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Modelling the adoption of conservation agriculture in the United Kingdom

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Abstract
The paradigm shift in agricultural activities towards a sustainable, eco-friendly system known as conservation agriculture (CA) has been asserted to be a solution to the current threat of global food insecurity, climate change, water scarcity and environmental degradation. However, despite the tremendous efforts to promote the practice of CA, the adoption rate is slow. This study uses a logit model to investigate the factors that influence adoption of CA in the United Kingdom. Results from the analysis of data from 2,469 farm units revealed that farmers' age, farm size, and household are significantly associated with increased adoption. The cattle owned, and unpaid workers, though statistically significant, have a negative relationship with the adoption of CA. The recommendation of the findings from this study is an improvement of the livestock feed subsidy to reduce the cost of production, and so permit the payment of better wages to farm workers.

Keywords: conservation, agriculture, adoption, logit

1. Introduction

The paradigm shift in agricultural activities towards a sustainable, eco-friendly system has been asserted to be a solution to the current threat of global food insecurity, climate change, water scarcity and environmental pollution. One of the strategies that could be used to tackle these problems, and at the same time enhance the sustainability of agricultural production is the adoption of ecologically based management practices [36]. Ecologically-based management practices could be embodied by Conservation Agriculture (CA). CA has consistently been promoted as a solution to the problems above, which may also occur due to adverse effects that may arise in the bid to intensify agricultural production through conventional practices. For instance, the indiscreet use of pesticides and chemical fertilizer poses a health threat to both humans and the environment [42]. Moreover, the loss of Soil Organic Carbon (SOC) has been broadly due to soil tillage [4]. In other words, sequestration of SOC could be realized by shifting from conventional to conservation tillage systems.

CA inclines the exclusion of unsustainable features of conventional agricultural systems such as tillage, mono-cropping, and removal of crop residues and the inclusion of minimal soil tillage and permanent cover crops, as well as crop diversification [39]. Some of the benefits of CA include but are not limited to, adaptation to and mitigation of climate change and its effects, enhancing food security and biodiversity, amongst others [12, 31, 30]. Having realized the positive impacts of CA, international bodies, international research centers, NGOs, religious organizations, and governments all indulged in the continuous promotion of CA technologies [30]. This campaign has contributed to the increase in the adoption of CA systems by an average of about 7 million ha over the past 11 years [12].

There has been a passionate adoption of CA in South and North America, New Zealand and Australia as well as some African and Asian countries. The rate of adoption obviously illustrates that CA could have a tremendous impact on solving the trending problems faced globally. In the UK, the contribution of agriculture to the economy is small, although the impact on the environment is quite significant [22]. For instance, soil degradation encompasses both erosions as well as a reduction in the quality of the topsoil. Evidently, about 2.2 million tonnes of the UK soils erode on an annual basis and symptoms of erosion are shown by over 17 percent of the arable land [41]. Furthermore, [27] lamented that the effects of eroded soils have increased since the 1970s in England and Wales, and the factors accounting for such an increase are related to some elements of conventional agriculture.

The need for a paradigm shift is paramount to ensure economic and sustainable agricultural production. The acknowledgment of CA as a sustainable system should provide solutions to some of the problems posed by conventional farming systems; thus, to this effect, several studies were carried out [29, 8, 32]. However, none of the studies focused on the measuring the adoption of CA in the UK; hence rationalizing the need for this study. Therefore, this research explored the determinants of adoption of CA by farmers in the UK.

The following section will discuss the methodology, study area and data, statistical framework, and the empirical result.

2. Methodology

2.1 Study Area and Data

The dataset downloaded from the UK Data Service database (http://ukdataservice.ac.uk) on June 2015, was used to conduct this research. The dataset is a 2012/2013 Farm Business Survey (FBS): UKDA study number 7461.

Farms are the observation units in the data. The data contains 2,469 units, where all the units have a minimum threshold of €25,000 output. The variables used in this study include, but are not limited to, farm size, farmer's age, education, gender, unpaid labor, and tillage among others. Selective sampling was used in obtaining the sample for this study. The entire 2,469 units were considered in the study, but only some of the variables were selected (Table 1). This study used an econometric model to analyze the data using Gretl version 1.10.1, which is a cross-platform software package used for econometric analysis.

