchical models. To accept an extended TPB model it is necessary to compare it with the traditional TPB model. The traditional TPB model (Model 1) hypothesized that attitude, subjective norm and PBC predict behavioral intentions to give to children fruit and vegetables, in this case parental intention, which in turn determines behavior, in this case the children's intake of fruit and vegetables. In the Model 2, trust toward government and toward retailers were included as additional factors. In the Model 3, a not significant additional factor (trust in government) was excluded from the structural model. The comparison between the traditional TPB model (Model 1) and the extended models (Model 2 and 3) was tested by considering the first model as a nested model of the others. Thus, in Model 1 the regression weights of the paths between trust in government and trust in retailers were fixed to 0. To accept the final extended model, we tested the hypothesized significant differences using Chi-square value were run. If the Chi-square difference ($\Delta\chi 2$) is significant, the larger model with more parameters and less degrees of freedom (Model 3) could be accepted as a better model than the smaller model (Model 1). Moreover,

we compared the models using AIC indexes. Models with low AIC values will have a higher level of empirical support than models with high AIC values. The model with the lowest AIC is taken to be the best supported model.

2. Results

At first, we can analyze the composition of the sample of the study. The sample was composed of 148 females and 75 males. The mean age was 43.08 (SD = 5.68; min = 28; max = 58). Regarding the participants' level of education, 2,7% of the sample achieved a primary level, 33,5% of the sample achieved a secondary level, 46,2% obtained a high school diploma, and 17.6% obtained a university degree (Table 1).

To test the construct validity, the measurement factor analysis model including six latent factors indicating attitude, PBC, subjective norm, intention and trust in government and in retailers. Goodness-of-fit statistics for this measurement model were acceptable (χ_2 = 374.90, df = 278, $p < 0.001$; RMSEA = 0.05; CFI = 0.90; TLI = 0.88; SRMR = 0.04). The parameter estimates were all significant and presented high values (from 0.55 to 0.97). Means and standard deviations of all items are reported in Table 2.

Table 1 - Sociodemographic characteristics of respondents

Age	28-38	16.9%
	39-48	67.8%
	49-58	15.3%
Gender	Male	33.63%
	Female	66.37%
Education	Primary level	2.7%
	Secondary level	33.5%
	High school diploma	46.2%
	University degree	17.6%

Table 2 - Means and standard deviations of study items

	Mean	Standard Deviation
Children's consumption of fruit and Vegetable		
FRUIT	1.35	0.77
VEGETABLE	1.67	0.81
Parents' intentions to give their children fruit and vegetables		
INT1	5.05	1.69
INT2	5.15	1.61
INT3	5.13	1.60
Parental Attitude		
ATT1	6.26	5.47
ATT2	6.25	1.66
ATT3	6.22	1.39
ATT4	5.11	1.87
ATT5	4.98	2.16
ATT6	6.16	1.71
Parental subjective norm		
SN1	4.98	1.77
SN2	5.39	1.73
SN3	4.75	1.92
Parental perceived behavioural control		
PBC1	4.61	2.07
PBC2	4.74	2.10
PBC3	4.61	2.20
Parental trust in government		
GOV1	5.29	1.87
GOV2	5.22	1.85
GOV3	4.62	1.92
GOV4	4.49	1.76
GOV5	4.59	1.76
GOV6	4.69	1.79

Table 2 - continued

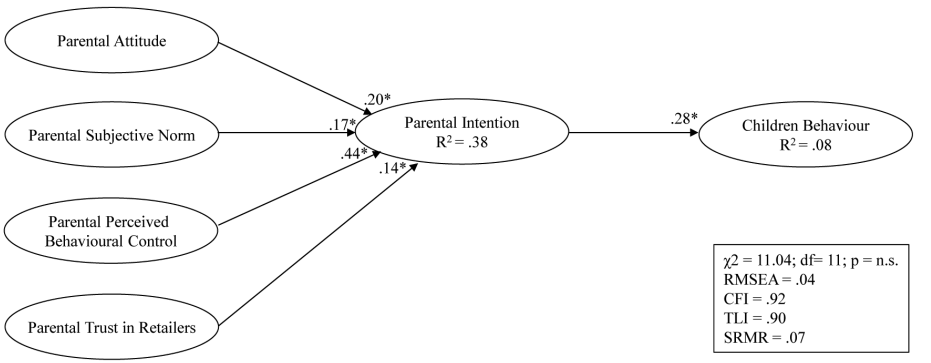
	Mean	Standard Deviation
Parental trust in retailers		
RET1	4.71	1.90
RET2	5.03	3.70
RET3	4.78	4.16
RET4	4.47	1.87
RET5	4.51	1.89
RET6	4.41	1.89

The Model 1 shows a good fit ($\chi 2 = 17.16$, df = 13, p = n.s.; RMSEA = 0.04; CFI = 0.96; TLI = 0.96; SRMR = 0.07). In this model, the parents' intentions to give their children fruit and vegetables are explained more strongly ($p < 0.001$) by PBC ($\beta = 0.48$), followed by the subjective norm ($\beta = 0.26$) and the attitude ($\beta = 0.18$). Children's consumption of fruit and vegetables reported by their parents was significantly ($p < .001$) predicted by the intention ($\beta = 0.22$). The Model 1 accounted for 45% of the variance of parents' intentions and 5% of children's behavior.

Moreover, the Model 2 has a good fit ($\chi^2 = 13.03$; df = 11, p = n.s.; RMSEA = 0.04; CFI = 0.96; TLI = 0.96; SRMR = 0.07), specifically the intention is explained ($p < 0.05$) by PBC ($\beta = 0.44$) and attitude ($\beta = 0.20$), followed by subjective norm ($\beta = 0.18$). Considering the additional factors, the trust in government is not a significant predictor of parents' intentions, while trust towards retailers significantly predicts parents' intentions ($\beta = 0.19$). Self-reported children's behaviors about their fruit and vegetables consumption is significantly ($p < 0.001$) explained by intention ($\beta = 0.28$). This model accounts for 38% of the variance of parents' intentions and 8% of children's behavior. Considering that trust in government is not a significant predictor of intentions, this path was excluded in a final extended TPB model (Figure 2).

The Model 3 (Figure 2) shows an acceptable fit ($\chi^2 = 11.04$, df = 7, p = n.s.; RMSEA = 0.04; CFI = 0.92; TLI = 0.90; SRMR = 0.07). Parents' intention is predicted ($p < .05$) by PBC ($\beta = .44$) and attitude ($\beta = .20$), followed by subjective norm ($\beta = .17$) and trust towards retailers ($\beta = .14$). Children's behavior about their fruit and vegetables consumption is significantly ($p < .001$) explained by intention ($\beta = .28$). This model accounts for 38% of the variance of parents' intentions and 8% of children's behavior.

Figure 2 - Extended TPB path model (Model 3) with standardized regression coefficients



Note: * p < 0.05; covariances and error variables not shown for ease of interpretation

Results show that the Chi-square difference value between Model 1 and Model 3 is significant ($\Delta\chi^2 = 6.02$; df = 6; $p < 0.05$), thus the Model 3 is significantly better than the Model 1. Table 3 reports the goodness of fit statistics for the confirmatory factor analyses and structural model of the estimated models. Table 4 shows standardized factor loadings of each tested models.

Table 3 – Goodness of fit statistics for the measurement and structural models

Model	Measurement Model – CFA	Structural Model 1	Structural Model 2	Structural Model 3
χ^2	$\chi^2 = 374.90$, $df = 278$, $p < 0.001$	$\chi^2 = 17.16$, $df = 13$, p = n.s.	$\chi^2 = 13.03$; $df = 11$, p = n.s.	$\chi^2 = 11.04$, $df = 7$, p = n.s.
RMSEA	0.05	0.04	0.04	
TLI	0.88	0.96	0.96	0.90
CFI	0.90	0.96	0.96	0.92
SRMR	0.04	0.07	0.07	0.07

Moreover, in these models the comparisons among the AIC indexes [73], which measures model parsimony, were respectively reduced to 6288.35 (Model 1) and 2285.85 (Model 3).

Table 4 - Standardized factor loadings of the estimated models

Model 1	**Model 2**	**Model 3**	**Parental attitude → Parents' intentions to give their children fruit and vegetables**	**0.18****	**0.20***	**0.22***
Parental subjective norm → Parents' intentions to give their children fruit and vegetables	0.26**	0.18*	0.17*			
Parental perceived behavioral control → Parents' intentions to give their children fruit and vegetables	0.48**	0.44**	0.44**			
Parents' intentions to give their children fruit and vegetables → Children's consumption of fruit and vegetables	0.22*	0.28*	0.28*			
Trust in government → Parents' intentions to give their children fruit and vegetables	/	–0.31	/			
Trust towards retailers → Parents' intentions to give their children fruit and vegetables	/	0.19**	–0.14*			
R^2 Parents' intentions to give their children fruit and vegetables	45%	38%	38%			
R^2 Children's consumption of fruit and vegetables	5%	8%	8%			

Note: * p = 0.05; ** p = 0.001

Results suggest that the use of an extended TPB model may be effective in explaining fruit and vegetables consumption in children. Firstly, their intake was significantly associated with parental intention to give them these foods (confirming our H1). In addition, H2, H3 and H4 were confirmed, since significant effects of attitude, subjective norm and PBC on parental intentions were found. This finding suggests that those parents who considered children fruit and vegetable consumption as an important healthy eating behavior were more likely to intend to provide their children with healthy food. Furthermore, the more other people approve this eating practice, the more parents were willing to intend to act it. Finally, parents, who perceived more control on possibilities to implement a promotion of fruit and vegetables consumption toward their children, were more likely to intend to perform it.

Considering the additional variables, the model confirms the decisive role of trust in determining parental intentions. Specifically, while H5 is not confirmed, H6 is accepted. In fact, trust in government do not influence parental intentions, while trust in retailers has a positive impact on parental intentions. These findings suggest that parents who trust retailers had higher levels of intention to provide fruit and vegetables to their children.

3. Discussion and conclusions

This study aims at understanding the determinants in parents in giving their children fruit and vegetables. This behavior is instrumental in determining the healthiness of children's diets to the extent that it is one of the most important strategies to prevent metabolic diseases and obesity. The incidence of such diseases in Southern Italy suggested this area as a suitable case study for the investigation. In detail, a TPB model has been used to explain the intentions of parents, but it has been extended to include trust towards government and retailers, the actors of the supply chain that can reassure parents about the safety of those foods. Our results confirmed the effectiveness of the TPB model to predict intention and behavior, as already showed in the several domains (Lombardi *et al.*, 2017; Riebl *et al.*, 2015).

Results yielded that PBC and attitude were the most important factors in determining the intention in parents of giving their children fruit and vegetables. The high predictive power of parental PBC in this context can be explained considering that parents are expected to control most of the food that children consume. Thus, the parental perception of being competent in controlling fruit and vegetable intake of their children may be a critical determinant in the development of healthy eating patterns in children. This confirms the need of providing parents with training sessions that can increase their perceived control (Hunsaker & Jensen, 2017).

Then, positive attitudes towards serving fruit and vegetables to children influenced the parents' intentions to offer them an adequate amount of these foods. This results is in line with prior evidences showing the important role of attitude to predict behavioral intentions for a range of eating protective behaviors (Carfora *et al*., 2018), including fruit and vegetable consumption (de Bruijn *et al*., 2014). Consistently, the present study confirmed that this is the case also for parental attitude towards the children' fruit and vegetable intake. Thus, future public campaign should try to improve parental positive attitude towards the children adherence to a diet rich in fruit and vegetables. To do so, health institution could use persuasive communication as strategy to induce attitude change, which in turn would lead to a change in their intention and behavior.

The model has been extended to trust, in order to consider that the intentions of parents in giving fruit and vegetables to children can be actually harmed by perceived risks about safety, due to the subsequent food scandals that affect the reputation of this food sector. Due to the long supply chain that brings food from the farm to fork, we considered that the role of actors of the supply chain could be multifold, according to consumers' perceptions.

Only trust towards retailers has been proved in being instrumental in influencing the parents' intentions while the role of government appeared to be negligible, according to our results. The reason why can rely in the closeness between retailers and consumers, that has also a psychological backlash that leads to the identification of the consumers with the retailers' values (Schultz *et al*., 2016). Furthermore, retailers appear to be concerned about the impact their business can have on society, so they are believed to convince consumers about the effectiveness of their risk prevention measures that they undertake (Tjärnemo & Södahl, 2015). In the end, the picture provided by this study, suggests that retailers play a pivotal role in shaping consumers' perceptions, also in a very sensitive case as risks connected to children's food.

Retailers' strategies to improve transparency to reduce the perception of food risk represent important tools in public and private interventions to foster healthier diets. Public policies and indications could encourage retailers' communication and information actions to inform consumers about their role in the children diet choices (Singh *et al*., 2020). These actions could be developed in a context of corporate social responsibility (CSR) approach (Ladwein & Sánchez Romero, 2021).

Policymakers and regulators need to improve trustworthiness in public certification and control measures to promote transparency and trust along supply chain. This strategy could compensate for weaknesses among individual partners and could limit the dangerous role of modern distribution

to represent the main trust maker. The actions of a single actor along supply chain remain insufficient to address the children dietary shifting challenge. However, consumer trust in retailers could be essential to reinforce the role of producers in this mechanism, also with the help of private standards and informative campaigns. The supply chain can give an image of openness with a larger number of products with credence characteristics like healthfulness and sustainability (Macready *et al*., 2020).

The digital technology has complicated the process of communicating the producers' message to customers. Modern and involved consumers search actively for information on their family diet, so web information or intelligent packaging technology (as QR code) can be leveraged to inform and build trust in consumers at the same time. This would have an effect on consumers' engagement at the point of sale, increase consumer trust and thereby influence their purchase decision.

Nevertheless, this study has some limitations. First, there are several elements that have been excluded from the study in order to have a clearer picture. For example, the role of children's perceptions has been neglected as other children's traits such as pickiness or food preferences. Second, the sample was limited to Italian families, limiting the generalizability of the findings. Third, the parental-reported assessment of children behavior is another limitation, although this is a common type of measurement in studies on parental influences on various children behaviors. Therefore, these elements may represent the challenges that may be addressed by future researches. They could also investigate what is the role of producers in truly working to improve people's diets and how their technological innovations can play a role.

In conclusion, the current study provides a useful contribution to the literature on the TPB and fruit and vegetable intake in children showing that parental beliefs – and importantly their trust in retailers – are relevant predictors of children healthy eating. The fact that parental attitude, PBC, subjective norms and trust in retailers influence parental intention, which in turn influences children behavior, suggests that these psychosocial factors might be a useful basis for attempting to promote an adequate intake of fruit and vegetable consumption in children, at least in Italian families.

Conflicts of Interest: The authors declare no conflict of interest.

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Whose salad is organic? An attribute segmentation perspective-evidence from Albania

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Abstract

Organic agriculture remains a black box attribute when considering consumer behaviour and preferences in developing countries. This is due partially to a lack of awareness about such products in addition to a lack of trust in relation to the certification bodies responsible. Meanwhile, increasing demand for these products comes as a result of food intolerance and hygiene safety issues. Through this framework it is crucial to clarify the concept from the consumer perspective. The objective of this paper is to understand consumer perceptions regarding organic attributes and identify the characteristics considered by consumers when buying organic products. The relative importance index shows the sensitivity of Albanian consumers in relation to the organic attribute, mainly in fruit and vegetables. Through the Contingent Valuation Method it is estimated that the consumer will pay an average premium of 27.7% for organic vegetables and 28.3% for organic fruit. The segmentation approach indicates that consumers linking organic attributes with health expressed a high willingness to pay for organic products. However, the majority use price as the main indicator of the quality of the product they consume; a higher price meaning an organic product. This conclusion is important in developing countries where consumers display low trust in food safety mechanisms and institutions.

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Introduction

Farming systems in Albania have changed radically at least three times over the last century. From being totally privately-owned at the beginning of the century, farms shifted to total state or collective-ownership after the Second World War, only to revert to private-ownership following the collapse of the collective system at the beginning of the 1990s (Guri *et al.*, 2011). All of these changes were driven by a unique objective: to reach a point of food security in Albania, while the methods used were heavily inspired by the main ruling ideology stream (Civici, 2003a). The collectivisation period improved farming systems by enlarging and merging plots, encouraging the heavy use of agricultural mechanics at least in the lowlands, increasing the use of chemical fertilisation, and the rotation of agricultural production strategies, all of which resulted in a net increase in agricultural yield (Civici, 2003a; Guri, 2008). The objective of the collective period of agriculture in reaching self-sufficiency, at least in cereal production, was realised for only a short period of time. Albania experienced a severe food shortage at the beginning of the 1990s after a period of food rationing that lasted for at least ten years (Civici, 1997). The decollectivisation period increased the number of farming households by 400 and reduced the average surface of agricultural units from 1,000 ha to less than 1.4 ha (Guri, 2010; Civici, 2003b). During the collective period, the production of fruit and vegetables, including the varieties consumed in Albania, was controlled and unified. However, the limited amount of chemicals used by state-owned farms and collective cooperatives built up the perception of Albanian fruit and vegetables as superior to imported products, with many assuming they were organic. During the first years of decollectivisation, the lack of public control over food safety, particularly imported products, increased consumer trust in domestically-produced fruit and vegetables. The results of qualitative studies in six Balkan countries indicated that consumers perceive domestic products as traditional, natural, healthy, and tasty[1]. Other studies carried out in Albania show that consumers do not differentiate between domestic and organic attributes when considering food products, especially fruit and vegetables (Kokthi *et al.*, 2015). In this vein, many scholars consider that organic fruit and vegetables in Albania are a valid solution to increase farming incomes within a framework of small and fragmented farming systems, which are in many cases situated in hilly and mountainous areas (Imami *et al.*, 2017; Skreli *et al.*, 2017). However, the evolution of organic

1. Focus – Balkans (2011). The market of organic products and traditional foods in the Western Balkan Countries (WBC) – Results of qualitative analyses in six WBCs. 5th Newsletter, November 2011, available at: www.focus-balkans.org.

fruit and vegetables in Albania has developed very slowly. According to Richter and Padel (2007), only 0.1% of Albanian agricultural land is registered as organic, which translates to 93 farms producing organic fruit and vegetables. The limited use of the organic label in Albania for fruit and vegetables is mainly linked to the low level of trust conferred on the existing organic label schemes in Albania; although the situation is quite different in relation to herbs and spices for which the majority of production is registered as organic. As a result, instead of the word "organic", fruit and vegetable producers often prefer to describe their products with the following designations: natural, seasonal, fresh or simply state the origin of the product. This practice means that the premium price attributed by consumers to the organic characteristic is lost.

Although consumers do not have in mind a clear list of organic attributes, they consider them during the purchasing process. Lancaster (1966) describes products as possessing a multitude of characteristics; these are laid out in the works of Nelson (1970) and Darby and Karni (1973) in terms of attributes related to search, experience, and credence. From the informational viewpoint, organic products are classified as credence goods (Nelson, 1970) because consumers cannot verify their organic attributes either before or after consumption. Attribute information, such as organic, is therefore analysed because it enhances consumer quality expectations and acts as a cue suggesting other attributes related to product quality such as taste (Ditlevsen *et al*., 2020; Hemmerling *et al*., 2016; Nadricka *et al*., 2020; Piqueras-Fiszman & Spence, 2015; Prada *et al*., 2017). In this context, the success of organic product schemes is intimately linked with the warranty offered by the institutions enforcing label controls, confirming that these products really are organic.

The misunderstanding related to organic product characteristics may encourage misleading practices with producers incorrectly adding an organic label to their products. This in turn may lead to consumer confusion in terms of the validity of the organic labels on the market, possibly leading to a decrease in consumer expectations and willingness to pay (Kokthi *et al*., 2016; Kokthi & Kruja, 2017). Within this framework it is important to understand consumer preferences in order to help farmers in the decision-making process as to whether they should produce organic goods and the best marketing strategy related to that decision. Information about consumer preference can also assist policymakers in the most efficient policy instruments to support farmers. The identification of the maximum price that consumers are willing to pay (WTP) and the determination of the factors that influence purchasing decisions will provide valuable information in this regard. The objective of this paper is to analyse consumer behaviour in relation to organic fruit and vegetables from a consumer segmentation perspective. The paper addresses this objective by focusing on the three

aspects necessary to understand: 1) whether consumers express an appetite to pay a higher premium for organic fruit and vegetables, 2) if there is a distinguishable type of consumer who is willing to pay more for the organic attribute, and 3) if the consumer relates the higher cost to the health or taste characteristics of organic products.

This paper is organised into four sections. The first examines the literature review of organic products from the perspective of the information offered to consumers. The second presents the methodology applied. A discussion of the field research results is presented in the third section, while conclusions are provided in the final part.

1. Literature Review

The rising incidence of lifestyle diseases, such as heart disorders and diabetes, show a growing preference for organic food over that which is conventionally grown, not only in developed countries but also in developing nations (Rana & Paul, 2017). The escalating occurrences of food-related diseases, such as Avian Influenza and Bovine Spongiform Encephalopathy (commonly known as "Mad Cow" disease) have increased the potential consumption of safe food items (Canavari *et al.*, 2007). This positive shift in consumer attitude occurred because organic food comforts the health fears expressed by modern consumers. Organic agriculture combines several practices including the application of organic fertilisers, locally adapted seeds/breeds, biological pest control, and intercropping with nitrogen-fixing trees, legumes, or with other synergistic crops (Adamtey *et al.*, 2016). In parallel with the rising emphasis on food safety and a healthy consumption relationship, organic production schemes incorporating the minimisation of chemicals have been recognised as an alternative food and agricultural supply system (Ceylan *et al.*, 2018). Thus, understanding consumer perceptions and how the informational value of the organic attribute is processed is not only a matter for marketers but also policymakers, especially in developing countries. Several authors have analysed the impact of the organic attribute on consumer preferences, taking into consideration different characteristics and viewpoints. Food safety has been identified as a key stimulus in increasing the consumption of organic food (Ranjbarshamsi *et al.*, 2016; Ceylan *et al.*, 2018; Elsa *et al.*, 2007; Hempel & Hamm, 2016). Other works undertaken in this direction show that in developing countries other labels under the umbrella of food safety, such as a lower chemical and pesticide attribute, receive a higher evaluation than organic food. These findings are linked to the fact that such attributes are more explicit to the consumer than those pertaining to the organic offering (Kokthi *et al.*, 2015). Consequently,

in emerging economies, the growth of the organic market will depend on the perceived robustness of regulatory systems (Shahabi Ahangarkolaee & Gorton, 2020).

Similarly, consumer attitudes have evolved over the years, primarily due to ethical concerns about the environment (McEachern & McClean, 2002). Social norms and environmental concerns in developed countries have created a feeling of moral obligation and a positive attitude among consumers towards the environment (Schwartz 1973, 1977). Practicing ethical consumerism inspires consumers to buy green or "eco-friendly products in order to satisfy their ethical responsibility" (Cho & Krasser, 2011). Organic food consumption decisions can be explained by relating attributes of organic food with more abstract values such as "security", "hedonism", "universalism", "benevolence", "stimulation", "self-direction" and "conformity" (Aertsens *et al*., 2009). In addition, the globalisation of food systems has created another attribute articulation known as local-organic. According to Milestad *et al.* (2017), environmental concerns and the globalisation of the food system are supportive arguments for local-organic food legitimacy. Ditlevsen *et al*. (2020) show that when comparing conventional consumers and those who buy organic, the motivations of the latter were more likely to include environmental issues in their deliberation. In addition, other studies have found when analysing short chain and local product schemes that local is viewed by the consumer as safer than organic (Kokthi *et al*., 2015). The explanation is that in developing countries consumers usually confuse organic agriculture with primitive methods. The literature also shows that many terms are used to refer to organic food, such as "natural", "local", "fresh", and "pure" (Hemmerling *et al*., 2016; Rana & Paul, 2017).

Health consciousness is another factor that strongly motivates consumers to purchase organic food. A neutral food product with an organic label is perceived to be healthier than the same product without such a label (Nadricka *et al*., 2020), while quality and taste are also significant considerations (Bernard & Liu, 2017). Cranfield *et al*. (2012) confirm these results and show that the environmental attribute is not significant during the purchasing decision. Other works point to taste as being relevant in the decision-making of organic consumers. An organic label increases the perceived taste and attractiveness of healthy food, which suggests an "organic = healthy = tasty" intuition (Bryła, 2016; Nadricka *et al*., 2020; Prada *et al*., 2017).

Studies focusing on willingness to pay show that consumers express a high willingness to pay for organic products compared with conventional ones (Bryła, 2016; Hempel & Hamm, 2016). However, the results on consumer preferences should not be generalised because they are a function of product type and the consumer's place of residence. According to Vecchio *et al.* (2016), consumers assign higher preference for locally-produced organic food

compared to organic products coming from outside the area. Imami *et al.* (2017), Vecchio *et al.* (2016), and Wägeli *et al.* (2016) came to the same conclusion; consumers living in rural areas are less willing to pay a premium for organic products than their urban counterparts. Rana and Paul (2017) classify the motivations for the importance accorded to health consciousness, quality and safety, with goods that are environmentally-friendly also very important. The less important group includes fashion trends, unique lifestyle, and social consciousness.

In conclusion, health and other quality attributes such as nutrition, taste and freshness are identified as being the most important to consumers when buying organic products. These are even more significant compared to environmental issues and rural sustainable development (Elsa *et al.*, 2007; Henry-Osorio *et al.*, 2012; Jahaveri *et al.*, n.d.; Mahé, 2009; Tagbata & Sirieux, 2010; Skreli & Imami, 2012). The following section examines whether the Albanian consumer makes an exception to follow the same model of those in other countries.

3. Methodology

3.1. *Sample selection and questionnaire*

The survey was conducted in 2019 on a sample of 324 consumers interviewed in different fruit and vegetable markets in the Tirana district. Consumers were interviewed in minimarkets (12.3%), supermarkets (16.7%), specialised fruit and vegetable markets (49.4%), and farmers markets (21.6%). Convenience sampling is applied. Several scholars have opted for convenience sampling because of its advantages in recruiting consumers at grocery stores, which are easy to reach in a low cost setting (Huang & Lee, 2014; Krystallis *et al.*, 2006). Only fruit and vegetable buyers are included in the study.

The questionnaire used for the purpose of this study was composed of three sections: the first collected the socio-demographic information of respondents such as: gender, age, education, income, and household size. The second section pertained to purchasing behaviour, asking respondents about their expenditure on fruit and vegetables and the main factors they consider when shopping. Attributes such as price, freshness, taste, and origin were retained from the literature review (see table 1 on sample statistics). A control question was also included regarding preferences about the organic attribute. The directed question was asked in relation to the daily consumption basket (fruit, vegetables, meat, dairy, cereals and beverages). The question was worded as follows: *From one to five how important is the organic attribute in the decision to buy fruit, vegetables, meat, dairy, cereals and beverages?*

Table 1 - Survey variable description

Variables	**Description**	**Frecuency**
Gender	1. females, 2. males	74% 26%
Age	Age categories: 18-24, 25-34, 35-44, 45-54, 55-64, 65+	 10,2 27,6 27,5 22,2 9,9 3,7
Education	Education level Low: 1-8 years; Medium: 8-12 years; High: more than 12 years	 7,7 33 59,3
Marital status	Single , Married, Other	19,8 71,6 8,6
Income Euro/monthly	€ 71-428, € 429-642, € 643-857, € > 857	15 32,7 24,4 28
Attributes considered as important during the buying process	Origin is the most important attribute when choosing fruit and vegetables 1 = Yes 41% 0 = No 59%	
	Price is the most important attribute when choosing fruit and vegetables 1 = Yes 56% 0 = No 44%	
	Appearance is the most important attribute when choosing fruit and vegetables 1 = Yes 12% 0 = No 88%	
	Freshness is the most important attribute when choosing fruit and vegetables 1 = Yes 72% 0 = No 28%	

Variables	Description	Frecuency
The extra payment for organic and the attributes implied	The extra payment for organic fruits and vegetables is linked to the higher nutritional values 1 = Yes 68% 0 = No 32%	
	The extra payment for organic fruits and vegetables is linked to freshness 1 = Yes 67% 0 = No 33%	
	The extra payment for organic fruits and vegetables is linked to health 1 = Yes 54% 0 = No 46%	
	The extra payment for organic fruits and vegetables is linked to Taste 1 = Yes 18% 0 = No 82%	

Source: Authors' elaboration

Scale one indicates that the organic attribute is not at all important and five ranks it as very important. Zero is also added to the scale as a 'don't know' option in order not to force a response. The preference importance index (RII) based on a five Likert scale allowed us to construct an index that facilitates the evaluation of the rate of importance conferred by consumers to the organic attribute in the considered food product category. This index also helps to identify the food product category that provokes a highly sensitive response from the consumer in relation to the organic attribute. The evaluation of the RII is followed by the CVM scenario, which yields the monetary value for the organic attribute. The combination of the two stated choice methods increases the viability of the data (Breffle *et al.*, 2011). In the following sections, the CVM is explained.

3.2. *Method*

Many researchers have analysed the effect had by the organic product attribute on consumer preferences and the impact of the latter on their willingness to pay (WTP). The methods used to determine the extra premium for organic attributes are ascertained by the CVM (Apaolaza *et al.*, 2018; Gil, 2000; Huang & Lee, 2014; Jo & Lusk, 2018; Mesías Díaz *et al.*, 2012;

Romano *et al*., 2018; Yiridoe *et al*., 2005), choice experiment (CE) (Hempel & Hamm, 2016; Janssen & Hamm, 2012; Magnusson *et al*., 2001), hedonic price and experimental auctions. In addition, sensorial experiments with products are increasingly used by researchers to assess preferences for sensorial attributes and the intrinsic characteristics of products (Bernard & Liu, 2017). The combination of sensorial experiments with experimental auctions is becoming an increasingly consistent trend in consumer preference analysis. This combined approach helps researchers to obtain a simultaneous assessment of preferences both in terms of the product's internal and external characteristics (Gallardo *et al*., 2018). The application of an experimental auction is a costly setup that can be successfully developed in markets where consumers have previous experience with such experimental instruments (Kokthi & Kruja, 2017). In the same vein, CE is applied when trade off decisions are demanded. The objective of the present study is to examine the extra payment that consumers are willing to pay for the organic attribute with no trade-offs included. CVM presents an interesting method that can be used flexibly with a range of goods and services that can be easily identified by consumers. It involves directly asking participants, in a survey, how much they would be willing to pay for a certain attribute of a particular product (Portney, 1994). CVM is considered the "stated preference" method because it asks consumers to directly state their values, rather than inferring values from actual choices, as is the case with "revealed preference" methods (i.e. CE). Since CVM is based on what people say it is a source of weakness. However, the combination of different contingent scenarios can increase the reliability of the data collected. To that end, two techniques of CVM are applied in the present study. The respondents were asked as follows: *Assuming that 1kg of fruit is priced at 100ALL in your store/shop, would you pay 150ALL to buy organic products?* Respondents could choose yes or no. The CVM scenario concerning vegetables is presented separately from the fruit CVM scenario. In addition to the referendum type of question a payment card was introduced in order to capture other WTP intervals and calibrate the WTP responses generated. This question type is criticised for its overestimation in the WTP assessment due to the use of a hypothetical scenario, the warm glow effect, and an affirmative bias (Portney, 1994). In this vein, a payment card design similar to that of CVM was applied (Hu *et al*., 2011). The payment card helps respondents to visualise the values and decreases the number of protest bidders. In the present study, respondents were presented with 5 bids; a zero payment was included in order not to force the choice decisions. Additionally, a regular price of 100ALL[2] was given to

2. Albanian Lek.

respondents and it was explained that the anchor price is hypothetical and is included in the payment card to help the pricing process. The wording of the scenario was as follows: *Assuming that 1kg of fruit and vegetables is priced at 100ALL in your store how much are you willing to pay? 10%__, 20%__, 30%__, 40%__, 50%*. After choosing one of the bids on the payment card the respondent was asked to justify their extra payment using one of the following attributes linked to the organic category, such as: 1) taste, 2) freshness, 3) high nutritional value, and 4) health. These attributes were identified in the literature review and supported by an open interview with 30 random consumers at the fruit and vegetable market. The question directed to consumers was: *What comes to mind when thinking about organic fruit and vegetables?* Consumers mentioned only the four attributes included in the questionnaire.

3.3. *Statistical analysis*

Several statistics are used to achieve the study objectives. First, the relative importance index (RII) is calculated on the part of the consumer regarding the organic attribute in their daily basket. Fruit, vegetables, meat, dairy, cereals and beverages are included. Following Holt (2014), the calculation of the relative importance index is computed using the following formula:

$$\textbf{Relative Importance Index} = \frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N} \quad (0 \leq \text{RII} \leq 1)$$

where *w* is the weighting given to each food product category by the respondent, ranging from one to five. The n shows the number of respondents in each scale, for example n_1=the number of respondents choosing not at all important, while n_5=number of respondents who choose very important. A is the highest weight (i.e. five in the study) and the N is the total number of respondents. Secondly, the linkage between WTP and demographic factors is investigated through a multinomial logistic regression (MLR). MLR is useful to classify subjects based on the values of a set of predictor variables. It is a classification method that generalises logistic regression to multiclass problems, i.e. with more than two possible discrete outcomes (Green *et al*., 2012). The model tested for this purpose is as follows: WTP for organic attribute as a function of demographics and the motivation to express an extra payment (health, freshness, taste, and higher nutritional value).

$$WTP = \beta 0 + \beta 1Age + \beta 2Gender + \beta 3Education + \beta 4AIncome + \beta 5health + \beta 6freshness + \beta 7taste + \beta 8nutrition + \varepsilon$$

Finally, two multivariate methods were used: PCA (Principal Component Analysis) and CA (Cluster Analysis) in order to classify consumers into similar segments according to their WTP, behaviour and motivation in relation to the elevated price of organic products.

Cluster Analysis is performed in two stages: a). Hierarchical clustering to define the most appropriate number of clusters, and b). Non-hierarchical clustering to define the clusters of the sample and the characteristics of each type. The main variables used for classification were: Freshness-Organic, Health-Organic, Taste-Organic, Nutrition values-Organic, Fresh, Purchase place, Appearance, Price, Origin, WTP fruits, WTP vegetables. For the Principal Component Analysis (PCA), the Kaiser-Meyer-Olkim (KMO) test was used to measure the relationship between variables (see table 2).

Table 2 - Correlation matrix between principal component analysis factors

PCA factors		**Purchase place**	**Freshness**	**Apperance**	**Price**	**Origin**	**WTP Vegetables**	**WTP Fruits**	**Organic-fressh**	**Organic-healthy**	**Organic-taste**	**Organic-high nutritional values**
Correlation	Purchase place	1,000	–,006	,049	–,018	–,042	,115	,095	–,042	,084	,116	–,001
	Freshness	–,006	1,000	–,032	,022	–,216	,189	,211	,224	,179	,111	,136
	Apperance	,049	–,032	1,000	,013	,196	,116	,113	–,025	–,037	,089	,067
	Price	–,018	,022	,013	1,000	–,332	–,238	–,234	,037	,008	–,052	,034
	Origin	–,042	–,216	,196	–,332	1,000	,124	,134	,046	,059	,194	,108
	WTP Vegetables	,115	,189	,116	–,238	,124	1,000	,934	,077	,309	,272	,255
	WTP Fruits	,095	,211	,113	–,234	,134	,934	1,000	,037	,259	,256	,237
	Organic-fressh	–,042	,224	–,025	,037	,046	,077	,037	1,000	,305	,486	,310
	Organic-healthy	,084	,179	–,037	,008	,059	,309	,259	,305	1,000	,325	,199
	Organic-taste	,116	,111	,089	–,052	,194	,272	,256	,486	,325	1,000	,451
	Organic-high nutritional values	–,001	,136	,067	,034	,108	,255	,237	,310	,199	,451	1,000

Table 2 - continued

PCA factors		Purchase place	Freshness	Apperance	Price	Origin	WTP Vegetables	WTP Fruits	Organic-fressh	Organic-healthy	Organic-taste	Organic-high nutritional values
Sig. (1-tailed)	Purchase place		,457	,188	,376	,228	,019	,044	,227	,065	,019	,493
	Freshness	,457		,282	,346	,000	,000	,000	,000	,001	,023	,007
	Apperance	,188	,282		,407	,000	,019	,021	,326	,253	,055	,113
	Price	,376	,346	,407		,000	,000	,000	,255	,440	,178	,272
	Origin	,228	,000	,000	,000		,013	,008	,207	,144	,000	,026
	WTP Vegetables	,019	,000	,019	,000	,013		,000	,084	,000	,000	,000
	WTP Fruits	,044	,000	,021	,000	,008	,000		,254	,000	,000	,000
	Organic-fressh	,227	,000	,326	,255	,207	,084	,254		,000	,000	,000
	Organic-healthy	,065	,001	,253	,440	,144	,000	,000	,000		,000	,000
	Organic-taste	,019	,023	,055	,178	,000	,000	,000	,000	,000		,000
	Organic-high nutritional values	,493	,007	,113	,272	,026	,000	,000	,000	,000	,000	

Source: Authors' elaboration

Four underlying factors explain 62% of the total variance (see table 3).

Table 3 - Total variance explained by PCA

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,807	25,517	25,517	2,807	25,517	25,517	2,151	19,556	19,556
2	1,631	14,831	40,348	1,631	14,831	40,348	2,138	19,439	38,995
3	1,360	12,365	52,712	1,360	12,365	52,712	1,460	13,275	52,271
4	1,062	9,657	62,369	1,062	9,657	62,369	1,111	10,098	62,369
5	,987	8,969	71,338						
6	,813	7,395	78,733						
7	,771	7,008	85,741						
8	,581	5,286	91,027						
9	,503	4,569	95,596						
10	,422	3,833	99,429						
11	,063	,571	100,000						

Source: Authors' elaboration

Table 4 - PCA Rotated component matrix

PCA Factors	Component			
	1	2	3	4
Purchase Place				,646
Freshness	,343		,509	
Apperance				,675
Price	–,400		,599	
Origin			–,831	
WTP vegetables	,924			
WTP-fruits	,930			
Organic-freshness		,794		
Organic-health	,303	,520		
Organic-taste		,795		
Organic-high nutritional value		,666		

Source: Authors' elaboration

The factors resulting from the PCA are used in the two-step clustering method: First, a hierarchical clustering method was used to create clusters of consumers within the sample. The algorithm used in this analysis was Ward's method with squared Euclidean distance measure. The number of clusters produced is four. The cluster selection is supported by the ANOVA test, see table 5 for high F values and P values < 0.001.

Table 5 - Anova results

Variables	F	Sig value
Freshness-organic	55,629	.000
Health-organic	46,410	.000
Taste-organic	223,208	.000
Nutrition values-organic	34,953	.000
Fresh	9,734	.000
Place of purchase	147,891	.000
Appearance	8,876	.000
Price	21,433	.000
Origin	73,477	.000
Pay more fruit	47,413	.000
Pay more vegetables	54,136	.000

Source: Authors' elaboration

We used K-Means Cluster Analysis with the number of clusters defined by the previous stage. Table 3, above, shows the mean of each variable for each cluster.

Table 6 - Consumer classification

Attributes	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Freshness-organic	0.29	0.94	0.21	0.08
Health-organic	0.40	0.98	0.56	0.08
Taste-organic	0.02	0.88	0.10	0.00
Nutrition values-organic	0.28	0.83	0.25	0.08
Place of purchase	1.66	2.35	3.18	2.19
Fresh	0.82	0.87	0.66	0.52
Appearance	0.05	0.21	0.04	0.26
Price	0.64	0.33	0.46	0.10
Origin	0.14	0.75	0.22	0.87
WTP organic vegetables (%)	25.34	34.81	28.09	26.13
WTP organic fruits (%)	26.18	35.00	27.94	27.74

Source: Authors' elaboration

4. Results and discussion

The higher relative importance index for fruit and vegetables compared to meat and dairy shows the pertinence of the monetary evaluation of the organic attribute. The RII of fruit and vegetables is 0.91 out of 1, showing the higher sensitivity of Albanian respondents toward the organic attribute. The meat RII is 0.87 out 1 and that for dairy is 0.75 out of 1. In the category of cereals and beverages, the respondents reported not knowing if organic is important. The results show that lack information about the organic attribute and its importance is evident only in fruit and vegetables. Following the RII results, about 93% of respondents considered organic product information to be important in their decision to buy fruit and vegetables. In this regard, respondents were asked: *Assuming that 1kg of fruit/vegetables is priced at 100ALL in your store/shop, would you pay 150ALL for organic products?* 93% reported their willingness to pay the proposed amount. However, when the payment card scenario was presented only 16.3% were willing to pay 50% above the anchor price. The same result is observed for both fruit and vegetables. The use of two different techniques show the need to calibrate and adapt the CVM scenarios in order to obtain an accurate evaluation of the sacrifice that consumers are willing to make. Figures 1 and 2 show the distribution of the WTP in the interviewed sample.

Figure 1 - WTP for organic vegetables

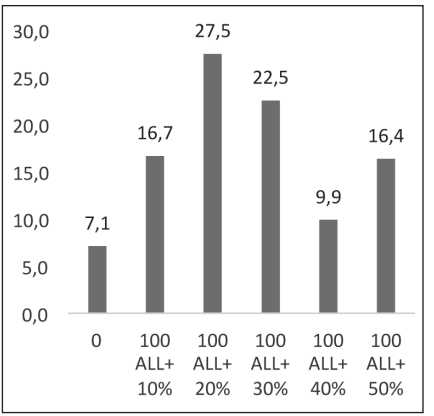
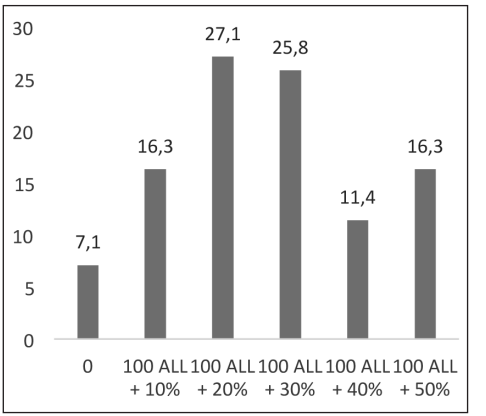


Figure 2 - WTP for organic fruits



Source: Authors' elaboration

The payment card data analysis show that consumers are willing to pay on average about 27.7% more for organic vegetables and 28.3% for organic fruit. The paired t-test shows that the difference between the two evaluations is statistically different (t = –2,167; p = .031). There are two explanations behind these results. The first being that fruit is still considered a luxury good and so the WTP is higher; second, fruit is generally not processed before consumption (cooked, boiled, etc.), meaning that the risk of being contaminated by the chemical residue of non-organic food is higher compared to vegetables.

These results confirm the fact that organic remains a black box since all of the attributes are inferred as organic; this is also true for highly educated people.

The results of Multinomial Logit Regression

The main indicators when dealing with a MLR procedure include: a) Model fitting information (Chi-Square = 653,783; p (value) = 0,000), b) Goodness-of-fit test through Pearson (Chi-Square = 929,498; p (value) = 0,915), and c) the coefficient of determination (Nagelkerke's R^2 = 62%). The Nagelkerke's R^2 shows a good proportion of variance in WTP for organic vegetables associated with the independent variables computed in the model. Regarding the effect of demographics in the levels of WTP, women with a low level of education are 9 times more likely than men to express zero payment when compared to WTP up to 20% (which is the premium expressed by 32% of participants in the study). Similarly, participants with low levels of education were nine

time more likely to pay 10% than 20% more. Participants who had completed eight to 12 years of schooling were twice as likely to pay 30% as 20% for organic vegetables. Interesting results occur when the "100ALL+ 20%" payment is compared to "100ALL+ 50%". Young consumers from 18-34 years old with a monthly income level ranging from €429 to €642, when linking the extra payment for organic with the health attribute were more willing to pay an extra 50% above the anchor price. Also post-hoc analysis shows that those aged 35-44 years and 45-54 years bid a WTP of 30% and 29% respectively. While the 65+ age group showed the lowest WTP of about 22% for organic fruit and vegetables. Concerning the income effect, those earning a high income showed the highest WTP at about 30%. The lowest bid was offered by participants with an average monthly income ranging from €215-428. Highly-educated respondents linked the extra payment for organic vegetables to health, while those with low levels of education associated the extra payment for organic with freshness and taste. This demonstrates the lack of information about the organic attribute.

Regarding the MLR on fruit, the following information is provided: a) Model fitting information (Chi-Square = 683,329; p (value) = 0, 00), b) Goodness-of-fit test through Pearson (Chi-Square = 929,498; p (value) = 0,715), and c) the coefficient of determination (Nagelkerke's R^2 = 58%). The Nagelkerke's R^2 show also a good proportion of variance in WTP for organic fruit associated with the independent variables considered in this study. Women with low levels of education were more likely than men to express zero payment when compared to their expressed WTP to WTP up to 20% (which is the premium expressed by 27% of the study participants). In the same vein, less educated respondents were 8 times more likely to pay a 10% premium than one of 20%. As with vegetables, young, highly-educated, high income respondents bid the highest WTP when considering fruit. Young consumers are more likely to pay a higher premium for organic fruit and vegetables. Similarly, only young-highly educated respondents linked the extra payment with the health claim.