2.2 Modelling the Adoption of Technology

The models used in analyzing binary choice models, such as whether to adopt or not to adopt should not always be bivariate [15]. The idea behind this statement is that frequent use of bivariate analysis does not provide sufficient understandings into the relationships between determinants of adoption and adoption.

Furthermore, ordinary and least square regressions are restricted when economic relationships are framed with a dependent variable having the values of 0 and 1 only [48]. According to [43], logit, probit, and linear probability could be used to analyze qualitative choice models, and due to the deficiencies of linear probability, the probit and logit models are ideal.

According to [3], the probit and logit are both probabilistic dichotomous choice qualitative models. In the 19th century, the logistic function was created for the explanation of population growth and the sequence of apocalyptic chemical reaction [7]. The use of the model has advanced from a specialized tool to the point of being considered as a standard method of data analysis [34]. Its ease of interpretation is probably the major reason behind its widespread adoption [34], and or its computational simplicity [24]. Similarly, the probit model was developed to analyze qualitative dependent variables within the framework of the regression, and it is also easy to use [28, 19].

The probit and logit models use approaches that limit predictions to values between 0 and 1 [37]. [38] affirm that the results from the two models are similar and are difficult to distinguish statistically [3], was of the view that although the logit takes up a logistic distribution of the dependent variable, the probit model takes up a normal cumulative distribution function. Therefore, the selection of one over the other is a matter of choice [37]. Thus, the researchers prefers the selection of logit model over the profit model in this study. The factors that determine the adoption of CA were analyzed using the logit model. Several studies have quantitatively analyzed the adoption of new technologies using this logit model [35]. The dependent variable (adoption of CA – no tillage) was a binary variable with a value between 0 and 1. In other words, 1 if a farmer is an adopter and 0 if non-adopter. Going by the conclusions of [26], CA can be described in various ways, including reduced, minimum, conservation and low tillage. For this study, no tillage was considered to be the description of CA because it is the only variable out of the three principles of CA available in the dataset. This study conceptualized that a farmer implements one out of the three principles of CA because, it is difficult to find a farmer practicing all the three principles at the same time [13, 6]. And in this case zero tillage - he/she is considered an adopter and will carry the value of 1, or 0 if otherwise.

Having described the dependent variable (Y) in the above paragraph, the independent variables (X) are presented as an explanatory variable related to adoption. The dependent variables are assumed to be a function of a combination of three factors, namely; farmer's socio-demographic characteristics, biophysical, and farm management characteristics. [46, 52, 51, 47] conducted some adoption studies using the logit model.

2.3 Statistical framework

According to [44], farmers' choices of adopting technology are associated with the characteristics of that technology, as much preference is on the technology that yields maximum utility (*U*). Academically, random utility models are mostly used to address this type of circumstance. Assuming a farmer's utility following the adoption of CA for a particular vector of biophysical, farm management and socio-demographic factors *Z*, is represented as $U_{CA}(Z)$ and as $U_{NCA}(Z)$ for not adopting, the linear relationship defining the preference for adoption or otherwise is:

$$U_{CA}(Z) = Z\beta_{CA} + \varepsilon_{CA} \quad (1)$$

$$Y_{NCA}(Z) = Z\beta_{NCA} + \varepsilon_{NCA} \quad (2)$$

Where β_{CA}, β_{NCA} and $\varepsilon_{CA}, \varepsilon_{NCA}$ are response coefficients and random disturbances related to adoption and non-adoption of CA technologies respectively.

Following [25], the probability that a farmer will adopt CA supposing *Y* is the adoption decision could be stated as a function of Z, thus:

$$P(Y = 1) = P(U_{CA} > U_{NCA}) \quad (3)$$

$$P(Z\beta_{CA} + \varepsilon_{CA} > Z\beta_{NCA} + \varepsilon_{NCA}) \quad (4)$$

$$P(Z\beta_{CA} - \beta_{NCA}) > (\varepsilon_{NCA} - \varepsilon_{CA}) \quad (5)$$

$$P(Z\beta > \varepsilon) = F(Z\beta) \quad (6)$$

Where:
P = probability of CA adoption
F = cumulative distribution function
β = vector unknown parameters
e = disturbance term