In this vein, when analysing a quality differentiation scheme for a given product, it is important to examine the factors that motivate consumers to pay an additional premium. This information is necessary to better signal the organic label. In this framework it is crucial to examine whether WTP is related to taste, freshness, high nutritional value, or the health aspects of organic products. The results show that consumers connect the extra premium first to nutritional values, second to freshness, third to health, and finally, to taste. The results point to a limited knowledge on the part of Albanian consumers about organic products and confirm the findings of similar studies conducted in the country. Organic information is not presented clearly to Albanian consumers (Kokthi *et al.*, 2015). Moreover, organic information is often interchangeable with the made in Albania attribute.

In addition to the demographic effects on WTP, we have also analysed this effect in the associations made in the extra payment for organic fruit and vegetables. The Kruskal-Wallis test is used for this purpose. It is a rank-based nonparametric 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. In this case the analysis is whether there is a difference in the mean rank of nutritional-organic, fresh-organic, health-organic, and taste-organic when the considered demographic factors are age, education, income, gender, marital status, and household size.

Related to the high nutritional value attribute linked to organic fruit-vegetables, only gender shows a significant effect. The Kruskal-Wallis test showed that there was a statistically significant difference in scores between women and men, $\chi^2(2) = 5{,}457$, $p = .019$, with a mean rank of 152 for women and 174 for men. Taste was shown to be statistically different in the group age variable $\chi^2(2) = 4{,}500$, $p = .034$. Respondents corresponding to the group aged 65+ linked the extra payment for organic with better taste. Other studies show that these consumers do not associate organic with health because older respondents are less aware of food safety risks, which do not affect their life expectancy (Kokthi *et al.*, 2015; Govidansamy *et al.*, 2010). Future studies should take into consideration the cultural dimensions of the population. In the Albanian case, higher levels of collectivism and risk avoidance – the two characteristics evidenced by Hofstede (www.hofstede-insights.com/product/compare-countries/) – require public intervention in terms of settling down and controlling the emerging organic schemes operating in the country. In societies where higher scores are attributed to collectivism-individualism, people tend to focus more on attributes other than health but for hedonic reasons. When the extra payment for organic is linked to health, age $\chi^2(2) = 14{,}232$, $p = .001$, marital status $\chi^2(2) = 10{,}035$, $p = .007$, education $\chi^2(2) = 4{,}415$, $p = .036$ and income level $\chi^2(2) = 16{,}097$, $p = ,003$ show a significant effect. Married people with a higher education level and high income link the extra payment to the health attribute. When freshness is considered, no demographic effect is observed. In addition to these attributes we have included in the questionnaire the option – *all the attributes are important*. Around 23% of respondents linked the extra payment with all attributes. Marital status scored $\chi^2(2) = 8{,}526$, $p = .014$, with a mean rank score for single people of 179 and 153 for married people. Education was found to be $\chi^2(2) = 26{,}823$, $p = .036$, with a mean rank of 127 for those with a lower education qualification and a mean rank of 174 for highly educated people. Regarding income level, $\chi^2(2) = 23{,}108$, $p = .000$ shows a significant effect with a higher mean rank for higher income earners. These results confirm the fact that organic remains a black box since all attributes are assumed to be organic and this is also true

for highly educated people. These results have been completed also by the consumer segmentation procedure (see table 6).

The PCA analysis produced four groups of consumers: *Cluster 1* – refers to price-oriented consumers. This group represents around 41.8% of the sample. For this category, high price is an indicator of organic attribute and drives the decision to buy and pay extra for the product. Consumers classified in this group have little or no information about the qualities of fruit and vegetables. Their decision to buy is generally comprised of the extrinsic attributes of the products (place of purchase, price, etc.). For this group of consumers the existence of a formal and trusted organic label is the best option and is a guide to the buying process. Even though their average extra WTP for organic products is not among the highest (25-26%), they can be considered high potential consumers for organic products in general, not only fruit and vegetables. *Cluster 2* – consumers who seek fresh and healthy products. Consumers within this group (about 16.6%) appreciate all considered attributes when deciding to accept an extra payment for organic fruit and vegetables. Their average extra willingness to pay is the highest. This group generally consists of experienced consumers who trust more their own judgment than the formal signs of quality, such as the organic product label. During the purchase process they evaluate a number of attributes (freshness, origin, etc.); "picky" consumers are identified as those who are very hard to satisfy but are prepared to pay higher prices for products they appreciate. *Cluster 3* – No specific orientation. This category (about 21.7%) most appreciates the freshness attribute when selecting fruit and vegetables, and health is the attribute for which they pay more, even though the score on attribute is 0.6 (from 0 to 1). The result shows that this cohort is neither aware of nor informed about the real attributes and qualities of organic products. This group is less likely to be highly potential consumers of organic products and can easily substitute organic goods for non-organic fresh ones. Although they have a positive average extra WTP, there are no proper organic product attributes to incite them. *Cluster 4* – origin-oriented consumers (about 19.9%). This segment appreciates only the origin factor in the decision-making process (for fruit and vegetables). The locality of the product is very important for this group of consumers according to other studies by Kokthi *et al*. (2015, 2016), and the local product is considered to be safer than organic.

4. Conclusions

Albanian consumers show very high sensitivity to organic fruit and vegetables. This is also observed within the meat category, which highlights the need for further studies in this sector. However, when dealing with

the beverages and cereals category respondents do not know how to reply. This might be related to the level of processing involved in these products. Generally, cereals and beverages are highly processed foods, which results in the consumer losing their connection with the raw product. It is for this reason that respondents have difficulties to understand the nature of an organic highly processed food product. Dairy products, on the other hand, are considered to have a medium level of processing and derive important sensitivity to organic attribute (0.76 out of one), albeit not an extreme one. For the Albanian consumer organic products are related to raw agricultural products. The more the product is processed, the less it is perceived to be organic. Other studies made in this direction show that organic is typically associated with fresh agro-food products, although there is a growing trend in the world market to extend organic certification and production to processed food (Imami *et al.*, 2017; Skreli *et al.*, 2017; Zhllima *et al.*, 2017). These findings show the necessity of raising consumer awareness as to the definition of organics and about the processing methods that fulfil organic requirements.

In relation to WTP, the extra price for the organic attribute for fruit and vegetables evaluated through the referendum CVM technique is almost double that of the WTP indicated by consumers through the payment card format. These findings show that the use of CVM should be cautious in order to offer qualitative and accurate data for interested actors such as producers and policymakers. Consumers are willing to pay on average 27.7-28.3%% more for organic fruit and vegetables. While Albanian consumers expressed a high willingness to pay for organic products, more should be done to better inform them. The majority (41.8%) use price as the determinant factor of the quality of the product they consume. Other studies have noted that consumers seeking value, in cases when they cannot assess the quality based on intrinsic clues, view price as a distinctive indicator of quality (Judd, 2000). A high product price is perceived as a proxy for overall quality. Many consumers perceive high prices as signals of high quality, however, the relationship between price and objective quality is important for these consumers. In the context of low trust in organic schemes due to the lack of day-to-day public quality control (as is the case in Albania), price seems to be more important than the stamp on the label. We consider that this result is not specific for Albania (Deliana, 2012). However, the exaggerated importance of the price may lead to abuse by producers and requires greater consumer awareness. Producers too should be aware of the high market potential to absorb organic products and lead to investments in organic products. The analysis of WTP for organic fruit and vegetables noted statistically different averages. The consumer in Tirana has a higher WTP for organic fruit. This conclusion has a distinctive meaning in the Albanian case because the consumer considers fruit to be a luxury good. On the other hand, fruit is

generally consumed fresh so consumers are more concerned about pesticide residuals compared with vegetables, which are generally prepared before consumption.

The findings of this paper are in line with public policy to encourage support for organic fruit and vegetable products in Albania. Organic products have a broad market in the country, and may even serve in the future as a development tool for small and fragmented farming systems to improve income levels. Farmers, on the other hand, may use participation in the organic product scheme to better employ the household workforce in the context – as in Albania – of low mechanisation farming systems. Public institutions should ensure support of farmers in terms of administrative and financial issues related to participation in organic schemes that in many cases remain prohibitive for small individual farmers.

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Comparison study of agricultural insurance government subsidy and farmers' self-subsistent premium in Indonesia

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Abstract

Agricultural Insurance as an embodiment of farmer protection and empowerment is carried out with The Rice Farming Business Insurance (AUTP) facility with an insurance premium scheme by the Government of 80% and 20% by farmers. This study aims to simulate the AUTP premium based on government's subsidy and farmers' self-subsistent premium. The simulation test used panel data estimates in Indonesia Province during 2016-2019. The AUTP premium simulation was identified through the Moderating Regression Analysis (MRA) approach, with the moderate variables being government subsidies and farmers' self-subsistent premium. The Government's premium subsidy policy became a pure moderator that significantly increased the AUTP land area by 0.057%. Meanwhile, the coefficient of the farmers' self-subsistent premium variable has a negative and significant effect on the realization of AUTP in Indonesia. The results of the policy simulation emphasize the importance of the government's role in encouraging the increase in the realization of AUTP through subsidizing premium assistance to farmers. The implication of this simulation of the MRA model is that the response and participation rate of the farmers' premium payments independently is not followed

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by an increase in the realization of AUTP in Indonesia. The policy implications in the simulation of the two equation models conclude the importance of managing subsidized farmer premium payments and self-subsistent schemes based on insured land and farmer insurance policy. Agricultural insurance policy needs to adopt risk management tools, diversify agricultural insurance programs, and calculate the willingness to pay agricultural insurance premiums appropriately.

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Introduction

The agricultural sector is always faced with a variety of risks that result in a decrease in production scale, losses, and crop failures. Risks arising from farming activities become a gap between the expected rate of return and the actual rate of return, so farmers must carry out a series of cost calculations, both planned and not. Farmers without doing a series of risk calculations, often have difficulty in carrying out mitigation efforts such as climate change, pest/disease attacks, and all forms of events that cause farming losses. Risk mitigation in farming can be implemented in the form of transfer of risk through agricultural insurance product facilities.

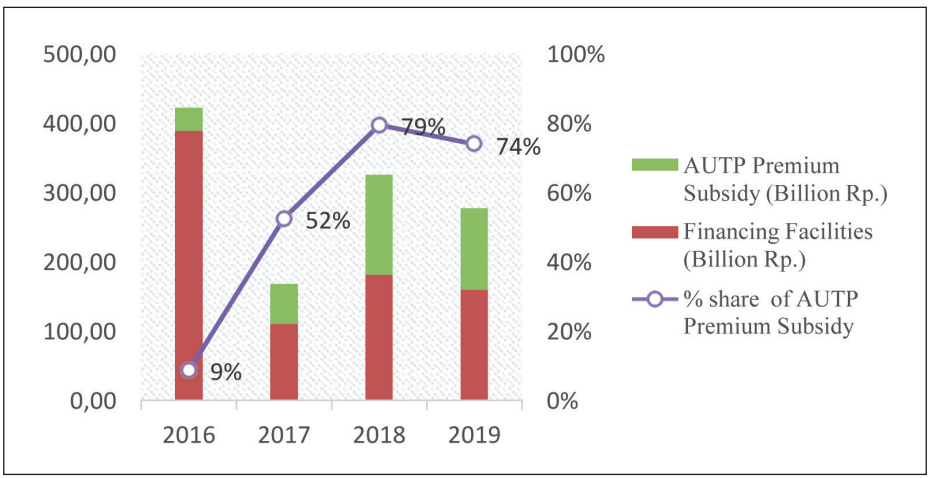
Agricultural insurance in various studies and implementations that have been running in Indonesia since 2015 by providing a focus on funding in the form of working capital recovery for losses suffered. Agricultural insurance within the framework of protection of rice farming as regulated in Law no. 19/2013 concerning protection and empowerment of farmers, classifying risks in the form of natural disasters, attack of plant-disturbing organisms, epidemics of infectious animal diseases, impacts of climate change, and/or other types of risks regulated by Ministerial Regulation. The central government and regional governments in accordance with their authority are obliged to facilitate every farmer to become a participant in agricultural insurance. Besides, in its implementation, the government issued the Minister of Agriculture Regulation No. 40/Permentan/SR.230/7/2015 concerning agricultural insurance facilities which in Article 9, included: (1) ease of registration to become a participant, (2) easy access towards insurance companies, (3) socialization of insurance programs to farmers and insurance companies, and (4) premium payment assistance.

The implementation of agricultural insurance programs in Indonesia aims to protect and empower farmers from a variety of risks of loss and crop failure. The implementation of the Rice Farming Business Insurance Program (AUTP) was first tested in 16 provinces in 2015 with a target of 1,000,000 hectares. The trial was started in the middle of October to December 2015

with the realization of 233,499.55 hectares or 23.35% (Directorate General of PSP, 2015). Based on the Strategic Plan of the Directorate of Agricultural Financing of the Ministry of Agriculture of the Republic of Indonesia Ministry of Agriculture (2016), the agricultural insurance program is targeted to be able to reach an area of land for 2015-2019 of 6.5 million hectares. In reality, the realization until 2019 has only reached a total land area of 2.9 million hectares or 45% of the planned target.

The government's premium subsidy policy in the implementation of AUTP is sourced from the Budget Implementation List of State Budget (APBN) in the Ministry of Agriculture through agricultural financing facilities. The PSP Ministry of Agriculture's annual report (2018) detailed the budget realized in the overall AUTP program (including AUTP operations) at 117 billion or 80.71% of the target set. The realization of the AUTP budget has decreased compared to 2017, which was able to absorb 99.8%. In full, the trend data showing the realization of the AUTP financing budget and the amount of government's premium subsidy for 2016-2019 (Figure 1).

Figure 1 - Chart of Development of AUTP Indonesia Premium Financing and Subsidy Facilities for 2015-2018



Source: Annual Report of PSP General Director 2016-2019.

The average premium subsidy budget for AUTP products for 4 years can be absorbed by 54%. The overall growth rate of the AUTP premium subsidy budget grew by an average percentage of 67%. The increase in premium subsidy experienced a significant increase in 2017, with realization growth

reaching 149%. This increase is the implication of increasing farmers' interest and mitigating the risk of rice crop business in the AUTP program in other regions, especially in Java. In terms of budget contributions to agricultural financing facilities, the 2017 AUTP premium subsidy program was also able to contribute to a growth rate of 27%. The realization of the agricultural financing facility budget in 2018 experienced a downward trend of 12%, followed by a decrease in the absorption of the AUTP subsidy premium budget by 5%. AUTP premium subsidy is a major component in empowering farmers to participate in the AUTP facility.

The realization of the AUTP premium budget will provide an initial picture of the importance of the role and contribution of the central government in increasing the achievement of the AUTP program in Indonesia. In the next test, a simulation of AUTP premium subsidy policy will be carried out as a role in increasing the realization of AUTP land achievements in 21 provinces in Indonesia.

As for the scheme of implementing agricultural insurance based on the Decree of the Minister of Agriculture No. 02/Kpts/SR. 230/B/01/2020 concerning AUTP premium assistance guidelines, the price of rice crops coverage is set at Rp. 6,000,000 per hectare per planting season with a total premium of Rp. 180,000 per ha/MT. The amount of premium assistance from government subsidy is 80% or Rp. 144,000/ha/MT and the remaining farmers are self-supporting Rp. 36,000/ha/MT. Implementation of the AUTP Premium according to the Performance Report (2018) and Annual Report (2018) of the Directorate General of Infrastructure and Facilities of the Ministry of Agriculture of the Republic of Indonesia, there are technical constraints where farmers who feel their land is safe from risk are still reluctant to become insurance participants and farmers willing to pay a 20% self-help premium still low. Farmers do not fully understand the objectives and benefits of insurance activities.

Based on data from the Directorate of Agricultural Financing (2018), financial realization absorbed from agricultural financing facilities for agricultural insurance reached 117.718 billion (reached 80.71% of the target of the AUTP program). The large budget value for the AUTP premium subsidy facility should be able to provide a stimulus for farmers' participation in the agricultural insurance program.

1. Background

Concerning the practice of Agricultural Insurance in many countries, two ideas are implemented: The first idea is; agricultural insurance practices through Government intervention by providing premium subsidy assistance to

farmers. Caneja *et al.* (2009) divides subsidy from the government in terms of insurance premium paid by the government, with details of Australia 46%, Rep. Czech 30%, France 2.4%, Italy 67%, Portugal 68%, and Spain 41%. An overview conducted by Mahlul & Stutley (2010) on agricultural insurance programs that developed in 65 countries, described the features of public support in expanding agricultural insurance through premium subsidy in areas of land with hail climate. Bozzola *et al.* (2018) reveal that the importance of seasonal climate changes when measuring impact and considering climate adaptation policies. the climate is an important factor determining land value in Italy.

According to Wenner and Arias (2003), high-income countries, such as the United States, Spain, France, and Italy, provide agricultural subsidy schemes in the form of; subsidized premium, operational subsidy, and subsidized reinsurance in reducing or managing risk. The crop insurance subsidy policy in Italy by Santeramo *et al.* (2016) explained the individual farmer model in terms of entry and exit the crop insurance program. the findings show that education and farm size are determinants of participation in the insurance market.

The second idea is the practice of agricultural insurance through a market/ private mechanism without a premium subsidy policy. The practice of agricultural insurance by private and open markets is carried out in several Latin American countries such as Argentina, Brazil and Bolivia (World Bank, 2010). Mitu (2007) also gave a description of agricultural insurance practices in Romania with the Public-Private partnership model through insurance premium payments by call and put agricultural contracts based on the weather index.

In the context of agricultural subsidy policy practices in Indonesia, the results of the simulation of agricultural insurance premium subsidy produced several findings. A study conducted by Ambarawati *et al.* (2018) who looked at the perspective of farmers in mitigating the risk of rice farming in Bali Province, found that 85% of respondents involved in the AUTP scheme wanted full premium subsidy from the government, while the remaining 15% of respondents were willing to pay premium independently. In another study, Mega *et al.* (2019) examined the farmers' satisfaction index of the AUTP attribute, resulting in a Farmer Customer Satisfaction Index value of 52.82% or the range of scores quite satisfied. Specifically, the value of satisfaction with farmers' premium subsidy by the government is confirmed with the largest Weight Score value of all attributes assessed, which is 0.137.

The parametric method of the AUTP Program premium conducted by Muraqin *et al.* (2016) proposed a method of estimating the premium amount of the AUTP insurance program in Indonesia by using a parametric statistical approach by assuming that the average yield of rice per hectare follows a normal distribution with an estimated premium of around Rp. 179,000 to Rp.

268,000. The implementation of AUTP in Indonesia, which has been running until 2020, maintains an AUTP subsidy premium scheme of Rp. 180,000. The review of the implementation of the AUTP using parametric empirical data has not been comprehensively carried out panelly at the provincial estimation level and on an annual scale.

Some empirical studies of the implementation of AUTP premium subsidy that have been carried out are still limited in the scope of cross-sectional modeling. Empirical studies of premium subsidy practices and farmers' responses are carried out in logistical modeling and willingness to pay, such as Iswandi (2016), Mutaqin (2016), Surning *et al.* (2018), and Yanuari *et al.* (2019). However, as far as the search has been done, there is no more comprehensive research on the AUTP governance panel data test in Indonesia. The subsidy policy simulation needs to be carried out in a broader perspective using empirical data on the implementation of agricultural insurance in Indonesia.

The AUTP premium subsidy policy simulation aims to provide empirical study space, the role of government's premium subsidy and farmers' premium contributions in supporting the implementation of agricultural insurance facilities in Indonesia. Panel Data Moderation Analysis was chosen because this model was able to identify the effects of moderation arising from government premium subsidy and smallholder self-help on the realization of AUTP in Indonesia. Therefore, the simulation results of the AUTP premium modeling for subsidy and self-help will map the impact and policy response to improve AUTP performance in Indonesia.

2. Materials and methods

The study of agricultural insurance in Indonesia was carried out with a quantitative approach with the modeling of agricultural insurance premium subsidy. Modeling was done using panel data estimation, which compiled data on regional/provincial scope (cross sectional) with an annual time span scale (time series). The use of panel data will increase the degree of freedom and reduce the possibility of colinearity (significant linear relationship) between independent variables. According to Baltagi (2005) the panel data approach provides the following advantages:

- controlling individual heterogeneity (individual heterogeneity);
- providing more informative data, variability which further reduces collinearity between variables, increases degrees of freedom and is more efficient;
- learning the dynamics of adjustment better (dynamics of adjustment);
- identifying and measure effects that cannot be detected in the time series or cross section data models better;

- it is possible to form and test behavior models that are more complicated than time series or cross section data models;
- macro panel data has a longer set of time and is not like the typical non-standard distribution problem of unit root testing in time series analysis.

Secondary data collection was done by a series of tabulation steps of AUTP performance panel data and land area intensity that experienced several risks in the rice crop sector. Based on the consistency of AUTP realization data in the annual report of the Indonesian Ministry of Agriculture and the performance report of the Directorate General of PSP, the Ministry of the Republic of Indonesia, 21 Provinces was used as samples of simulated agricultural insurance premium. For the time series scale, it was set from 2016 to 2019. The following Table 2 tries to explain the operational definition of variables in the simulation of agricultural insurance premium subsidy policies.

Table 1 - Definition of operational variables in the simulation of agricultural insurance premium subsidy policies

Variable	**Operational Definition**	**Information**
AUTP performance	Achievement percentage of the realization of the AUTP implementation of the target	Dependent
Land of Insurance	Land area of rice plants registered by farmers as AUTP Policy (in Ha)	Independent
Premium Subsidy	The amount of premium subsidy by the Government is 80% of the premium paid (in Rp)	Moderating
Self-subsistent	Self-subsistent premium paid by farmers amounting to Rp. 36,000 (in Rp)	Moderating
Plant Pest (HPT)	The intensity of paddy fields damaged due to a number of attacks such as Rice Stem Borer, Brown Planthopper, Rat, Blas, Hawar Daun/ Crackle, and Tungro (in Ha)	Control
Flood Land	The intensity of the area of rice fields damaged due to flooding (in Ha)	Control
Drought Land	The intensity of the area of rice fields damaged due to drought (in Ha)	Control

Source: processed by authors.

Model of Analysis

The main framework in the simulation of agricultural insurance premium policy is to combine the multiple linear regression estimation model of panel data by placing the government premium subsidy variable as a Moderating Regression Analysis (MRA). Panel data regression model analysis is known as three kinds of approaches which consist of pooled least square approach, fixed effect approach, and random effect approach (Nachrowi, 2006). The selection of the panel data regression approach will be tested with the Chow test and Hausman test. Chow tests determine the choice of the best model between the common effect or fixed-effect model. Next, the Hausman test is conducted to determine the best choice between the fixed effect or random effect model (Muliadi and Amri, 2019).