The distribution of ε determines the precise distribution of *F*. The assumption of normal distribution and logistics distribution give rise to the probit and logit models respectively. Going by the logit model, the probability of adopting CA is $P(CA|Z)$, specified as:

$$P(CA|Z) = \frac{\exp(Z\beta + \varepsilon)}{1 + \exp Z\beta + \varepsilon}$$

Where $\alpha < Z\beta < a$

The probability of not adopting CA is,

$$P(NCA|Z) = 1 - P(CA|Z) = 1 - P(CA|Z) = \frac{\exp(Z\beta+\varepsilon)}{1+\exp(Z\beta+\varepsilon)} = \frac{1}{1+\exp(Z\beta+\varepsilon)}$$

The relative odds of adoption against non-adoption of CA in the UK is:

$$\frac{P(CA|Z)}{P(NCA|Z)} = \frac{[\exp(Z\beta+\varepsilon)][1+\exp(Z\beta+\varepsilon)]}{[1+\exp(Z\beta+\varepsilon)]} = \exp(Z\beta + \varepsilon)$$

Taking the logarithm of both sides:

$$\ln\left[\frac{P(CA|Z)}{P(NCA|Z}\right] = Z\beta + \varepsilon \quad (1)$$

The hypothesis to be tested is:

1. The number of cattle owned and the household number will not influence the adoption of CA. in addition to this, the Household number (HHOLDNUMB) indexes of the number of family members are hypothesized not to have any influence on the adoption of CA

2.4 Specific model

The combined effects of socio-demographic characteristics of farmers, biophysical characteristics, and farm management characteristics of a given farmer were assumed to influence farmers' decision to adopt or not to adopt a technology based on innovation diffusion theory as well as related studies. The dependent variable is tillage, And it takes the value of 1 if a farmer adopts and 0 for no adoption. The explanatory variables are discussed below.

$$\ln(P/(1-P) = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \beta_6 Z_6 + \beta_7 Z_7 + \beta_8 Z_8 + \beta_9 Z_9 + \beta_{10} Z_{10} + e \quad (7)$$

Where the probability of adopting CA is in (P/(1-P), β is coefficients of the explanatory variables in the adoption equation, while Z denotes the explanatory variables, *which include:* Z_1, Z_2, Z_3, Z_4, Z_5, Z_6, Z_7, Z_8, Z_9,*and* Z_{10} as defined below.

Z_1= Farmerage
Z_2= Gender
Z_3= Farmsize
Z_4= Cattleowned
Z_5= Unpaidwks
Z_6= Offfaminc
Z_7= Hholdnumb
Z_8= Membership
Z_9=Edualevel
Z_{10}=Eduuptopg

Gretl software (1.10.1) was used for the above-stated model, being a statistical package ideal for econometrics. The p-value (evaluated at 5 percent level of significance) assisted in indicating their relevance in explaining the adoption of CA in the UK**.** The number of cases correctly predicted, R-squared, and the log likelihood is the basis of selection of the model of the goodness of fit. The log likelihood is the function of the parameters and the data and the higher the value, the better. R-squared is the estimate of how the set of independent variables explains many variations in the dependent variable.

Table 1: Description of Independent Variables and Hypothesized Indicators

Variables	Indicator	Rationale for variable selection
Farmerage	+	Older farmers may adopt newer technologies compared to younger farmers
Gender	+	It may have a positive influence on adoption as the nature of CA practices mean less hard labor
Farmeredu	+	Educated farmers may have more possibilities for adopting new technologies
Farmsize	+	Bigger farms have the ability to spread risk; as such, they have more possibilities of adoption
Cattleowned	_	High number of cattle may lead to competition for crop residues for ground cover
Unpaidwks	+	Lower cost of production is assumed to influence adoption
Offfaminc	+	This may give the advantage of allowing the taking risk on the farm business
Hholdnumb	_	This may not influence adoption
Membership	+	Farmers may have access to information on the benefits of CA

Source: Authors' computation from 2012 FS dataset obtained from the UK Data Service (http://ukdataservice.ac.uk/)