The equation function will be transformed in logarithmic form, considering that each variable has a different size. As explained earlier, this research will establish moderating innovation variables in the equation model. Moderated Regression Analysis (MRA) is a special model of linear regression whose regression equation has an element of interaction between variables (Ghozali, 2014). Determination of variable moderation aims to see the effects of moderation as an element that reinforces or weakens the influence between independent and dependent variables.

In this study, the use of MRA is intended to further identify the role of government and farmers' self-subsistent premium on AUTP performance in Indonesia. That is, in the AUTP premium simulation, the interaction of moderating variables will identify how strong the influence of moderation can increase the realization of AUTP provinces in Indonesia. Then it can be simulated two MRA equation models:

- First Simulation: AUTP premium simulation model with government's subsidy policy as a moderating variable. This simulation is based on the AUTP premium policy based on the Minister of Agriculture Decree No. 02/Kpts/SR. 230/B/01/2020 regarding guidelines for AUTP premium assistance of 80% or Rp. 144,000/ha/growing season. In addition to seeing the role of AUTP premium subsidy as a moderating variable in the relationship between AUTP land area and AUTP performance, a risk control variable for rice farming is also included.

Equation of MRA 1:

$$Log(AUTP_{it}) = a_{it} + \beta 1\log(LA_{it}) + \beta 2\log(Subs_{it}) + \beta 3\log(MDR1_{it}) + \beta 4\log(LHPT_{it}) + \beta 5\log(LB_{it}) + \beta 6\log(LK_{it}) + e_{it}$$

- Second Simulation: AUTP premium policy simulation model by testing the role of self-subsistent farmers' premium as a moderating variable on the

AUTP land area with AUTP performance with risk control variables in rice farming land (Figure 2). The second simulation model only distinguishes the variable moderation of premium paid for self-help by farmers which is set at Rp. 36,000/farmer.

Equation of MRA 2:

$$Log(AUTP_{it}) = a_{it} + \beta 1\log(LA_{it}) + \beta 2\log(Swad_{it}) + \beta 3\log(MDR2_{it}) + \beta 4\log(LHPT_{it}) + \beta 5\log(LB_{it}) + \beta 6\log(LK_{it}) + e_{it}$$

Notes:

Subs : Government's premium subsidy
Swad : Farmers' self-subsistent's premium
MDR1 : Moderating variable multiplication results between AUTP land area and government's premium subsidy
MDR2 : Moderating variable multiplication results between AUTP land area and farmers' self-subsistent's premium
AUTP : Performance of AUTP
i : Cross sectional consists of 21 provinces
t : Year of observation (2016-2019)
a : Constant
β1-β6 : Regression coefficient
LA : Insured Land
LHPT : Intensity of damage to rice fields due to HPT attacks (control variable)
LB : Intensity of damage to rice fields due to flooding (control variable)
LK : Intensity of damage to rice fields due to drought (control variable)
e : Error term

3. Results

Equation model simulation was done on the basis of placing moderation variables as roles that strengthen and/or weaken the influence of insured land area on the realization of AUTP in Indonesia. As explained in the research methodology, the equation model will test 2 simulations; they are:

- simulation of governments' premium subsidy policy as a moderating variable;
- simulation of farmers' premium self-subsistence as a moderating variable. Before further analysis, a feasibility study of panel data estimation models was firstly conducted to be used for MRA analysis. The method of testing the feasibility of the model was done by the Chow Test and the Hausmaan Test. In the panel data estimation there are 3 models, namely pooled least square (PLS), fixed-effect model, and random effect model

(REM). The model selection criteria can be approached with the following test:

- if the value of the redundant test and the Hausman test are both significant then the FEM model is used;
- if the redundant test is significant and the Hausman test is not significant, then the REM model is used;
- if the redundant test and the Hausman test are both insignificant, the PLS model is used.

Table 2 - Panel Data Estimation Model Selection Test

Model	Test	Statistic (Cross Section F/Chi Square)	Conclusion
Simulation 1a Non MRA	Chow Test	3,965***	Fixed Effect Model
	Hausmann Test	13,702**	
Simulation 1b MRA	Chow Test	8,849***	Fixed Effect Model
	Hausmann Test	13,081***	
Simulation 2a Non MRA	Chow Test	3,92***	Fixed Effect Model
	Hausmann Test	11,83**	
Simulation 2b MRA	Chow Test	3,406***	Fixed Effect Model
	Hausmann Test	11,883*	

Information:
* significant at α 10% ($p < 0.1$);
** significant at α 5% ($p < 0.05$);
*** significant at α 1% ($p < 0.001$).

Based on the results of the equation model test for each simulation, consistently the panel estimation model was chosen and the most appropriate in explaining the equation relationship was the fixed effect model (FEM). So in explaining the simulation results and policy implications, the model used was FEM.

Simulation of Government's Premium Subsidy Policy

The MRA analysis model in the simulation of the government's premium subsidy policy was based on the 80% premium value borne by the government based on the area of insurance participants. This policy is notated as M Simulation involving risk control variables of land damage, considering that this risk aspect is something that is unpredictable. The panel estimation results with 3 equation models are as in Table 3.

Table 3 - Simulation estimation of the government's premium policy substitution panel as a moderating variable for AUTP performance in Indonesia

Variable	***Panel FEM Non MRA (1a)***		***Panel FEM MRA (1b)***	
	Coefficient	**t-stat**	**Coefficient**	**t-stat**
Dependent Variable: AUTP				
Konstanta	25.323	0.303	–39.566	–0.603
LHPT	0.200	1.615	0.389	2.730 (***)
LK	–0.021	–0.756	0.061	2.653 (***)
LB	0.009	0.290	–0.050	–1.686 (*)
LA	2.787	0.396	–4.241	–0.765
SUBS	–2.456	0.349	3.071	0.556
MDR1	–	–	0.057	6.795 (***)
R-squared	0.730		0.860	
F-stat	9.912 (***)		20.163 (***)	
Total Observation	**82**		**82**	

Source: Output E-Views 8.0.

Information:
* significant at α 10% ($p < 0.1$);
** significant at α 5% ($p < 0.05$);
*** significant at α 1% ($p < 0.001$).

The estimation results, as in Table 3, illustrated that the panel equation model with the MRA that placed the moderating variable premium subsidy on insured land gave a greater coefficient of determination (*R-Square*). Then it can be argued that government policy in terms of premium subsidy on the

land of insurance was able to moderate and increase the realization of AUTP in Indonesia. The coefficient of determination of the MRA equation model was 13% greater than non-MRA.

The interpretation is a step to encourage the performance of the implementation of AUTP in the context of protection and empowerment of farmers, has a great dependence on the policy of premium subsidy by the central government. This can be seen from the aspect of using MRA variable government subsidy premium that were able to moderate the increase in the realization of AUTP in Indonesia. In Panel FEM MRA (1b), most of the coefficients of each variable are partially significant, both the independent variables and the control variables. It means the policy of premium subsidizing insurance by the central government is a major element in the governance of the AUTP program in Indonesia. Some specific explanations of variables can be explained below:

- the land area insured does not directly affect the achievement of AUTP realization in Indonesia. The implementation of agricultural insurance subsidy contracts in Indonesia is indemnity-based, where coverage is based on actual loss or damage experienced by farmers for 75% of the total damage in 1 hectare of land. Referring to the Regulation of the Minister of Agriculture Number 30/Kpts/SR.2010/B/12/2018 about AUTP Premium Assistance Guidelines is carried out by checking and assessing the area of subsidized land by regional field agricultural. This relationship showed that the use of subsidized insurance budget in the scale of the AUTP land area must interact with each other. This interaction means that the implementation of the AUTP premium subsidy must refer to information on high risk endemic lands. The target of subsidized AUTP land must consider the risk profile to maintain the sustainability of the insurance company. Its implementation is not only carried out in endemic areas – anti-selection;
- if the variable land area of insurance and subsidy policy interact, it will be able to increase the achievement of AUTP realization in Indonesia. This MRA relationship illustrates, increasing 1% of AUTP premium subsidy based on the area of the land insured by farmers, then the realization of AUTP will increase by 0.057%. In other words, the role of premium policy subdivision was able to strengthen and enlarge the achievement of the implementation of the land area of insurance by 0.057%.

Simulation of Self-subsistent Premium of Agricultural Insurance in Indonesia

The next simulation provided an empirical study of the implementation of AUTP by placing farmers' self-subsistent premium as a moderating variable. In this second simulation, the effect of the area of insured land on AUTP performance would be moderated by farmers' self-subsistent premium.

Similar to the first simulation, the control variable also consisted of various rice crop risk (Table 4).

Table 4 - Simulation of the Estimation of Farmers' self-subsistent Premium Panel as an AUTP Performance Moderation Variable in Indonesia

Variable	***Panel FEM Non MRA (2a)***		***Panel FEM MRA (2b)***	
	Coefficient	**t-stat**	**Coefficient**	**t-stat**
Dependent Variable: AUTP				
Constant	–2.477	–1.640	0.512	0.242
LHPT	0.244	2.113 (**)	0.227	1.912 (*)
LK	–0.033	–1.207	–0,028	–1.016 (*)
LB	0.028	0.898	0.002	0.066
LA	0.389	9.018 (***)	0.078	0.458
SWAD	–0.118	–1.986 (**)	–0.269	–2.754 (***)
MDR2	–	–	0.017	1.921 (*)
R-squared	0.750		0.760	
	10,721 (***)		10,756 (***)	
Total Observation	**82**		**82**	

Source: Output E-Views 8.0.

Information:
* significant at α 10% ($p < 0.1$);
** significant at α 5% ($p < 0.05$);
*** significant at α 1% ($p < 0.001$).

Estimation results in equation models 2a and 2b showed that there was a difference between the influence of the area of insured land before and after the self-subsistent premium variable. In equation 2a, there was a significant influence between the area of insured land on the achievement of AUTP realization in Indonesia. An increase in the area of insured land by self-subsistent by 1% would have an impact on the increase in AUTP realization by 0.389%. Meanwhile, Equation Model 2b with the innovation of placing

variable moderation of farmers' self-subsistent premium with agricultural insured land coverage, did not significantly influence the achievement of AUTP realization in Indonesia. The estimation results of equations 2a and 2b can be explained as follows:

- in the second simulation, the effect of farmers' self-subsistent variables had the same coefficient direction between equation models 2a and 2b. The variable coefficient of agricultural insurance self-subsistent premium had both a negative and significant effect on the realization of AUTP in Indonesia. In other words, it can be explained that if the farmers' self-subsistent premium increase by 1% would have an impact on the AUTP realization decrease of 0.118% (2a) and 0.269 (2b). There were indications of symptoms that indicated farmers' interest to participate in the insurance program because they were not willing to pay a self-subsistent premium of Rp. 36,000 as stipulated in the Republic of Indonesia Decree. No. 02/Kpts/SR.230/B/01/2020 about the AUTP premium assistance guidelines;
- on the other hand, the placement of MRA innovation variables by looking at the interaction of self-subsistent premium variables with the area of insured land was able to drive an increase in AUTP realization by 0.017%. The interaction of this variable had a significant and positive relationship direction at the 90% confidence level (p-value 0.1). AUTP governance by optimizing farmers' self-subsistent premium payment based on land area, would provide a positive image of AUTP performance improvement;
- control variables of land damage from the aspect of HPT attacks, floods, and drought as a whole had the same direction to the AUTP performance. The mechanism of offset losses to farmers due to drought had a negative impact on AUTP performance in Indonesia. Chavas *et al.* (2019) captured that adverse weather has significant and persistent effects on agricultural productivity;
- in the second simulation model, farmers' self-subsistent premium were more controlled by the impact of land damage due to HPT attacks. This means that farmers' responses to HPT attacks were more dominant encouraging their participation in agricultural insurance programs;
- the simulation of the AUTP equation model with a self-subsistent premium from farmers had a moderating relationship that is Quasi moderator. This result was illustrated by the significant variable farmers' self-subsistent premium before and after the interaction of moderating variables with the independent variables in the two equations (2a and 2b).

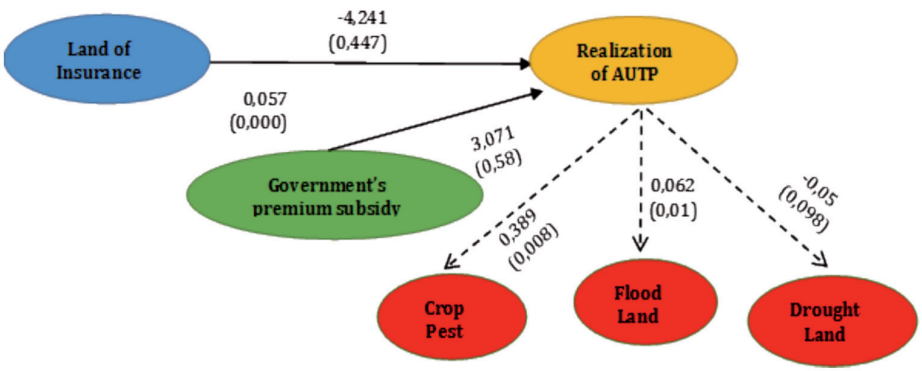
Implications of AUTP Premium Policy in Indonesia

The results of the policy simulation stressed the importance of the government's role in encouraging the escalation of AUTP realization through

subsidizing premium assistance to farmers. The Indonesian government should gradually decrease the amount of subsidy to increase the self-resilience and empowerment of farmers in Indonesia. The Comparison of government subsidy premiums and self-sufficiency implies that the dependence on following AUTP products through subsidies by the government with the cost compensation model is still very large. The adoption of risk management tools needs to be developed to realize the independence of farmers to pay premiums independently.

Based on simulation model 1, the interaction of subsidized moderation variables with the area of insured land could increase the achievement of AUTP performance in Indonesia. If illustrated in the MRA model scheme, we can see the actual coefficient value in Figure 2.

Figure 2 - Simulation Scheme of Government's Premium Subsidy of MRA Model



The government's premium subsidy policy of 80% to farmers participating in insurance must be implemented in an integrated manner based on the policy basis of the Prospective Participants/Candidates for Land (CP/CL) of farmers. This can be seen in the MRA simulation scheme, where variable land area and subsidy without moderation did not affect AUTP performance. Thus, the right target farmers' premium subsidy policy instrument would be able to improve the relationship between land area and AUTP performance by 0.057%. The Indonesian Ministry of Agriculture needs to verify accurately and credibly in the provision of premium subsidy for farmers. AUTP performance can be optimally realized with this good process.

Empirically, the simulation results of willingness to pay (WTP) for farmer premium payments using the Contingen Valuation Method (CVM) found

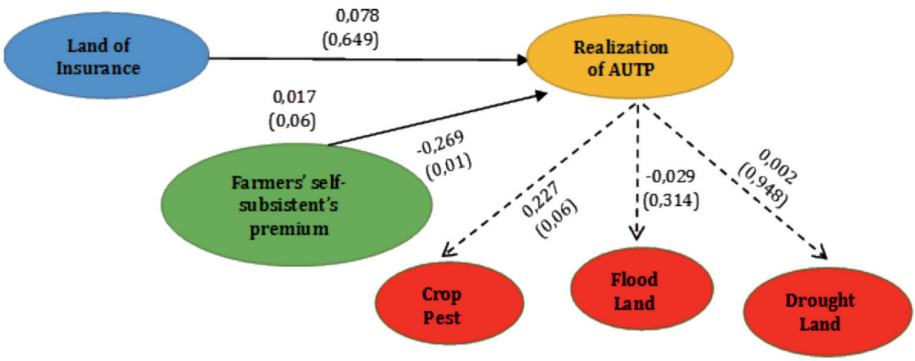
that the willingness to pay was IDR 30,853/Ha/cropping season (Surning *et al*., 2018) and Rp. 30,358/ha/croping season (Mutaqin, 2019). Socio-economic variables such as farmer tenure status, farmer education level, and rice farming productivity have influenced the WTP to join the Rice Farm Insurance program. The rice farmining insurance premium of IDR 60,000 per hectare can be charged to insurance, while the government can reduce the subsidy to IDR 120,000 per hectare in one planting season. The farmer's willingness to pay is equivalent to 1.0% of the value coverage premium (Budiasa *et al*., 2020).

AUTP Premium Subsidy Policy has become an important element in moderating the relationship between land area and the achievement of insurance realization, also known as pure moderator. Pure moderator occurs if the independent and moderating variables become significant to the dependent variable, after the interaction between variables. So in this case, the policy of premium subsidy to farmers absolutely must be carried out at 80% as stipulated in the Republic of Indonesia Ministry of Agriculture. No. 02/Kpts/SR. 230/B/01/2020 concerning AUTP premium assistance guidelines. An empirical study of 240 smallholder farmers in Garut Proviance Regency, West Java by Mutaqin (2019), found that a strategy approach to the sustainability of farmer insurance premiums, can be carried out by reducing premiums (supply side) and increasing farmer WTP (demand side). The farmer requires the allocation of more government budget to the premium subsidy; however, due to the financial constraints on the government, further subsidy for the premium cannot be relied upon.

The next simulation provided an empirical study of the implementation of AUTP by placing farmers' self-subsistent premium as a moderating variable. In this second simulation, the effect of the area of insured land on AUTP performance would be moderated by farmers' self-subsistent premium. AUTP premium also regulates farmers'self-subsistent contributions of IDR 36,000/ ha/MT or 20% of the total premium after the government's subsidy. Based on the simulation results in the context of farmers' self-subsistent premium as a moderating variable that interacts with land area, it was found that there was a positive and significant direction of influence on AUTP performance in Indonesia. Simulation results with the provisions of farmers' self- subsistent premium can be explained in Figure 3.

The MRA model simulation results are related to the effect of variable moderated farmers' self-subsistent premium in increasing the achievement of AUTP performance giving a significant impact of 0.017%. However, the self-subsistent premium policy directly had a negative impact of 0.26% on AUTP performance in Indonesia. The implication of this MRA model simulation was that the response and participation rates of farmers' premium payments were not independently followed by an increase in the realization of AUTP

Figure 3 - Simulation Scheme of Farmers' Self-Subsistent Premium of MRA *Model*



in Indonesia. This means that agricultural insurance policies in order to encourage the independence of farmers have not yet developed optimally.

The Indonesian government needs to make efforts to diversify AUTP products to encourage the independence of farmers. Crop Diversification is a strategy that can be used as a solution to increase the participation of farmers participating in agricultural insurance. this was confirmed by Di Falco *et al.* (2014) and Santeramo *et al.* (2016) in the implementation of crop insurance in Italy which adopts crop diversification as an alternative risk management strategy and a substitute for financial insurance in hedging against the impact of risk exposure on welfare.

The MRA model simulation results are related to the effect of variable moderated farmers' self-subsistent premium in increasing the achievement of AUTP performance giving a significant impact of 0.017%. However, the self-subsistent premium policy directly had a negative impact of 0.26% on AUTP performance in Indonesia. The implication of this MRA model simulation was that the response and participation rates of farmers' premium payments were not independently followed by an increase in the realization of AUTP in Indonesia. This means that agricultural insurance policies in order to encourage the independence of farmers have not yet developed optimally.

The simulation of the AUTP equation model with a self-subsistent premium from farmers had a moderating relationship that is Quasi moderator. This result was illustrated by the significant variable farmers' self-subsistent premium before and after the interaction of moderating variables with the independent variables This simulation provided an overview of the importance of self-subsistent farmers' premium payment management based on the area of land administration registered in the insurance policy. Therefore, the implications of government policy to encourage the

independence of farmers to participate in paying premium contributions must be in line with the insured land ownership information system.

Jayanto (2018) explained that the risk of crop failure is the risk of farmers' households who do not get results on their farming business, with the category of puso per hectare caused by drought, floods, and attacks of Plant Disturbing Organisms (OPT), with a percentage of damage of 75% of the total land area. The risk of land damage as a control variable in the equation simulation had a significant directional relationship to AUTP performance in Indonesia. AUTP performance was absorbed dominantly and significantly by 38.9% due to HPT attacks. The HPT in question includes, among others, Rice Stem Borer, Brown Planthopper, Rat, Blas, Hawar Daun/Crackle, and Tungro. There were indications that many AUTP claims were caused by HPT attacks that were difficult to control by farmers. For the risk of land drought, the amount of intensity that affected the performance of AUTP is only absorbed by 6.2%. Flooding land in the context of model 1 simulation has a negative effect on AUTP performance in Indonesia.

Similar to the simulation of the first model, in model 2, HPT control variables also dominantly absorbed the damage rate or AUTP claim, amounting to 22.7%. As for damage due to the floods and drought the absorption rate was low. The level of damage caused by HPT attacks encouraged farmers to designate areas whose land is to participate in the AUTP program. This indicated that HPT damage was more predictable by farmers and more compatible with the protection of short-term rice business.

This study has limited data coverage and methodology at the level of realization of the Agricultural Insurance Program (AUTP) in a cross-sectional manner at the provincial level in Indonesia. An in-depth study to see the behavior of farmers in order to be willing to pay agricultural insurance premiums must be reviewed in the context of primary data on independent farmer participants and government subsidies. The willingness to pay study is useful for identifying the impact of farmers' willingness to participate in the Agricultural Insurance Program.

4. Conclusions

The premium subsidy policy in the AUTP program has an important role in the implementation of protection and empowerment of farmers in Indonesia. Premium subsidies by the government can increase the area of insurance land which can further improve the performance of AUTP in Indonesia. The results of the simulation of the premium policy with the MRA prove that an increase in the area of insured land will not have a significant effect in increasing AUTP performance without being moderated and strengthened by an 80%

premium subsidy facility. Premium subsidies by the government are pure moderators in the AUTP simulation scheme in Indonesia.

Farmers' self-subsistent premium in the MRA model simulation scheme affects the improvement of AUTP performance in Indonesia. The MRA model simulation results prove that the self-subsistent premium directly has a negative impact of 0.26% on AUTP performance in Indonesia. Agricultural insurance policies in order to encourage the independence of farmers have not yet developed optimally. However, farmers' self- subsistent premium is able to moderate the relationship between land area and AUTP performance.

Farmers' awareness of adapting to risk mitigation is still meager. The farmers need to improve their understanding of the negative impacts of climate change. furthermore, the government should prepare an independent Agricultural Insurance scheme that can practically decrease the 80% government subsidy gradually. consequently, risk management tools adoption needs to be made based on the risk profile in each region, the diversification of agricultural insurance programs, and the calculation of the willingness to pay agricultural insurance premiums appropriately.

So overall, it can be concluded that the simulation model of AUTP premium subsidy policy and farmers' self-subsistence is very closely related to the area of land registered in the insurance policy. Both simulation models confirm the impact of moderation on subsidized premiums and self-subsistent premium on enhancing AUTP performance in Indonesia. The government needs to carry out the land verification policy set out in the AUTP program. The CP/CL element will have an impact on increasing AUTP performance, both in terms of the premium subsidies approach and independent smallholders.

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Innovation in Basilicata agriculture: From tradition to digital

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Abstract

The 4.0 technologies are changing agricultural production processes and with them the agro-food supply chains, fundamental for the competitiveness of the Made in Italy and Basilicata, a region of southern Italy. It has invested in modernization and restructuring of agricultural, agri-food and forestry farms by rural development policies, which address respect for sustainability and to reduction of renewable and non-renewable resources, preserving quality and the link with the territory.

Some Lucanian agricultural entrepreneurs, interested in experimenting with innovative and sustainable agriculture, has intensified relations with the local scientific world, the advisors, training institutions and with small and medium-sized agro-industrial enterprises, setting up clusters. Then European Partnerships for Innovation have formed inside them.

This paper analyses the eleven Operational Groups of the Lucanian European Partnerships which represent the incubators for the digitalization of agri-food 4.0. From the analysis it emerged that the maximum expression of digitization in Basilicata is Precision Farming, as evidenced by the establishment of a specific operating group, AgrotechBasilicata. However, the other Lucanian OGs can also be classified as digital because they are interested by information collection systems, software and data analysis, as well as robotics and automation.

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Introduction

The first technological developments, applied to the primary sector, date back to the second half of the last century when glass greenhouses were equipped with devices to measure and control the internal microclimate, in order to produce fruit and vegetables out of season or high-income crops. In fact, the evolution of electronics led to the affirmation of automatic control systems; these used microprocessors characterized by a high ability to adapt to the complexity of the system management, by the speed of response, by high reliability and by the progressive reduction of costs (Sica, 1996; Manera *et al.*, 1988).

Over the years, the introduction of other innovative technologies (satellites, Global Position System-GPS, Geographical Information System-GIS, dedicated software, etc.) has produced changes that have allowed, and still allow, sustainable management of the agricultural landscape. For example, Remote sensing techniques are used to monitor changes in agricultural soils, the Decision Support System (DDS) to manage greenhouse production system (Dimitrijevic *et al.*, 2015), while GIS remain excellent tool to evaluate morphological and vegetation changes in agro-forest land over time. Among its numerous applications, there are the control of hydrogeological instability, the identification of the different categories of land use, the optimization of agricultural plastic waste management (Blanco *et al.*, 2018) and mechanized management, more targeted and efficient, of some agricultural practices such as soil preparation, sowing, water and nutrient management, weeding, harvesting and sorting of harvested products (Precision Farming, Agriculture 3.0) (Falzarano, 2018; D'Antonio *et al.*, 2015; D'Antonio *et al.*, 2011).

PF is a multidisciplinary and technologically advanced form of agriculture that produces economic and environmental benefits (Medici *et al.*, 2019). These benefits are due to the reduction of the quantities of production inputs, to the labor savings (reduction of working hours and stress levels of the operator as well as management of large companies with the same workforce) to the possibility of operating in any climatic conditions and to have a fuel saving producing, at the same time, a reduction of the environmental impacts on air, water and soil. The reduction of direct (for the purchase of inputs) and indirect (environmental restoration) costs produce a significant economic improvement.

Agriculture 4.0 can be considered the evolution of agriculture 20 years ago. In the first two decades of the 21st century, the advancement of geomatics technology produced new tools and/or improved existing techniques for near-surface geophysical surveys (and therefore applicable to agricultural soil) in a robust, cost-effective and non-invasive way (Bitella *et al.*, 2015). This is

the case of electromagnetic devices that were extensively used in precision agriculture, alone or in combination with information on the ground, to help delineate uniform management zones.

Today in Italy the agri-food and forestry sectors are affected by a technological revolution closely linked to the use of digital applications and artificial intelligence, which is why Agriculture 4.0 is also known as Smart Agriculture.

Its most important innovative element is represented by automated robotics which, in turn, is enriched with new technological applications: innovative sensors (e.g. optical fibres) applicable or not to agricultural equipment, software capable of automatically learning the data, advanced algorithms for 2D and 3D tomographic imaging, robots capable of moving on the ground, by means of vehicles equipped with wheels or sliding on rails, or in the air above by means of drones (Zorer, 2020; Klerkx *et al.*, 2019), and unmanned land vehicles. The agri-food and forestry sectors are affected by the multi-actor platform, a tool capable of ensuring resilience and an effective mechanism to guarantee the co-creation of knowledge and definition and implementation of innovation (Salvia & Quaranta, 2019; El Bilali H. & Allahyari M.S., 2018).

Agriculture 4.0 allows a greater guarantee of yield and sustainability of the crops, as well as production quality, potentially even in the most disadvantaged rural areas.

Italian Observatory Smart Food study on 986 farmers shows that the Italian Agriculture 4.0 market went from 100 million euros (2017) to 540 million euros in 2020 with an increase of 270% in just one year (2017-2018). When a farmer uses an agricultural 4.0 solution (55% in 2018 e 60% in 2020), he is more willing to adopt other technological solutions. The same study indicated the business management software as the first most adopted digital solution in Italian agriculture with 37%, followed by the monitoring and control systems for agricultural machinery and equipment (33%), the crop and land mapping services and precision irrigation systems, equally to 27%, the crop and land monitoring and control systems (17%), the decision support systems and remote and monitoring systems of corporate infrastructures, both to 15% and the variable rate distribution systems (10%).

The technologies of the production processes, already developed, aim at improving working conditions, optimizing production (quality and quantity), contemplating environmental (reducing the consumption of non-renewable resources to meet the needs of the present without compromising the needs of future generations) and promoting significant economic savings.

In order to optimise production efficiency, digital agriculture mainly aims to satisfy two specific objectives: 1) to produce safer and healthier food products as consumers have become more attentive to their health and

environmental well-being; 2) to increase production in order to meet the growing demand both for agricultural production, which will have to exceed the existing ones by at least 70% in the next 30 years (Nicoletti, 2019), and for processed food necessary for a population constantly growing but with limited economic capacity. Regarding the first objective, in the last decade, researchers focused their attention on fast, stable and continuous, reliable and non-destructive techniques than the existing ones, able to accurately evaluate the physical and chemical parameters that contribute to defining the quality of an agri-food product. Moreover, researchers looked particular attention to the verify of authenticity and adulteration. These methods have also proved to be often suitable for both laboratories use and installation on processing lines (Fabbri *et al*., 2019).

As for the satisfaction of the increase in demand, however, attention is focused above all on the greater diffusion of Precision Farming (Barnes *et al*., 2019; Eastwood *et al*., 2017; Wolf & Buttel, 1996).

The enhancement of logistics activities become an advantage for the competitiveness and the business growth. In fact, logistic innovations entail a cost reduction and the revenue growth due to the higher prices of the better quality products guaranteed by monitoring, anti-counterfeiting systems and that enhance their origin. Logistic activities are generally supported by the use of sensors and technologies, such as the Internet of Things (IoT), able to connect human and technological resources (Panniello & Pontrandolfo, 2019).

The "strongest" innovation is represented by the use of technologies in logistics as tools to innovate the product. In fact, some technologies can make smart some food products, transforming them from simple consumer products to suitable tools for data collection; this causes an immediate impact on the economy of the farm.

Finally, the computerization allows a good manage of the purchase orders because products are visible online with a considerable amount of them information, included prices, easily available for consultation.

1. Innovation in Basilicata agriculture

Italian agriculture is still indisputably traditional, with 4,11% of the total cultivated area managed with Agriculture 4.0 systems (Valmori, 2021); in Basilicata region the production sectors have not reached the same degree of efficiency, as emerges from an analysis conducted using the results of 1,759 company surveys carried out for the regional RICA sample in the period 2011-2016 (D'Oronzio & Potenza, 2020).

Fortunately, the Italian "agricultural culture" is changing: about 60 Start-up (equal to 12%) among 481 Smart AgriFood international start-

up, born since 2011, are Italian ones and some of these also operate in Basilicata; moreover, investments in Agriculture 4.0 reached a turnover of 350,000,000 dollars in 2018 (equal to 5% of the global value), as shown by the Smart AgriFood Observatory of the Politecnico of Milan (Italy) and reported by Panniello & Pontrandolfo in 2019. Similarly, the Lucanian "agricultural culture" is in transition towards a new border through the adoption of paths and processes of social innovation, processes and products: this is demonstrated by the monitoring data of the PSR of the Basilicata region starting from the period 2007-2013 (D'Oronzio & Costantini, 2018, D'Oronzio *et al.*, 2020).

Geographic Information System of Agriculture 3.0 has been the digital tool most used in agricultural-forestry sector in Basilicata as testified by several scientific paper produced following applications and experiment of Agriculture 3.0 and 4.0. In fact, the GIS, individually or together with other digital tools (Remote sensing, Satellite imagery, Digital ortho-photos, 3D analysis), have been used for mapping, monitoring and control of land (Viccaro *et al.*, 2017; Dimotta *et al.*, 2017) and crops (Statuto *et al.*, 2019; Dimotta *et al.*, 2016), mapping of forest areas and variations in land use (Cillis *et al.*, 2020), mapping rural structures (Romano *et al.*, 2016) and enhancing the typical products of some areas (Claps *et al.*, 2002). Another digital solution, the Electrical Resistivity Tomography (ERT) has been used to characterize the coastal saltwater intrusion in the pine forest reserve of Metapontum (Matera) to highlight the spatial distribution of saline water in the soil (Satriani *et al.*, 2012) and to evaluate the quantitative relationships between soil electrical resistivity and root biomass to determine if resistivity tomography could detect the spatial variability of tree roots in the field (Amato *et al.*, 2009) while GPR has been used to locate losses of pollutants in groundwater (Satriani *et al.*, 2018).

PF, initially welcomed with extreme caution and scepticism, is also spreading to small and medium-sized enterprises (D'Antonio P. *et al.*, 2015) while experimental applications of Smart Agriculture have been launched for some years.

In the last decade, the regional agri-food system has been characterized by multi-company and bottom-up experiences that have led to the adoption of "territorial" and "regional" production chain models and process, product and organizational innovative developments. The phase of identifying the needs of the Lucan agri-food, agroforestry and rural world was accompanied by a simultaneous listening phase by the world of public research which identified possible innovative solutions for every production sector and made them available to a broad partnership. In the context of the European Innovation Partnership (EIP), several innovations have digital characteristics, so their experimentation / adoption is giving rise

to new professional skills in the Lucanian agri-food and forestry sector in production, sales and, more generally, in the interface with all possible stakeholders.

This work analyses the digital innovations introduced by the Operational Groups (OGs) of the Lucanian EIPs, classifying them by type, by production sector to which they belong and by type of partnership. The analysis of the eleven Lucanian OGs was conducted on desk and through some interviews to partners who have applied digital innovation.

2. Materials and Methods

The rural development policies identified in the 2007-2013 and 2014-2020 community programs, and specifically in the Rural Development Program (RDP), have allowed the Lucan farmers to make important changes and innovations through specific measures. More precisely, the part of Lucanian agricultural entrepreneurs most interested in innovation has intensified relations with the local scientific world, consulting and training.

Eleven Operational Groups (OGs) of the EIP-AGRI, incubators and precursors of digital innovations (Carta & Bonfiglio, 2020), have expressed their interest in Measure 16 (Cooperation), sub-measure 16.1 (Support for the establishment and management of Operational Groups of EIP), to contribute to the growth and development of the Lucanian agri-food and forestry sectors.

The OGs, born from the voluntary aggregation between public and private actors, have a common goal: to increase productivity through already mature innovations that involve a more rational use of production inputs and, consequently, to increase the sustainability of production processes from the technician, economic and environmental points of view.

Collaborative relationship between both public and private actors play a crucial role in the development of agro-food supply chains and of the rural areas and are subject to scientific in depth analysis, also a multi-disciplinary level (Briamonte *et al.*, 2019).

In the period September 2019-July 2020, the authors analysed the eleven OGs in relation to the partnership (number of actors involved and type), the links with one or more Focus Areas of the Basilicata RDP, the problem faced and the innovation adopted. The EIP projects were then reclassified based on the digital innovation adopted, optimal for the development of the sector to which they belong. Specifically, it was verified which OGs had envisaged the use of smart agricultural techniques (precision and conservative ones) and, subsequently, which type of digital innovation they had adopted among cloud computing, data collection and querying systems, decision support

systems, sensors, robotics, software, data analysis, e-commerce, more. The authors also considered appropriate to have telephone interviews with the scientific managers of the projects and/or with the representatives of the main partners responsible for innovation, in order to understand the evolution of project activities, changed in the timing of implementation due to the Covid pandemic.

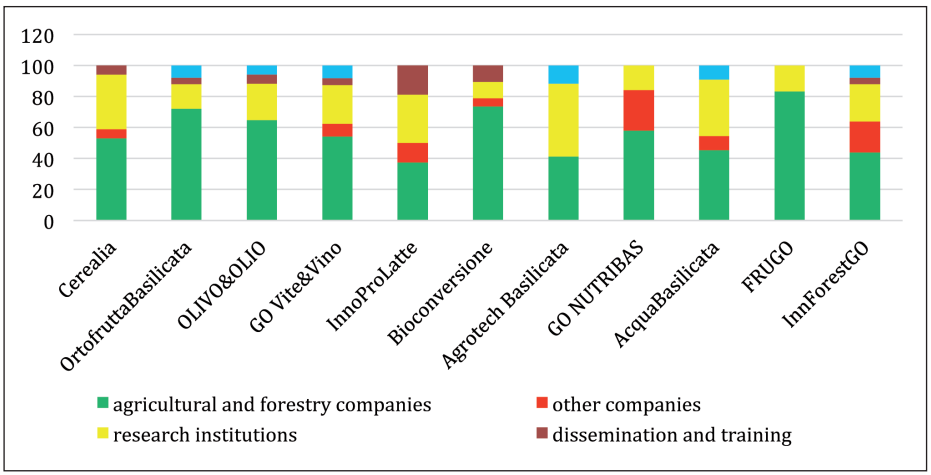
Finally, the Authors verified whether and how many OGs had applied for funding the digital innovation by means pilot projects (sub-measure 16.2 Support for pilot projects and the development of new products, practices, processes and technologies, PSR Basilicata) to have a more complete vision of the transformation underway.

3. Results and discussion

The eleven Lucanian OGs are organized by production chain and smaller supply chains, responding to the logic of the integrated strategy adopted by the Basilicata RDP and, therefore, combining competitiveness, environmental sustainability and rural development measures already adopted, among other things, also in the 2007-2013 programming (D'Oronzio & Pascarelli, 2018; D'Oronzio & Costantini, 2021).

Each OG is different from the others in terms of number and type of Partner; due to own characteristics of the EIPS, each Lucanian partnership includes research bodies, services for dissemination and agricultural, agri-food and forestry entrepreneurship (Figure 1). In detail, the research bodies are the University of Basilicata; the Council for Agricultural Research and Analysis of the Agricultural Economy (Research Centre for Livestock and Aquaculture in Bella, PZ); the National Research Council (Institute of Methodologies for Environmental Analysis) and the Lucanian Company for Development and Innovation in Agriculture (ALSIA). The University of Basilicata, represented in the different OGs by School of Agriculture, Forests, Food and Environment; Department of Sciences; Department of European and Mediterranean Cultures and the School of Engineering, is present in all partnerships and it plays the role of leader in four of them. ALSIA is present in eight OGSs and its role is to transfer innovations while it is research body in the OG AgrotechBasilicata, operating on the Precision farming, thanks to the recent incorporation of the regional research centre Metapontum Agrobios.

Figure 1 - Composition of Lucanian EIP partnership



Source: Our processing of Basilicata region monitoring data

The presence of these research bodies in the Lucanian EIP projects is the result of the work of the regional research table set up by the establishment of the Lucan bioeconomy cluster (D'Oronzio *et al*., 2000).

Agricultural and forestry entrepreneurship, on the other hand, is represented by single or associated farms (cooperatives, consortia, producer organizations), as well as wineries and oil mills and this is a very important particularity since the numerousness enriches the "transmission of knowledge" and promotes the potential for disseminating innovation to a greater number of users. In fact, the innovative agricultural, agri-food and forestry companies of the EIP play a crucial role both in ensuring the introduction of radical changes in the production practices and indicating most sustainable new trajectories, generating a domino effect on the territory.

Six partnerships have the consultant (spin-off, professional associations, professional people) in the partnership team and in seven OGs there are other companies, as a high school agricultural institute, municipalities, a company for the development of the milk supply chain, agri-food processing companies, a local authority for observation on hydrogeological risks and others. In six OGs, there are also numerous non-beneficiary actors, represented by agricultural and forestry companies or Lucanian municipalities, as in OG InnForestGO.

Already from a first analysis, it emerges that the OGs have launched an innovative ferment in the primary sector of Basilicata which aims to bridge

the gap between those who use new technologies and those who still do not do so for technical, economic or social reasons. In particular, many OGs have foreseen the use and the diffusion of digital technology, among the possible innovative solutions that have been identified by production sector, included the forestry one which in Basilicata had not yet experimented with participatory innovation (Costantini *et al.*, 2018).

About 82% of the total OGs, that is nine OGs, are identified as digital OGs because they adopt digital tools in their activities to support implementation of the project; they are Cerealia, OrtofruttaBasilicata, Olivo & Olio, Vite & Vino, AgrotechBasilicata, Nutribas, AcquaBasilicata, FRUGO, Innovation and Management of Lucanian Forests (Table 1).

Table 1 - Main innovative tool used by "digital" OGs

Production sector	OG	Innovative tool					
		Cloud compunting	Remote sensing and GIS	SSD	Sensors	Robotic	Satellites
Cereal farming	Cerealia		X	X	X	X	
Horticulture	OrtofruttaBasilicata		X	X	X		
Olive growing	OLIVO&OLIO		X	X	X	X	
Viticulture	Vite&Vino	X	X	X	X		X
Dairy animal husbandry	InnoProLatte						
Meat husbandry	BIOCONVERSIONE				X		
Transversal project on Precision Farming	Agrotech Basilicata		X	X	X	X	X
Transversal project on Healthiness of food products	Nutribas		X	X			
Transversal project on Water in agriculture	AcquaBasilicata		X	X	X	X	
Minor chain: Cultivation of hazelnuts	frugo		X		X		
Forest	Innovazione e gestione delle foreste lucane	X	X				

Source: Our processing of EIP data

By analysing relating to digital innovations, it is clear that seven OGs (Cerealia, OrtofruttaBasilicata, Olivo & Olio, Vite & Vino, AgrotechBasilicata, Nutribas and AcquaBasilicata) share and disseminate the PF by means of different technological innovations able of interacting with each other them, but all aimed at rationalizing and optimizing the use of productive inputs, renewable and otherwise.

These OGs spread the usefulness of sensors, from the simplest ones for measuring soil water content in order to limit its waste, irrigating improperly (AcquaBasilicata) to more complex sensors for the control and monitoring of the soil-plant-atmosphere system (OrtofruttaBasilicata and AcquaBasilicata) up to digital ones mounted on tractors (Cerealia, OrtofruttaBasilicata, Olivo & Olio, Vite & Vino, AgrotechBasilicata and AcquaBasilicata) able to read the data detected and transmitted via satellite remote sensing or drone flight.

Digital sensors are closely linked to the use of "DSS" which in turn are strongly supported by OGs Cerealia, OrtofruttaBasilicata, Vite & Vino, AgrotechBasilicata and AcquaBasilicata as they are able to support farmers in strategic decisions and/or to find solutions to problems that they are not able to solve with operational research models. DDS are dedicated software able to operate actuators to satisfy the different needs of plant species and to control and monitor the various cultivation activities, from soil preparation to localised manuring (Cerealia, Olivo & Olio), from sowing to fertilization and irrigation (Cerealia, OrtofruttaBasilicata, Olivo & Olio, Vite & Vino, AgrotechBasilicata), from defence of plants to the need to cover them (OrtofruttaBasilicata), from the reduction of pesticides (NUTRIBAS) to the harvest of fruit (OrtofruttaBasilicata, Vite & Vino).

The OGs Vite & Vino and FRUGO highlighted the usefulness of GIS applications in the creation of thematic maps that allow to evaluate the natural vocation of some territories in order to influence the choices of young farmers, inducing them to invest in specific sectors, such as viticulture and hazelnut cultivation.

Another GIS Application has been taken into consideration to realize a Dedicated Geo-Databases and an interactive Web-GIS portal, consultable and updatable daily, by project partners and other users, with project data and meteorological and agricultural ones observed in the field, georeferenced and collected through specific applications for smartphones and Tablet. This application was conceived by the OG Vite & Vino.

The OG of the Forestry chain has implemented a Knowledge-Based System (KBS) platform where researchers, entrepreneurs, technicians or other people, however previously qualified operators, can enter technical-scientific information, research results, personal work experiences and so on. It can

be consulted thanks to its database and it is an interactive system capable of responding when a user asks something about the forestry chain.

Unfortunately, the introduction of digital technologies in the Lucanian agriculture have not yet given results entirely positive: some methodologies, such as drone flights for PF, are not always economically advantageous and sustainable for small agricultural farms while they are more effective at territorial level (Cerealia, Olivo & Olio).

In the case of the KSB (InnForestGO) platform, it seems that no significant number of registrations have yet been made by possible users who could interrogate it to solve own problems. In this regard, it is important not to forget that many farmers over 60 are unable to use computer; moreover, they have poor knowledge both on last technologies and foreign languages (especially English) so they have many difficulties to manage digital tools and operate with them.

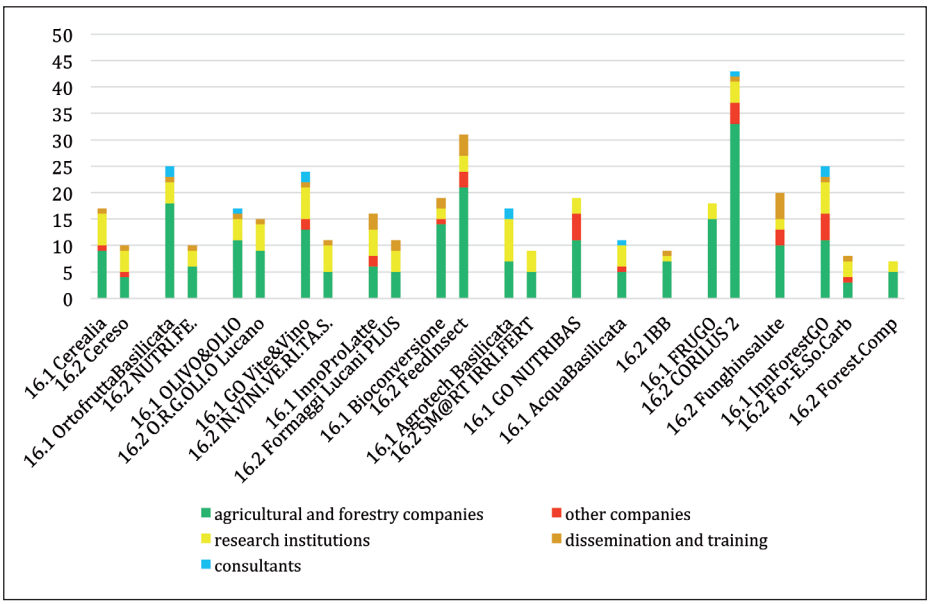
Finally, it must not be neglected that the high-performance network (narrow band) does not cover the entire Basilicata region while broadband is almost absent in rural areas while many digital tools need of them.

From the analysis of the 12 partnerships financed by sub-measure 16.2 it emerges that nine of them can be considered the natural continuation of the work started by the OGs; however, there is a numerical reduction of "agricultural and forestry companies" (Figure 2) probably due to the fact that the projects financed by sub-measure 16.2 mainly activate experimentation actions. In detail, the reduction of the farms has been more consistent in the partnerships of 4 projects (Cereso, NutriFe, IN.VINI.VE.RI.TA.S., For-E. So.Carb), less marked in the partnerships relating to the projects of the olive growing and dairy farming sectors, as well as that headed by ALSIA, the main promoter of digital diffusion. Contrary to the trend, the number of farms is significantly increased in the FeedInsect and Corilus2 projects, respectively of the livestock sector and minor chain, this last both for numbers of partners and typology of the same. Moreover, Corilus2 is the only one that provides for the figure of the consultant.

In the digital field, there is the continuous and strengthened use of all the technology/instrumentation connected above all to a more advanced and widespread precision farming. In particular, the project presented by ALSIA (SM@RT IRRI.FERT) envisages the experimental development of a flexible pilot platform of smart farming for the management of agricultural irrigation and ferti-irrigation practices.

The digital technologies considered in sub-measures 16.1 and 16.2 have been applied in process and product innovations but none have concerned e-commerce.

Figure 2 - Comparison between the partnerships of projects 16.1 and 16.2



Source: Our processing of EIP data

A note must also be made on the dissemination and transfer of results as well as communication activities that have suffered delays and changes in the period under review, due to the Covid-19 pandemic which hindered the normal continuation of activities in Basilicata as in the rest of Europe. For this reason, the OGs have resorted to webinars, streaming, video recordings on multimedia platforms or social networks, such as Facebook and Youtube. Only in a few cases it was possible to carry out the demonstration in the field, for the presence of specialized equipment.

Covid induced everybody to work in a different way, remotely through computers, smartphones and tablets; so, it is very likely that people, until they are completely certain will prefer this work option.

In summary, the precision agriculture of the AgrotechBasilica OG is the expression of digitized production, through satellites, drones, proximity sensors, etc. The remaining OGs can be classified as digital as they present robotic-automation digitization processes regarding information collection systems, software and data analysis.

Conclusion

The innovation of the supply chains fully answers needs of territorial production specializations and their excellences, adopting more advanced agricultural techniques, more responsive and immediate to the logic of the market and to EU policies oriented towards sustainability. One of the most recent innovations concerns the introduction of 4.0 technologies into the primary sector in general; they are changing agricultural production processes and with them the agri-food chains, fundamental for Made in Italy and especially for the economy of some Italian regions such as Basilicata with its productions linked to the territory.

The widespread use of digital technology will positively influence the Lucanian supply chains as it will allow:

- better working conditions;
- greater environmental sustainability;
- economic and social growth thanks to inclusion of new knowledge and professional figures, start-ups and so on.

The establishment of the EIP in Basilicata, stimulated the implementation of a new knowledge transfer model based on collaborative approaches and on the co-development of innovation. The EIP offered the opportunity for partners to transfer innovations and improve their skills; therefore, Lucanian OGs used innovative technologies that affect the environment, reducing the use of non-renewable resources, as soil and water, and pesticides; they define the certification schemes, implementing techniques for monitoring and defence against hydrogeological risk or erosion of the soil. The most common innovative devices introduced in Lucanian farms are sensors, drones for remote sensing useful for the production of digital mapping systems of wooded or cultivated (olive groves, vineyards, fruit and vegetables and so on) areas, Decision Support Systems aimed at a better management of fields and production processes in order to eliminate all possible factors that determine yield drops and consequent damage to the economic management of the farm.

The spread of open, interactive and dedicated platforms to be used for the dissemination, information, training and transfer of knowledge is very interesting and useful for the cultural growth of Lucanian agriculture, or better, both of the entrepreneurs directly involved as partners and the others who have indirectly joined. Through information events that are being carried out digitally, it is possible to reach a greater target of beneficiaries; this requires careful communication and awareness of dialogue only with companies that are attentive and ready to respond to new methods thanks to their specific skills. In fact, some Lucanian farmers are making considerable efforts to have more knowledge and skills on digital technologies because they have understood that these can help them find solutions that best suit

their needs and that by using them to the best they can obtain greater benefits.

The OGs that have experimented with digital innovations represent incubators where it is possible to continue the experiments that must also include tools for the development of food 4.0 that are absent today.

Unfortunately, not all farmers are ready to start digital innovation processes due to economic and cultural shortcomings and not all rural areas offer equal opportunities for the necessary digital coverage. To relaunch the Lucanian agri-food industry, therefore, greater support is needed from the Regional Authority with particular attention to both the promotion of the training, to increase the knowledge, and the provision of funding, to spread the digital technologies.

Currently, the Authors consider the development of the Lucan EIPs on digital innovation to be inadequate and not exhaustive, since their implementation has slowed down due to Covid. For this reason, the study foresees a second phase, ongoing to implement the results. The authors will monitor some aspects, which they consider fundamental:

- partnership still operational;
- degree of innovative application achieved in the farm;
- difficulties (if) encountered in applying the innovation;
- impact of innovation on production and sustainability;
- degree of satisfaction of the farmer with respect to innovation;
- willingness and interest of the farmer to continue the innovative activity even at the end of the project.

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Food security and land use: The Ethiopian case

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Abstract

From the financial crisis of 2008, international investors have addressed their attention to new investment and expansion opportunities and have acquired millions of hectares of land in various parts of the world. Developing Countries are the main target for such Large-Scale Land Acquisition (LSLA). While the adverse effects of these land grab are well known, their implications on food security have been less studied. In the context of an increasing disequilibrium between local food needs and international investors goals, the examining the potential adverse effects of LSLA on food security become an increasingly pressing matter. The paper illustrates an in-depth analysis on the impacts of LSLA on food security in Ethiopia. The results indicate that if the entire area of the acquired land is assumed to be used for domestic food production, it could feed around 7.1 million people.

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Introduction

In the past decade, the number of transnational land deals has put the phrase land grab on the headlines of international news. Some scholar even speaks of a new scramble for Africa (Onoja & Achike, 2015). This expression rings a bell that most people associate with images of international investors forcefully taking land away from a poor rural community, linked to neo-colonialism and violation of human rights. Officially, however, the phenomenon is called agricultural investment (World Bank, 2010). This term refers to Large-Scale Land Acquisition (LSLA) by private or public, national, or international, investors and agribusinesses that buy farmland or lease it on a long-term basis to produce agricultural commodities. Such acquisitions are praised to yield sustainable and equitable benefits for both parties. Both interpretations and titles do not do complete justice to the phenomenon, which remains a heavily discussed and complex topic. Land grabbing or investment in the 21st century occurs in a variety of ways and can be interpreted from multiple perspectives. In particular, land grabbing is not just a North-South dynamic but also takes place in a South-South context and sub-national context large scale land transfer being a tool to promote wealth redistribution across regional and ethnic lines within a country. Furthermore, the impulse for a land grab does not always come from the acquiring party. Although the dominant narrative is that of investors targeting weak countries where buyers exploit corrupt or indebted governments, destination countries may explicitly seek to attract investments.

Land grab as a transnational phenomenon has raised several pressing legal, economical, political, and philosophical questions.

The transnational phenomenon of land grab or investment can thus be studied to a variety of issues such as climate change, demographics, or global financial markets.

This paper aims to illustrate a small component of this diverse and complex phenomenon, setting aside some of the larger underlying questions.

In particular, the paper examines the impacts of LSLA on local food and water security.

While wage work in large-scale agriculture is not always impoverishing, there are without doubt also effects of LSLA on the food and water security of the local population. There is a vast literature showing that LSLA can complicate food and water insecurity. It is well understood that LSLA is not only an acquisition of land by foreign investors but also an appropriation of domestic food and freshwater resources (Rulli & D'Odorico, 2014; Johansson *et al.,* 2016). While this linkage has already been addressed by the current literature and associated effects have been thoroughly analysed in theory (Behnassi *et al*. 2011), the magnitude of this adverse correlation remains

largely unknown and unclear on the country-level. The effects of foreign land acquisitions on local food and water security are poorly quantified.

This paper investigates the topic using a quantitative assessment in Ethiopia. We focus on Ethiopia as an example of global hotspots for LSLA which is furthermore both highly affected by severe food risks and water shortage. Also, in this country already limited land available for African farmers is diminishing in the face of lingering hunger and poverty.

The paper investigates the appropriation of domestic food and freshwater resources through LSLA. More precisely, we quantified the blue water consumption of biofuel production from foreign land deals in the country; further estimated the potential amount of food that could be produced on the acquired land; and finally derived the number of people that could be nourished by it. Naturally, food insecurity can never be attributed univocally to one variable and the paper does not intend to establish any causal relationships. Also, hunger and the number of people suffering from it are difficult to measure. Nevertheless, this paper highlights the worrisome potential consequences of weak land policies for the target country. The quantification is a hypothetical one, where we attempt to calculate the potential burden of LSLA on local food security.

The paper is structured as follows. In chapter 1 we will provide a literature review including the analysis of the most relevant references of LSLA; we will also highlight the controversial definitions of land grabbing and the main channels through which LSLA affects food security. In the following chapters, we will analyse the effect of land grabbing on the food security situation of Ethiopia. Using data from the Land Matrix Database and referring to the literature and analytical report we will then conduct a quantitative assessment where we estimate the potential food and water appropriation of LSLA in Ethiopia. The paper will also consider an overview of the challenges for governance mechanisms that are arising and the response that have been drafted [proposed?] so far. The analysis is focused on the effect of LSLA on food and water availability without considering other dimensions of food security such as food access, food utility, and food stability. The analysis assumes also that farmland acquired by foreign investors is fully cultivated with the crops indicated by the Land Matrix data, neglecting the fact that some parts have not been put under production or might be temporarily uncultivated.

The motivation for the paper is to help clarify the effects of LSLA on food security; we also provide policy implications.

The novelty of the contribution is the quantitative assessment of the implications of LSLA on local food and water security by analysing the situation in Ethiopia.

The use of quantitative data is important to understand the magnitude of this correlation and could have a positive influence on the definition of the

substantially qualitative and controversial assessments that have emerged from the literature review.

1. Literature Review

The theme of land grabbing or LSLA has been addressed by numerous researchers over time.

This issue is particularly sensitive in the countries of the African continent.

Available pieces of evidence have shown that there is a global rush for LSLA and the demand for Africa's land has increased over time (Kareem, 2018).

A general definition of land grabbing is the purchase or long-term lease of vast tracts of land from mostly poor, developing countries by wealthier, food-secure nations as well as private entities to produce agricultural commodities for export (Shepard & Mittal, 2009). This definition serves as a starting point and can provide a first theoretical classification of the phenomena.

Despite this, the most cited definition is that used by Borras (Borras *et al.*, 2012).

Borras describes contemporary land grabbing as achieving control on relatively vast tracts of land and other natural resources through a variety of mechanisms and forms. This normally involves large-scale capital that often shifts resource use orientation into extractive character, whether for international or domestic purposes, as capital's response to the convergence of food, energy and financial crises, climate change mitigation imperatives, and demands for resources from newer hubs of global capital.

However, these definitions do not reflect all aspects of LSLA. Defining land grabbing involves a variety of elements such as land ownership, land acquisition, and land use.

Land ownership can be summarized under the following three categories: private land ownership; communal land ownership; state land ownership (FAO, 2002).

The legal land ownership regime of the country determines the ways of transferring land. For land grabbing, the land ownership system is particularly relevant, since it determines who has the right to sell or lease the land to the investor party. If the government is transferring or redistributing land ownership, this may happen via a unilateral legal provision by the authorities. Lease or concessions are common in countries where land is owned by the state as in Ethiopia.

LSLA are typically contractual agreements between two parties that define the terms of an investment project and the way risks, costs, and benefits are distributed (Cotula, 2011).

The parties involved in the contract and the exact terms of the land acquisition can have different repercussions for agriculture and food security in recipient countries.

Concepts of food security have evolved in the last thirty years to reflect changes in official policy thinking. The term first originated in the mid-1970s when the World Food Conference (1974) defined food security in terms of food supply – assuring the availability and price stability of basic foodstuffs at the international and national level.

The widely accepted World Food Summit of 1996 definition affirms that food security exists when all people, always have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

The issue of the effects of LSLA on food security has become the subject of numerous media reports since the global food crisis worsened in 2008 and this has led to the rise of many scientific studies concerning this subject (Shepard & Mittal, 2009; Borras *et al*., 2011; Santangelo, 2018; Petrescu *et al*., 2019).

Despite this today almost a billion people across the world experience the effects of food insecurity and about 850 million people are undernourished. According to demographic forecasts of International Organisations, in 2025 the Earth will be inhabited by 7.4 billion people, and in 2050 9.1 billion people. This makes food security a global issue to be solved.

The importance of the topic is underlined by the fact that one of the biggest challenges that governments and people must face to achieve food security includes land use and land availability for agricultural production.

The seriousness of the matter is clear when we consider that the average amount of cropland per capita in 1970 was 0.4 hectares and by 2010 this had decreased to 0.2 hectares (FAOSTAT, 2013).

Essential to the end of this question are the theses carried out by different and authoritative authors.

Several scholars have described the negative consequences of LSLA in general terms.

The societal and environmental implications resulting from the adoption of LSLA raise sustainability concerns. The phenomenon of land grabbing entails a shift from traditional, local, small-scale systems of production to large, intensive, commercially oriented agricultural models (Dell'Angelo *et al*., 2017).

The LSLA phenomenon leads to an abrupt change in land use and this transition leads to rapid environmental transformations (Lazarus, 2014).

Farmlands are being stripped from their long-time owners by large corporations, destroying cultural ties, traditional agriculture, and ancestral grounds along the way (Bisbing, 2015).

LSLA provokes different manifestations of inequality: unequal distribution of environmental risks and economic benefits, structural inequalities of access to resources (including food) and control over their allocation and use, and knowledge asymmetries that translate into a variety of unequal power relations (Dietz, 2014).

In addition to this Giovinetti & Ticci (2016) affirmed that biofuel development in Sub Saharian countries through LSLA is driven by factors that have little to do with the interests of local populations.

De Schutter (2009) elaborates a set of principles and measures to deal with the issue of human rights in the land acquisition context including the right to adequate food, the rights of land users (specifically of indigenous peoples, and farm workers).

FAO (2012), states that a lack of respect for the rights of the poor contributes to tenure insecurity, which in turn can hamper human development, more people in poverty, and contribute to food insecurity.

Oxfam (2016) put evidence on the fact that countries where hunger and food scarcity is an issue, producing food for countries where is not.

Climate change could amplify food insecurity risks mainly through intensified extreme weather events and shifting rainfall patterns (Pidcock *et al*., 2017). In a changing climate, precipitation becomes less regular and therefore less predictable (Good *et al*., 2016). In regions where the majority of local farmers rely on rain-fed agriculture, domestic food production is highly sensitive towards these climatic changes with associated risks for local food availability. In East Africa, climate shocks are already the main driver of food insecurity (FAO, 2017). This in turn can increasingly force food-insecure countries to acquire productive farmland abroad. At the same time, climate change has raised the interest in the cultivation and production of biofuels. Increased land demand may have been triggered by the implementation of the Kyoto Protocol's Clean Development Mechanisms, which give countries credit in their carbon accounts if they invest in reforestation in other countries, as a report by the IHDP/GLP assesses (Friis & Reenberg, 2010).

The authors (Rulli & D'Odorico, 2014, Deininger *et al*., 2011) and Institutions (World Bank, 2010) that try to underline the positive effects of LSLA argue that this phenomenon is welcomed by the local governments and highlight the potential opportunities for the agricultural sector, in terms of labor demand, technology, and know-how import. Apart from the monetary payment of lease rental, there are several other reasons for countries to encourage LSLA in their territory. Most notably, agricultural investments may spur development by creating jobs and contributing to infrastructure installations. To benefit more from this, some LSLA contracts contain provisions that require at least part of the processing to be done locally. This can help the host country move up the value chain – from the low value-

added, primary sector towards the secondary sector (Cotula, 2011). The point of view of Deininger revolves around three key considerations.

The first one is that the large size of the parcels of land which may change ownership and their concentration in a limited number of countries with weak governance implies that there are significant risks for investors in terms of the guarantee of invested capital. The second one is that the Institutional challenges influence the interest of investors and this leads to increased opportunities.

The third consideration regards the impacts of LSLA considered as a global responsibility of the international institution.

Some scholars (Cotula *et al.*, 2009; Hallam, 2010) suggest that governments should work towards minimizing the negative consequences of foreign land deals with policies that would increase the potential benefits of LSLA and investments from foreign countries and companies.

The study of World Bank (2010) aimed to investigate how the growth in the acquisition of arable land could contribute to the fight against poverty and food insecurity.

The study addressed the theme using a neutral dialectic and acknowledges the risks (actual) and benefits (potential) resulting from acquisitions of large-scale land, claiming the need for more regulation through seven Principles called Responsible Agricultural Investments (PRAI).

2. Materials and methods

We draw the number and areas of LSLA contracts issued from the Land Matrix database. We accessed the database on December 2019, and included data for 2017, and queries on outright purchase; lease; concession; and exploitation permits.

Yield values for aggregated cereal crops, mean nutritive values of cereal crops, and consumption rates of plant and animal food come from FAOSTAT database. We then adopted the average dietary energy requirement estimated from Roser & Ritchie (2017). We built up on Johansson *et al.* (2016) for the country-specific blue water index for crops defining the share of blue water demand. We adopted the mean annual crop water requirement as in Brouwer & Heibloem (1986) and Garg *et al.* (2013). Finally, the minimum water requirement per person for healthy conditions is defined by Institute Water for Africa (2018).

Few caveats hold for our analysis.

In our simulation, we assume that only staple food (i.e. cereal crops) is cultivated; we recognize that this does not cover all nutritional requirements of a balanced diet.

We also assume that acquired farmland is fully employed on food production. We recognize that alternative use might exist, but for the sake of simplicity, we are not adopting in this analysis.

We assume that crop yields in the analyzed regions most likely differ from the country average values adopted. However, and in line with current literature (e.g. Rulli & D'Odorico, 2012) we think a simplified model is still informative.

We assume homogeneity of gender, age, and employment of population. In other words, we do not take into consideration the real demographic distribution of the country, when calculating the potential beneficiaries of the food production achieved by redistributed LSLA.

We assume linear correspondence between the amount of water employed in biofuel production and that potentially provided for human consumption. In other words, we do not assume any intermediate and/or alternative use for water. This, to associate LSLA and water appropriation.

Finally, the data employed are cross-section. This limits our capacity to detect changes over-time. However, we still consider as a valid prospect of the potential use of the acquired land. Nevertheless, it is important to mention that deals are normally signed for long-time periods, if not for several decades. This of course will translate into greater damage for future generations.

For measuring the impact of LSLA on local food production, we build on existing literature. Following Mueller *et al.* (2012) and Rulli & D'Odorico (2014) we multiply the land area by country-specific values of crop yields; we multiply the result by the corresponding caloric content of cereal crops; and finally we divide the result by the amount of vegetal calories required (on average) by a human being.

For measuring the impact of LSLA on local water, we largely build up on Breu *et al.* (2016). We assume that acquired land is employed in the biofuel production. We then estimate the water footprint, i.e. the volume of water consumed per unit of crop (Mekonnen & Hoekstra, 2011; Mekonnen *et al.*, 2012). We therefore converted water footprints from m^3/t to standardized water consumption per unit area (m^3/ha*year). These figures have been then multiplied with the number of LSLA contracts. Alternative methods exist (such as Bossio *et al.*, 2012; Williams *et al.*, 2012) which however address slightly different purposes.

3. The case study

In Ethiopia, the agricultural sector accounts for 37 percent of GDP, one of the highest shares in sub-Saharan Africa, as well as 83.9 percent of exports. Moreover, the sector employs around 72 percent of the total

population. About 74 percent of the countries' farmers are small family farmers (FAO, 2018).

Ethiopia is affected by chronic food insecurity with 28% of the population currently being undernourished (FAOSTAT, 2017).

All this even though Ethiopia is one of the countries with the largest amount of underutilized land of all the land available for cropland expansion in Sub-Saharan Africa (Chamberlin *et al.*, 2014).

Notwithstanding the considerations on availability of unutilized cultivable lands, findings show that land is already, especially in some regions, under the pressure of demands for several purposes (Teklemariama *et al.*, 2017).

At the same time according to FAO (2010), Ethiopia loses approximately one billion tons of topsoil annually, is faced with a high rate of nutrient loss in the soil, and 30,000 hectares are lost to water erosion each year.

Climate hazards have been the main driver of food insecurity in Ethiopia during recent years (FAO, 2017). Since 2015, the country has been hit by a series of severe droughts, which caused heavy harvest failures and water shortages. Local farmers experienced crop losses of between 50 and 90 percent due to the El Nino drought in 2015/16, leaving 10.2 million people in need of emergency food and nutrition aid (World Food Programme, 2016). Such extreme conditions are projected to become more frequent and more intense in the future (Pidcock *et al.*, 2017), posing a growing pressure on domestic food supply in vulnerable regions as Ethiopia. Persistent dryness has significantly undermined food security and threatened the livelihood of numerous households (FAO, 2017). As of 2017, about 18 million people (17%) were food-insecure of which 8 million are in urgent need of immediate emergency food and water aid (FAO, 2017). Large parts of the country are arid regions where water is a scarce resource. Today, only 57% of the population has access to improved water sources (FAOSTAT, 2017). The long-lasting drought conditions over the past years have caused a regional water crisis throughout the entire Horn of Africa.

In parallel with this Ethiopia is among the top ten target countries of LSLA globally (Land Matrix, 2016). The actual amount of land deals remains unclear, as primary, and secondary data on land acquisitions in Ethiopia is scarce. This is why we here refer to the number of land deals that have been registered by the Land Matrix Global Observatory (Land Matrix, 2017). By 2017, the Land Matrix database has documented 67 international concluded land deals in Ethiopia. The agricultural land acquired by foreign investors (i.e. total contract size) covers an area of around 996,000 ha. (Hectares) which makes about 6.6% of the country's arable land (Land Matrix, 2017). Teklemariam *et al.* (2017) adopt a mixed method (qualitative and quantitative) to indicate that in 2005-2015, the government leased nearly 2·47 million ha of the country's approximate total 114 million ha area and offered 11·5 million

ha of cultivable land to domestic and transnational investors. The biggest investor countries in terms of contract size are Saudi Arabia, India, and the United Kingdom of Great Britain.

What makes the race to the Ethiopic land particularly attractive to these investors is the low cost. The annual rent of one hectare of land ranges approximately from 1 to 5 euros. Also, all contracts allow you to start paying after 3-6 years, allowing the accumulation and subsequent installment of the rent of the first 5 years. Another important benefit for the investors is the formulation of the price of contracts in Birr, the national currency, thus being able to benefit from the devaluation of the currency. Therefore the practice of negotiation of the terms and conditions of the contracts has been a point of acute criticisms in Ethiopia.

These contracts are largely unregulated by a transnational or supranational entity and little is known about the exact terms of agreements. Furthermore, while some land acquisition contracts are long and detailed, others are a mere three pages, with poorly specified investor obligations (FAO, 2018).

Contractual agreements are often not publicly available. Thus, there is a huge lack of transparency and no sensitivity towards the issue of food security – on the contrary, food security risk assessments are rarely applied before striking a deal.

More than half of the acquired land is intended to be used for non-food crop production of which biofuels take the biggest share (36%) while only 39% of the land area is to be used for food production (Land Matrix, 2017).

Concerning land ownership according to Article 40 of the Ethiopian Constitution"… The right to ownership of rural land and urban land, as well as all-natural resources, is exclusively vested in the state and the people of Ethiopia. The land is a common property of the Nation, Nationalities, and Peoples of Ethiopia and shall not be subject to sale or other means of transfer…" (Vhughen *et al.*, 2013). The Constitution further declares the right for private investments in land and the state's right to expropriate private property for public use in exchange of "adequate compensation" (Rural & Administration Proclamation, 1997; Behailu, 2016). Since 2014, the federal organ Agricultural Investment Land Administration Agency is responsible for all land deals in the country through the effective identification of the plot takes place at the regional and *woreda* level (Vhughen & Gebru, 2013; Fana Gebresenbet, 2016). It is being criticized that decision-making processes of international land acquisitions are often lacking transparency and adequate compensation especially for pastoral communities that are not recognized by the formal law (Vhughen *et al.*, 2013). Another related concern is the fact that the Ethiopian government has exempted investors from paying any export- or other taxes on commodities intended for export (OI, 2011).

4. Results and discussion

If the entire acquired land was cropped with domestic food (i.e. staple crop), and under the assumption that a balanced diet in the East African region requires, on average, a daily nutritional energy intake of around 2,200 kcal per capita, this would have fed 7.1 million people in Ethiopia (Table 1).

Table 1 - Ethiopian nutritional potential of food production in acquired land

		Mean energy content of cereal (Kcal /kg)	Total energy content of potential annual cereal production in acquired land (Kcal)	Total amount of vegetal calories for balanced diet (Kcal/ per capita/ per year)	People that could be fed by potential food production in acquired land (capita)
Total Area of Acquired Land (Ha)	995.709				
Mean yield of cereals (kg/Ha)	2484				
Potential cereal production (kg)	2.473.341.156	3290	8.137.292.400.000	1.140.260	7.136.348

Source: Our elaboration on FAOSTAT data base, 2018.

This number raises concern regarding the fact that most of this agricultural output from acquired farmland is being exported and therefore remains not available for the local population. This is confirmed from the literature when it is affirmed that the main concern regarding LSLA is the fact that most transnational land deals are highly following export-oriented agriculture. Whether it is for commercial purposes or for securing the food supply in investor countries, food commodities produced in the acquired land are typically exported abroad, even if target countries exhibit high levels of malnourishment (Rulli & D'Odorico, 2014). Due to the prioritization of export profits and foreign interests in foreign land deals, local communities in Ethiopia do not benefit from the food production on the acquired land. Instead, LSLA can even have negative impacts on domestic food availability. The underlying problem is often associated to a lack of adequate export regulations in transnational land deals (Alemu, 2011). On the contrary, many land acquisition contracts even offer incentives to foreign investors to export their products.

These considerations confirm that LSLA normally does not contribute to local food security – instead, they can have negative impacts on local food

and water supply in target countries through the large-scale appropriation of domestic fresh water and food resources by foreign investors.

Also, it is confirmed that in regions as Ethiopia with unstable food and water systems, LSLA poses an enhanced pressure on the domestic food and fresh water supply, especially when adequate land policies are missing (IFPRI, 2012).

A second concern regarding the effects of LSLA on food security is the fact that the main objective of LSLA in Ethiopia is the cultivation of non-food crops while food production is only a secondary intention.

As mentioned before foreign land deals have caused a large-scale shift of agricultural production from food crops to non-food commodities.

The fact that most of the land is not destined for food crops shows that the potential availability of food previously indicated to ensure the food security of 7.1 million people does not, however, correspond to the real one given the cultivation investments made.

This is why there are no formal or informal obligations on the part of investment projects to contribute to the food security needs of the country (Rahmato, 2011).

Ethiopia is both a food-insecure country and net food importers, making agricultural land a vital food resource. If used for domestic food production instead of foreign cash crop production and food exports, these land areas could make a significant contribution to local food availability.

Concerning water, the analysis has investigated the freshwater appropriation considering blue water demand of biofuel crops cultivated in acquired land. Bluewater refers to surface and groundwater used for irrigation which is extracted from renewable and non-renewable sources such as rivers, dams, aquifers, and lakes (Johansson *et al.*, 2016). Biofuel production is one of the main drivers of LSLA and captures an important share of the acquired land area in the country. While it requires a considerable amount of local freshwater input, it does not contribute to local food security and is mostly fully intended for export – with an associated transfer of virtual water.

The obtained results have demonstrated that the blue water demand of annual biofuel production from land acquired by foreign investors is 1.8 billion m 3 in Ethiopia. This equals the annual water requirement for healthy conditions of around 97 million people in Ethiopia. Such a significant amount of water exhibits potential risks of increased competition over freshwater use in the target country. The results confirm (Breu *et al.*, 2016) that Ethiopia is affected by a significant increase in water consumption intensity through LSLA, posing enhanced pressure on the local water balance. It is also important to add that freshwater access must be considered as a possible driver of land acquisitions, also referred to as "water grabbing" through virtual water trade (Mehta *et al.*, 2012; Land Matrix, 2016). This is why freshwater access and use rights are insufficiently addressed in foreign land investment contracts

or when investors did have to apply for water rights or adhere to extraction limits, at the project approval stage, there was no subsequent monitoring of adherence to the agreements made (Mbengue & Waltman, 2015).

5. Policy implications

Having examined the potential adverse effects of LSLA on local food and water security, it is important to examine how the international community is (re)acting in the light of this development.

Scholars have acknowledged that land grabbing is an important and urgent topic for global governance; NGOs and civil society have been fighting for more stringent international regulations on the issue. Global alliances such as the International Land Coalition push for secure access to land, and thus for the availability of water and food resources for the local population. However, transnational initiatives are still young and often remain informal. In fact, throughout the 1990s, the land question was kept out of formal international governance institutions and practices (Margulis *et al.*, 2012). Nevertheless, since the 2008 Global Financial Crisis and the rush on land, the topic is increasingly appearing on the agenda of international organizations and institutions. Multilateral institutions are slowly emerging as key sites for addressing the major policy challenges of land grabbing. One important player is the Food and Agriculture Organization of the United Nations (FAO), which organized a conference on Agrarian Reforms and Rural Development for the first time in 2006. In 2012, as a result of intensive NGO lobbying during the negotiations within the Committee on World Food Security(CFS), the FAO-Voluntary Guidelines on the Governance of Tenure were presented (FAO, 2012). This is considered to be the first global standard addressing problems of land-grabbing within the overarching goal of achieving food security. The guidelines are intended to provide governments, investors, and civil society with rules on how to protect, document, and administer legitimate rights; how to organize a change of land ownership, and how to define public priorities and goals for land use. In particular, the FAO document insists on "meaningful prior consultations" of local communities before the conclusion of an LSLA agreement. Similarly, a report published by a civil society and academia alliance called "Dealing with Disclosure" made recommendations regarding the need for inclusion and transparency when LSLA deals are made (Global Witness *et al.*, 2012). The report welcomes initiatives such as the Roundtable on Sustainable Biofuels. The High-Level Panel of Experts on Food Security established in 2010 also recommended that states report annually to the CFS on the alignment of foreign investment with food security objectives. Overall, most transnational policy initiatives so

far acknowledge that to provide adequate protection of food security interests, measures must be implemented throughout the LSLA process.

This includes recognizing eexisting land and resource rights, setting up inclusive negotiation mechanisms, an effective monitoring system, and post-project transparency.

Apart from these concrete measures, both FAO and CFS are global policy institutions that have been much more open to exploring and incorporating food sovereignty as an alternative paradigm for global agricultural policy. Therefore, global civil society and transnational rural movements rely strongly on the FAO and the CFS to serve as a comprehensive arena for emergent global land governance on agricultural investment (Margulis *et al*., 2013).

At the same time, investor countries have enrolled the World Bank as their preferred arena for the creation and implementation of emergent global land governance. For them, the World Bank represents the leading authority in this new sphere of global land governance. While the World Bank does promote good practice standards for investing in developing or emerging markets and requires projects implemented through its funding to apply several safeguards, its official policy supports LSLA as a means of improving agricultural productivity and economic growth. The World Bank as well as major investor countries favour private standards and certification mechanisms to tackle the issue.

The World Bank also elaborated the Principles for Responsible Agricultural Investment (PRAI), which is essentially a corporate self-regulatory instrument. Non-state actors are powerful agents that can play an important role in governing transnational financial transactions and economic flows, often through self-regulation.

These principles were voluntary and have not been accompanied by policy proposals that could make them binding on the actors involved in the acquisition of land and to be so effective on a practical level in the regulation of this phenomenon by now widespread and full of shadows.

With the concept of Corporate Social Responsibility gaining momentum, this role may be further enhanced. However, Fortin and Richardson argue that these private schemes fall short of ensuring the necessary protection and guarantee of food security (2013).

Cotula (2011) also highlighted that although investors do regularly conduct feasibility studies, governments often lack the will or the capacity to properly assess such studies. Considering the central role of the host state in the land allocation process, state-led, multilateral regulations are indispensable.

Unfortunately, none of these transnational governance mechanisms are legally binding international treaties. With five years having passed since the Voluntary Guidelines were presented, monitoring, and reporting of the

phenomenon is still largely done by private initiatives, risk assessments are rare, and post-project transparency is also still lacking.

Furthermore, the issue of water highly relevant but particularly tricky for global policymakers. It is necessary to consider the specificities of water as a resource that is variable over time and moves across political boundaries (Breu *et al.*, 2016). So far, few of them directly addressed these challenges. A suggestion could be that in the contract, local authorities and/or the providing party could oblige investors to include water management strategies (such as crop rotation, or floodwater harvesting) in their endeavour – a response to the fact that technologies employed on the affected land often negatively impact the livelihood of people nearby, diminishing the availability of fresh water for the local population. This measure could be a promising step to limit off-site adverse effects.

The major challenge that remains is to find an appropriate, comprehensive governance mechanism for investments in agricultural land. These mechanisms must be able to deal with varied interests of local farmers, NGOs, multinationals, and government, as well as incorporate the specific characteristics of water issues.

In any case of primary importance for the fallout, it entails is the theme of land ownership. As we have seen the land ownership has important repercussions on the size of the LSLA phenomenon. State ownership favours the conclusion of LSLA contracts. From this point of view, it is desirable how much-developing countries have undertaken reform policies concerning this aspect. While state ownership was very common throughout the past decades, many governments have now updated their land legislation to clarify rights over land and natural resources.

For the future, it is desirable to strengthen these reform policies together with the activation of the LSLA process that is effectively in line with transnational food security policies.

The activation of these policies seems particularly urgent in countries such as Ethiopia where the negative effects produced by domestic legislation on land ownership and use are accompanied by increasing phenomena of food insecurity that have become a chronic critical issue. Policies for the redistribution of land would be the first step towards satisfying at least the pillar of availability within the framework of the food security policies pursued.

Finally, it should be emphasized that the choices of investors that we have seen to give priority to the production of biofuels are reflected in the incentive policies pursued at the international level starting from the EU (European Union).

This consideration indirectly confirms the role of EU member states in the International land-grabbing scenario (Carroccio *et al.*, 2016).

This points to the need for a change of course in incentive policies for the production of biofuels. In particular, international Institutions should take on initiatives to discourage or prohibit the production of biofuels in countries with food deficits such as Ethiopia.

Food security and poverty alleviation will be achieved if the land is firstly prioritized to people's needs and is then catered to biofuel industries (Sekoai & Yoro, 2016). A key element in countering the production of biofuels by investors may be the effective activation of the Ethiopic Growth and Transformation Plan, which, in addition to increasing the productivity of small farmers, involves promoting investment in medium and large commercial farms, to increase the production and availability of raw materials for food purposes.

Conclusions

The issue of land grabbing and agricultural investment remains polarising. In particular, the tension between those who view land grabbing as a clear violation of human rights and the environment, and those who see a large development potential continues to be unresolved. To find a solution where these two contrasting positions might be reconciled, a more evidence-based approach to specific challenges is necessary. We tried to provide a small insight into such a challenge, by quantifying the food and water potential of acquired land in Ethiopia. While the calculation is hypothetical, it attempts to exemplify the magnitude of the phenomenon. The large size of the areas involved, over which the population would have little agency if the food security situation worsens, represents a looming danger regarding the food and water security situation in the country. Or, expressed in less negative terms, there is a large potential to nourish the population and possibly diminish food insecurity – but this potential is negatively influenced due to LSLA. The results do not imply that 7.1million people in Ethiopia are suffering from food insecurity due to LSLA. As you know, food security depends on availability, accessibility, stability, and use of food. Therefore the achievement of food security in Ethiopia depends on a cross-sectoral approach which leads to satisfying all the four pillars of food security. At the same time, we could affirm that the main obstacle for food security which can be affected by LSLA is linked to the pillar of availability in terms of priority to solve.

The paper rather intends to emphasize with the calculation that if LSLA remains unregulated, up to 7.1 million in Ethiopia could be considered deprived of availability to food and water resources since the land is under control of a non-local/foreign entity. This is a potentially worrisome scenario, especially if we consider that climate change might exacerbate the situation

in the future. These developments call for international land and agricultural policies that specifically address the challenge of food and water security. National governments and global institutions need to tailor their strategies to incorporate food and water security implications on the various levels in which LSLA is conducted. Generally speaking, not every LSLA leads to an aggravation of food and water security situation in the host country, but only stringent regulations, applicable for both private and state actors, can make sure that the risks of food and water insecurity are properly assessed. This imposes the revision of the Ethiopian legislation through addressing the many challenges mentioned in this paper. Efforts to empower local communities to be part of the decision-making process with regards to the use of their land and natural resources are recommended to ensure results that are mutually beneficial both to investors and the local population.

At the same time, the Ethiopian agricultural policy must be effectively addressed promoting small farmers and breeders, with services, support, and credit activities aimed at the growth of this sector, which remains by far the first in several employees. This is also because the agricultural territorial context is made up almost entirely of small farmers whose common feature is tending to sell food crops only after meeting household food needs.

Therefore, through the reform of land ownership and the involvement of small farmers, it is considered possible to meet the needs of food security in terms of availability, at least as far as family farms are concerned. The reform of land ownership should also lead to a smaller expansion of the LSLA due to the reduced presence of the state as a landowner. The revision of contractual forms will, however, make it possible to reduce the potential negative influences of LSLA on food security quantified by this study.

The revision of the contracts should also involve a revision of the rents currently charged. The current rents could be taken as a benchmark in the case of renting land to small farmers as a result of land reform.

Furthermore, agricultural investments and land grabbing is not just an issue that concerns developing countries in the global South; the phenomena can increasingly be observed in Europe too. Transnational institutional arrangements that regulate global agricultural investments are thus borne to be part of our future. To achieve institutional arrangements that fulfil these requirements, more information is required. In the past decade, a lot has been already achieved. A prominent example is the Land Matrix a highly successful global initiative that aims at making the LSLA-phenomenon more transparent to the public. However, more evidence is necessary especially on the local scale, highlighting the need for further research and monitoring assessments. After all, it becomes clear that how we manage and interact with the land is increasingly important for the livelihood of the future generation.

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Consumer demand information as a re-balancing tool for power asymmetry between food retailers and suppliers

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Abstract

This conceptual paper presents a model that may be used to redress the power balance between retailers and suppliers in the supply chain through better information symmetry and mutual dependence. It explores power dependence and resource dependence theories to conceptualise the use of demand information, by drawing on the diverse viewpoints within the extant literature on the effect of supply chain power asymmetry on exchange relationships and mutual dependence. Co-optation adds stability and reduces uncertainty through the exchange of resources. The dynamic nature of relationships and power between retailers and suppliers requires a multi-theory approach to identify a robust understanding of the interplay of different influence factors. This study has both operational and strategic implications for the food supply chain, as power asymmetry in relationships affects sustainability, especially in sales promotions periods for both retailers and suppliers. Improving power equilibrium between the buyer and supplier through information symmetry with the integration of power and resource dependence theory is novel.

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Introduction

Power is the property of social relation and therefore lies in the dependency between actors. Assessment of this dependency reveals that these relationships are affected by control of valuable resources (Emerson, 1962). If the actors jointly share these resources, it will reduce the imbalance between the relationships. This will increase reciprocity in relations resulting in even distribution of rewards for all actors. However, there are different levels of dependencies thus requiring different balancing operations to stop relationships from becoming unstable in the long term (Pfeffer & Salancik, 1978).

Power asymmetry is a major subject in supply chain relationship management discourse (Yang *et al*., 2018; Wang *et al*., 2016; Hingley *et al*., 2015; Cox & Chicksand, 2005). However, there is a lack of research agreement as to why and how to redress such power imbalance and to what effect (see Naude & Buttle, 2000 and Svensson, 2001 for typical opposing views on the role of power in supply chain relationships), as some consider this asymmetry to be an inherent part of the business transaction; whereas others authors have treated this power asymmetry as opportunism by retailer. Consideration of the extant literature reveals two dominant schools of thoughts as to how rebalancing power asymmetry ought to be approached (see Tables 1 and 2 for examples of studies that follow one or the other positions for their respective enquiry).

One strand of the literature posits that power dependence is a major cause of instability in supply chain relationships and steps must be taken to redress the imbalance to the advantage of the weaker party (Yang *et al*., 2018; Maglaras *et al*., 2015; Nyaga *et al*., 2013). The alternative school of thought is that the presence of a powerful partner adds stability with resources, and a weaker partner should adjust to living with the pertaining arrangement (Hingley *et al*., 2015; Cox & Chicksand, 2005). Despite the considerable contributions made by the key proponents of these contrasting schools of thought, power asymmetry between suppliers and retailers (Hingley, 2005a; Hingley, 2005b; Belaya & Hanf, 2009) continues to impinge on the risk exposure and success of supply chain stakeholders within the food industry (Hingley, 2005a).

Resource dependence theory suggests that power is not a zero-sum game and dependencies should be managed in organizations to reduce uncertainty and to improve autonomy (Pfeffer & Salancik, 1978). One possible tactic can be to co-opt and look for alternatives. This includes agreeing to joint objectives of knowledge and resource sharing. This will reduce the transaction costs for the organizations and also decreases the propensity to be exploited by power actors. Whereas power dependence theory considers relations as part of power sharing and its imbalances affects resource access.

As retailers and suppliers relations and their access to the resources are an integral part of the food supply chain, hence these two theories plays an important part in explaining the interplay of these factors. Based on two important organizational behaviour theories (power dependence and resource dependence, the paper will investigate: 1) How the power of retailers (due to better access to the resource) affects relationship management with the supplier. 2) What set of conditions could prevail between suppliers and retailers so that the advantage gained by one partner is not at the expense of the other? 3) What set of tools or resources are available to suppliers (especially small food suppliers) to create mutual benefit (win-win situation) for both actors in the supply chain?

This paper contributes to the discourse around power and dependence by conceptualising the use of consumer information (shopper demand) as a critical set of tactics to be explored by food retailers and suppliers, especially small food supplier in the UK to redress power asymmetry with powerful retailers for mutual benefit. This context is important as food chains are more vulnerable to wastes (shorter product shelf lives) due to power asymmetry. The UK food industry is chosen for the focus/ exemplar of the paper, as it is (typically for mature developed economies) dominated by a small handful of big chain retailers, and these exercise considerable buying power over small food suppliers. Tesco is one such example, being the largest retailer in the UK it has access to a huge database of 1.4 million consumers (Malik *et al.*, 2019). It uses insights from this to plan and execute sales which are targeted and sustainable. If cooption will occur the small food suppliers will benefit from this knowledge and a better power equilibrium can be achieved.

This paper argues for a reconfiguration of supplier-retailer relationships that facilitates mutual utilization of resources that will not only improve the power balance for the weaker partner but also benefit the powerful partner by increasing its profit in that category, and reduce the waste (both in terms of value and volume) along the supply chain.

This position represents an integration of the tenets of organisational behaviour theories (power dependence and resource dependence theory). Specifically, these theories explain why and how power exercised by one partner (due to resources and size) in a relationship of mutual dependence can be countered by balancing operations by a weaker partner (Emerson, 1962). This re-balancing of power may be achieved by better utilisation of resources, through increasing investment and reducing costs (Davis & Cobb, 2010; Pfeffer & Salancik, 1978).

To address these research questions, the paper creates a conceptual framework by first reviews the literature on power and relationships with special emphasis on the retailer-supplier supply chain context. Thus,

highlighting gaps around the balance of power, access to resources and proposed strategies to counter it. This is followed by a conceptualization on how power asymmetry can be balanced for mutual benefits by drawing on consumer information (shopper demand) as a critical data set to enable suppliers to manage mutual dependence. Discussions and implications of the theoretical propositions and a developed model are made, and recommendations then presented.

1. Conceptual model

1.1. *Power and supply chain relationships*

The extant literature on relationships and power among suppliers and retailers depicts critical issues of interest to management researchers and practitioners of supply chain management and business research (Kähkönen, 2014; Wang *et al*., 2016; Maglaras *et al*., 2015). One stream contends that a supplier-retailer relationship is characterised with conflicts and opportunism where powerful retailers are using this relationship of mutual dependence to their advantage (Chung *et al*., 2011; Viitaharju & Lähdesmäki, 2012). They are believed to exploit these relationships by compelling suppliers to bear the costs of doing business with them, with attendant punitive actions such as delayed payments and unsold stock penalty costs (Caniëls & Gelderman, 2007; Croson & Donohue, 2006). It is worth noting that the lack of a cooperative position that may allow a rebalancing of power asymmetry, has been articulated in leading supply chain and management journals over a long period as shown in Table 1 below.

Table 1 - Power imbalance inimical to the weaker partner–rebalancing power asymmetry imperative

Author	Title	Journal	Findings
Kähkönen (2014)	The influence of power position on the depth of collaboration	*Supply Chain Management: An international journal*	Power influences the depth of collaboration, which is minimal if the actors do not have balanced power positions
Bowman, Froud, Johal, Leaver & Williams (2013)	Opportunist dealing in the UK pig meat supply chain: Trader mentalities and alternatives	*Accounting Forum*	Buyer-led organizations have strong supermarket chains who have the power to capture processor and producer margins
Nyaga, Lynch, Marshall % Ambrose (2013)	Power asymmetry, adaptation and collaboration in dyadic relationships involving a powerful partner	*Journal of Supply Chain Management*	Power imbalances affect suppliers' behaviours and operational performances along with relationships in a supply chain
Viitaharju & Merja Lähdesmäki (2012)	Antecedents of trust in asymmetrical business relationships: Differing perceptions between food producers and retailers	*Marketing Intelligence and Planning Journal of Business Research*	In an asymmetrical business relationship, the role of the more powerful partner in the development and maintenance of trust is minor
Krolikowski & Yuan, (2017)	Friend or foe: Customer-supplier relationships and innovation		Strong bargaining power in the supply chain by the powerful actor stops suppliers from investing in product development

Table 1 - continued

Author	Title	Journal	Findings
Rokkan & Haugland (2002)	Developing relational exchange: effectiveness and Power	*European Journal of Marketing*	Asymmetry of market position is negatively related to relational exchange between powerful retailers and suppliers
Kumar (1996)	The power of trust in manufacturer-retailer relationships	*Harvard Business Review*	Exploiting power to extract unfair concessions can come back to haunt a company if its position of power changes

Conversely, a significant number of researchers take the view that co-operation and conflict co-exist between weaker and stronger partners within the supply chain (Belaya & Hanf, 2009; Collins & Burt, 2003). As such there are open communication channels where channel partners manage conflicts by undergoing continues balancing act (Terpend & Krause, 2015; Shen *et al.*, 2017). The findings of publications outlined in Table 2. indicate that cooperation and coordination approaches to power dynamics in supplier-retailer relationships are not only popular with management and business researchers but also current (see for example Kumar *et al.*, 2016: Terpend & Krause, 2015).

Table 2 - Co-operation and conflict co-exist – A balancing approach for win-win

Author	Title	Journal	Findings
Terpend & Krause (2015)	Competition or Cooperation? Promoting Supplier Performance with Incentives Under Varying Conditions of Dependence	*Journal of Supply Chain Management*	Cooperation and competition can coexist without significant risk of decreased performance b/w suppliers and buyer

Table 2 - continued

Author	Title	Journal	Findings
Shen, Wang & Teng (2017)	The moderating effect of interdependence on contracts in achieving equity versus efficiency in interfirm relationships	*Journal of Business Research*	The threat of coercive tactics recedes when joint dependence on the resources increases due to better operational efficiency
Chung, Huang, Jin & Sternquist (2011)	The impact of market orientation on Chinese retailers' channel relationships	*Journal of Business and Industrial Marketing*	Suppliers should focus on improving retailers' economic satisfaction through role performance and market intelligence rather than seeking the power of social satisfaction
Belaya & Hanf (2009)	The two sides of power in business-to-business relationships: Implications for supply chains	*Marketing Review*	Different aspects of power in the supply chain can be used for coordination and cooperation
Svensson (2001)	Extending trust and mutual trust in business relationships towards a synchronised trust chain in marketing channels	*Management Decision*	An approach beyond dyadic business relationships of power between suppliers and retailer is necessary to truly understand the trust
Kumar *et al*. (2016)	Collaborative culture & relationship strength roles in collaborative relationships: a supply chain perspective	*Industrial Marketing Management*	The relationship strength partially mediates between collaborative culture & market-based information sharing

Emerson (1962) noted that mutual dependence between the partners will influence their conduct and this will determine the direction of the relationship. Power dependence theory provides a theoretical justification for its usage by retailers for business relations with suppliers (Davis and Cobb, 2010). On the other hand, resource-dependent theory (RDT) highlights the resource-based view of the firm, which deals with managing inter-organisational relations by minimising the environmental uncertainty and dependencies (see, Davis & Cobb, 2010, p. 5). Given the limitations of existing paradigms about power-play in food supply chain relationships, perhaps, there is potential mutual leverage to be gained by combining the ethos of both power dependence and resource dependent theories to address the dynamic and complex process of supplier-retailer relationship. Approaching power relationship challenges in the food supply chain from a multi-theory perspective projects an integrated view of organisations, its internal and external environment and its interaction with power structures.

1.2. *Power asymmetry and relationship management in the UK food supply chain: the case of Tesco*

In the UK, it is generally acknowledged that food retailers like Tesco enjoy power asymmetry in their relationship with suppliers (Robson & Rawnsley, 2001; Bowman *et al.*, 2013). As a result, major retailers' control exchange relationships in the supply chain. This is especially in the case of fresh produce (fruit, vegetables and salads), which is predominantly supplied as retailer private (own) label (Hingley, 2005a). As fresh produce is short shelf life, suppliers need a stable and dependable buyer who can commit to a long- term relationship. Seeking stable long-term contracts to counteract perishability and seasonality issues overly exposes these suppliers to the dictate of retailers, who exploit their buying power to the disadvantage of suppliers (Hingley, 2005b; Kumar, 1996).

Ironically, in suppliers' desire to control market vulnerability due to perishability challenges, they unintentionally create another dependency with retailers in terms of unfavourable terms of contracts (Pfeffer, 1981). Thus, suppliers' trade sovereignty for support and create new sets of interdependencies with retailers. Such a commercial dilemma is akin to operating in a situation where there is a continuous struggle for survival (Davis & Cobb, 2010; Hillman *et al.*, 2009) and chances of success are uncertain. In such an environment characterised by uncertainty, the powerful retailers control resources which are valuable, non-substitutable and rare (Hillman *et al.*, 2009; Erturk *et al.*, 2010). Therefore, access to these resources as highlighted by the resource dependence theory creates multiple dependencies and increases power imbalances.

Another source of competitive advantage for retailers is their proximity to consumers. Tesco being one of the biggest retailers in the UK is one such example. They have access to 1.4 million-consumer demand information (loyalty card database) which is an important resource (Yu *et al*., 2001) and this closeness to the consumer gives retailers a powerful lever (control over mass consumer information) (Felgate & Fearne, 2105). Data and consequently insights can be used from the point of sales or through loyalty card data (Felgate *et al*., 2012; Burt & Sparks, 2003). Insights obtained from Tesco consumer data helps retailers mitigate the uncertainty of demand by effectively and efficiently employing resources across the chain. Conversely, this proximity of the retailer to the consumer has created a win-lose situation. Where, suppliers are obliged to the requirements of their powerful retail partner, such that they may manage their production/manufacturing facilities without necessarily knowing what consumers want.

Despite the skewed relationships that compel suppliers to comply with demands to take more cost-sharing, making them vulnerable, a profound point about this argument is its adverse effect on the entire supply chain sustainability. Indeed, red flags have been raised about the competitiveness and sustainability of the UK food chain (Taylor & Fearne, 2009) in which incomplete, skewed and one-sided channel leads to unsustainable practice (for example, short-term multi-buy offers on perishables). Here, uncertainty is driven by power asymmetry.

The conditions of this challenge further underscore this paper's position to explore rebalancing power asymmetry within the UK food supply from a multi-organisational behaviour theory perspective – that is, combining the principles underlying power dependence and resource dependent theories. The prospects of such as approach are enhanced by the exponential growth of information technology and availability of consumer purchasing information (Davis & Cobb, 2010) that can be used for the mutual benefits of both actors in the food supply chain. Similarly, there is ample basis to envisage that approaching this supply chain problem from the combined viewpoints of power dependence and resource dependent theories could help address other problems.

Ettouzani *et al*. (2012) used case studies of seven major UK retailers and four major suppliers to study the issues around promotions. They identified thirty-two problemsand grouped them into eight themes. Uncertainty around consumer demand information was considered as the biggest problem faced by both of them reducing both efficiency (cost/waste) and effectiveness (sales growth) of promotions.

But the critical questions in this context are when and with whom this information should be used to improve the effectiveness of supply chain during promotions (Cannella & Ciancinnio, 2010)? Effective information

sharing at critical stages of promotional activity would potentially help suppliers make informed decisions that would improve power imbalances in their favour.

1.3. *The power and relationship matrix*

Having proposed and justified the need to draw on the tenets of resource dependence and power dependence theories to address power asymmetry between retailers and suppliers. what is now presented is the relationship matrix between the retailer's power and supplier relationship management. This integrates different levels of retailer's power with relevant relationship management styles and thus highlights different arrangements in a different context. The theoretical underpinning of resource dependence and power dependence theories serve as the context for this figure's development.

To visualise the development of the collaborative environment, there is a strong need to first understand the relationship between levels of retailer's power with their management style as it strongly affects the suppliers sourcing options. Synthesising different power matrices in the literature (Cox, 2004 a & b) and linking it with different relationship management styles along with suppliers' management and selection, this research proposes the following (see Figure 1).

Figure 1 - Impact of retailer's power and relationship style on the supplier's management and selection

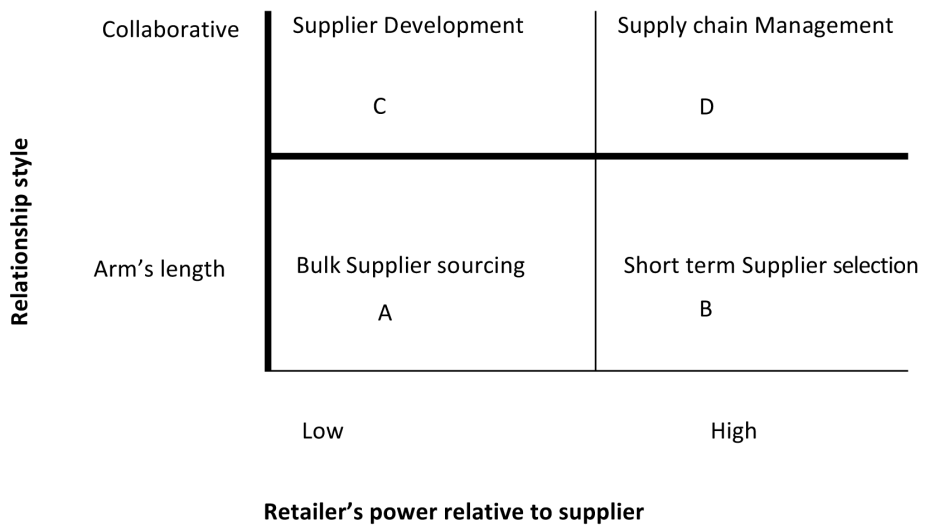


Figure 1 shows the multiple combinations of supplier's management based on different levels of retailer's power and relationship styles. Exercising a relatively low level of power, the retailer will choose a supplier based purely on volume and manages an arm's length relationship as shown in quadrant A (usually with tier two suppliers). Retailers will not work directly with them. An intermediatory like tier 1 supplier is involved to manage the relationship. On the other hand, retailers will exert more power when they choose suppliers based purely on short-term and focus is exclusively on cost as shown in quadrant B. This arm's length approach is changed into a more collaborative style when they start developing the relationship with their suppliers, for example, through joint decision making and new product development. This arrangement is shown in supplier development as shown in quadrant C. Retailer's influence starting to grow as seen from raw material to finished product through proactive adaption and innovation working closely with the suppliers along the chain. Focusing on this quadrant D where the relationship is collaborative and retailers power is high there is a strong need by both stakeholders to maintain equilibrium between retailer and supplier. In this way, retailers extend their market expertise to suppliers by co-opting and co-creating a product which is close to consumer needs and have a long-term focus.

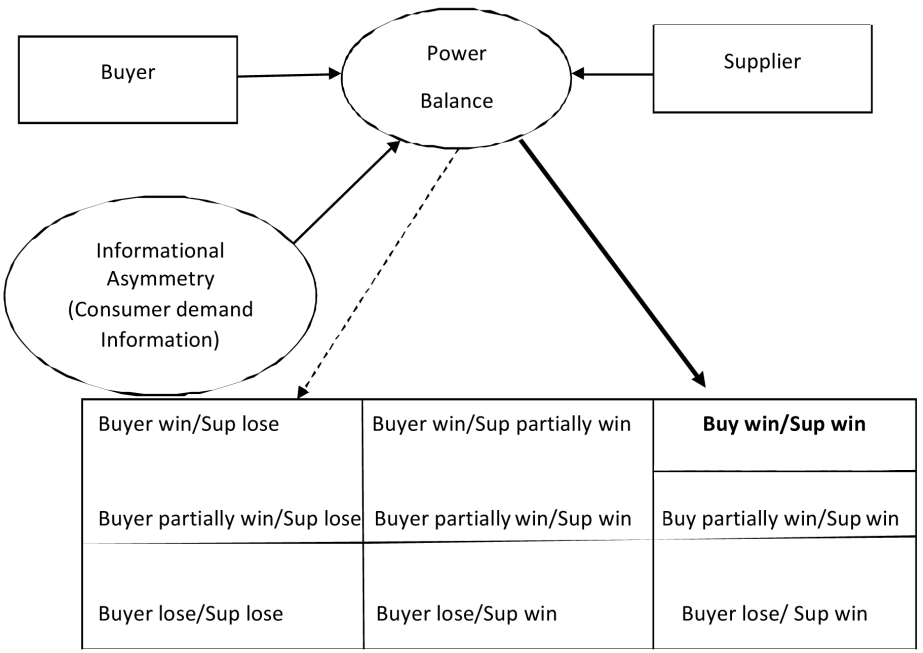
Resource dependence theory suggests that firms try to maximise their power by altering their structures and behaviours to acquire external resources as these resources decrease their dependencies on others (Pfeffer, 1981). One means of acquiring these valued resources is by co-opting with other organisations through social exchange. Co-optation adds stability to the inter-organisation relationships and serves to ameliorate the adverse effects of power asymmetry (Ulrich and Barney, 1984). In the context of a power imbalance scenario between small food suppliers and major retailers, that is characterised by inefficient promotions (Bogomolova *et al.*, 2017) and poor food waste records, both parties should as a matter priority begin to create favourable conditions for co-optation (Marcos & Prior, 2017). Eventually, co-optation will reduce the uncertainty of the business environment, which is an essential element for organisational survival.

1.4. *Conceptual model*

Based on the above research matrix, a conceptual model for balancing power asymmetry in the UK food supply chain with consumer demand information is presented (Figure 2). The literature revealed information asymmetry is one of the reasons for the power imbalance in the retailer-supplier relationship and resource dependence theory suggest that better resource access to information will reduce uncertainty. However, due to the

proximityof an important source (consumer demand) for a retailer, a win-lose scenario, especially for a small food supplier is created. This resource can potentially change the balance of power by converting a win-lose into a win-win situation for both as shown below. As consumer demand information is a resource controlled by retailers, sharing it with suppliers will improve power balance and mutual performance benefits for both partners.

Figure 2 - Conceptual model for balancing power asymmetry in the UK food supply chain with consumer demand information source



It is clear from the above figure no 2 that 9 different scenarios of win & lose situations (in relationship exchange) can be created when comparing buyer and suppliers value in the context of balancing power between them. However, information access and proximity can act as a balancing tool for this arrangement as highlighted in both resource dependence and power dependence theories. Consumer demand information is a key resource (resource dependence) as it provides useful insight about consumer behaviour, which not only improves supply chain efficiency but overall power balance(power dependence) as well.

This is important in the sales promotions of food items especially fresh produce where the shelf life is short and the chances of food waste are high. A better-resourced (informed) supplier with the help of a cooperating buyer (retailer) will make informed decisions and effective execution, thus maintaining the overall value for both of them. Due to demand information asymmetry, the buyer (retailer) is in a win situation as compared to suppliers (as indicated by the dotted line). However, when the buyer owned demand information is shared with the supplier, the exchange relationship moves towards a win-win situation for both (as highlighted by the bold line) in Figure 2, thus creating a dynamic equilibrium. This shows that proximity to a scarce resource as if demand information can affect the overall balance of power and relationship for the benefits of all stakeholders. Thus, information asymmetry can be reduced and co-optation will increase when the right information resource (consumer demand information) is used for planning and execution between both the stakeholders.

2. Research prepositions

Based on the above framework and two organizational theories this paper makes the following propositions:

Proposition 1: *Better access to resources through co-opting between small food supplier and retailer will improve power asymmetry*

This proposition concerns the type of resources (a specific set of tools) which can help maintain a healthy and balanced exchange relationship between small food suppliers and their powerful food retailer buyer. Allocation of resources is a function of power (Pfeffer & Leong, 1977) and this becomes more critical when resources are either scarce or plentiful. Organizations endeavour to increase their power by gaining control over the flow of these resources. Consumer demand information is an important resource and its control by the focal organisation can create different dependencies (Provan *et al.*, 1980). Different authors have highlighted multiple resources such as capital investment and human resources. These resources have been shown to improve supply chain relationships (Provan *et al.*, 1980; Li & Lin, 2006). However, learning through non-competitive and cooperative manner is the most suitable resource as it helps firms to absorb, and transfer knowledge through collaborative arrangements and creates a win-win condition for collaboration (Tsang, 1999; Fawcett *et al.*, 2012). It also helps firms to share risks and cost in a more complementary way, thus enhancing each other's skill and position in the market (Tsang, 1999).

Information as a resource in a supply chain network has been discussed at two different levels (strategic and tactical). Consumer demand information has been classified as strategic because it helps interpret consumer behaviour to make an informed decision in volatile and uncertain markets. This critical for small food suppliers as their products have limited shelf life and resources to manage any uncertainty. However, opportunistic behaviour and divergent objectives have caused information asymmetry in the supply chain as information disclosures can be perceived as a loss of power for focal organisations (Li & Lin, 2006). Therefore, a better strategy is needed to overcome the barriers to information sharing and encouraging better supply chain relationships through knowledge and learning (Kembro & Näslund, 2014).

Resource dependence theory (RDT) is considered suitable in understanding the barriers and enablers of information sharing in supply chain networks, as it provides the resource-based view of the firm (Kembro & Näslund, 2014). Better information sharing has been shown to reduce environmental uncertainty (Li & Lin, 2006), which is essential for reducing dependencies between suppliers and retailers. According to Benton & Maloni (2005) failure to share information is considered a barrier to using power as a potential tool in supply chain integration for higher performance (Benton & Maloni, 2005). Therefore, the paper further proposes that:

Proposition 2: *Sharing consumer demand information between small food suppliers and their retail partners can act as a balancing tool for reducing power asymmetry between suppliers and buyers for mutual exchange relationship benefits*

Conclusions

The significance of power asymmetry in food supply chain relationships management cannot be overemphasised. However, there is disagreement in the extant literature regarding how power imbalance ought to be approached for the benefit of partners in the exchange channel. Despite the strong theoretical foundations of the existing schools of thought on power dynamics in supply chain management, they appear insufficient to address the risk exposure of small food suppliers and to guarantee the success of the entire supply chain and its long-term sustainability. By contrast, this paper draws on organisational behaviour theories (power dependence and resource dependence theory) to contributes to the discourse around power and dependence by suggesting that, the use of consumer demand information (shopper demand), as a critical set

of tactics, can be utilised to redress power asymmetry with powerful retailers for mutual benefits.

The conceptual model suggests that on the contrary, the often-imbalanced vertical food supply chains also adversely affect both partners, particularly in terms of promotions efficiency and food waste. This calls for a change of approach to value addition through interaction and co-operation to create favourable conditions for co-optation between the powerful retailers and small food suppliers. In this way, consumer demand information sharing is possible and thereby serve as the critical set of tools to improve power balance for a mutually beneficial performance.

Important strategic and practical implications for stakeholders within the food industry emerge from the analysis in this paper. Reducing uncertainty by a better understanding of supply chain stakeholder's behaviour will improve coordination. Waste and efficiency issues are key challenges faced by the food sector and using the information as a tool to manage them is gaining traction. The success of a firm is measured by the management of a complex web of relationships, which leads to simulated learning through the integration of information and its effective use. The emergence of big data has changed the way organisations manage their dependencies with other firms and the business environment. High level of information sharing could improve the performance and sustainability of the food supply chain. Sustainability is another important key dimension to this collaboration, better cooption and power equilibrium will result into better.

Contribution to theory

No single theory can adequately explain the complex business environment of the food supply chain due to the impact of multiple factors. Integration of resource theory and power dependence theory provides a more robust explanation of current issues of power balance and relationship management (Takashima & Kim, 2016). It shows how one aspect of a theory (power imbalance) provides a better explanation for another phenomenon (relationship management) in a given set of conditions with a specific context of the food industry (Hingley, 2005b). This integration also adds a novel resource (consumer demand) into the mix of relationships, power and their overall management.

To build more effective food supply chain relationships, improved information sharing should also be accompanied by shared objectives between the channel partners. This will help in developing a positive power base where each partner will be conscious of its available resources and manage them for the benefit of the whole supply chain. Thus, relational

use of power by the dominant firm will strengthen effective integration and improve suppliers' satisfaction towards creating mutual trust and coordination.

Future research direction and limitations

This research directs towards a novel direction of information used for the sake of power balance and better relationship management. This is especially true in today's environment of big data and consumer insights. All stakeholders are increasingly becoming aware of its use for their business and long-term prospects. This is especially true for the food industry where profit margins are low and competition is fierce. Consumer insights obtained through information sharing can play a significant role in shaping tomorrow's relations and power structures.

Information extraction and application has to be done keeping in view the available resources with stakeholders as using and generating consumer insights from big data needs extensive training. This becomes critical for small food suppliers as they are already short of resources and need retailers to help in generating useful decisions making for information sources.

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