TILLAGE is the dependent variable, and it is also a dummy variable that shows whether the farmer is using one of the 1three principles of CA. Farmer's age is measured by this variable (FARMERAGE). Older farmers are assumed to adopt newer technology compared to younger farmers, probably due to greater experience. Farmer gender (FARMERGENDER) is a dummy variable that indicates the sex of the farmer. It has the value of 1 and 0 for male and female farmers respectively. It may well have different effects on the adoption of technology. It is expected that females may have some constraints regarding labor, which may affect adoption [20]. However, the effect of gender in this study is hypothesized to be positive. Farmer education the level of education of a farmer is measured by this variable (FARMEREDU). It ranges from 0-9. School only, General Certificate of Secondary Education (GCSE), and A level are categorized as 'eduptoAlevel.' College/National Diploma certificate, degree, and postgraduate qualifications are categorized as 'eduptoPG,' while apprenticeship and other qualifications are categorized as 'approthers.' According to [2], the capacity for innovation and creativity is enhanced by education. As such, educated farmers have more possibilities to adopt CA. Farm size is another variable recorded as FARMSIZE. According to [39], farm size may positively influence the adoption of technology because risk can be spread in larger farms. Cattle owned (Cattleowned) specifies the total number of cattle owned by a farmer. It is hypothesized that adoption of CA may be affected when the number of livestock is high due to the utilization of crop residues as livestock feed [39]. Unpaid workers (Unpaidwks) measures the family labor available. It is hypothesized that it may influence the adoption of CA, due to the little or no cost incurred in weeding. Off-farm income (Offfaminc) measure any income not related to farming activities. It is hypothesized to influence adoption due to the increase in financial capacity. Household number (Hholdnumb) indicates the number of family members. It is hypothesized that they will have a positive influence on the adoption of CA. This is assumed that the higher the number of family members the more likely it is to have for labor and capital. Membership of a farmer's association (Membership) is a dummy variable and indicates whether a farmer belongs to any farmer's membership association. It is hypothesized that members of a farm group may have access to information on the advantages of CA, and as such, it may influence adoption.

3. Empirical result

The descriptive statistics (Table 2) present the mean and standard deviation of the variables. It could be observed that the average farmer's age is 56 years, indicating that the majority of the farmers are above the young age benchmarks. Gender is a dummy variable, and male farmers are considered as the base. The majority of the farmers are male, with a very limited number of female farmers - an average figure of 0.961118 (4%) of the total number of farmers in the UK. The level of education ranges from school only to postgraduate qualifications and also includes apprenticeship as well as other qualifications. Education level was categorized into three types; up to A level (school only, GSCE, and A level), up to PG (college/national diploma, certificate, degree, and postgraduate qualifications), an apprenticeship, as well as other qualifications, forms the last category. Although the latter category is considered as the base, as such, it is not reflected in the results. On average, up to A level, up to PG, apprenticeship and others represent 46.5, 50.5, and 2.95 percent respective levels of education of UK farmers respectively. Farm size is also categorized into large (3), medium (2), small (1), and very small part-time (0). The average farm size of a UK farmer is medium. Despite the fact that most of the farms are medium, a very high number of cattle are owned by farmers, about 112 on the average. The mean of unpaid workers, which could be assumed to be family labor, is limited to about 2 percent. An average of £4,200 per annum is earned from other sources of income besides the farm business. The majority of the farmers are members of one or more farmers' associations.

Table 2: Descriptive Statistics of Logit Model

Variables	Mean	Standard deviation	Minimum	Maximum
Farmerage	56.0705	10.8210	21.0000	112.000
Fgender	0.961118	0.193353	0.00000	1.00000
Farmsize	2.03038	0.841759	0.00000	3.00000
Cattleowned	112.120	145.614	0.00000	1400.00
Unpaidwks	1.92548	0.856448	1.00000	6.00000
Offfaminc	4215.07	11209.4	0.00000	158750
Hholdnumb	0.861077	0.787707	0.00000	5.00000
Membership	0.850142	0.357005	0.00000	1.00000
eduptoAlevel	0.465371	0.498900	0.00000	1.00000
Eduptopg	0.505063	0.500076	0.00000	1.00000
Approthers	0.0295666	0.169423	0.00000	1.00000

Source: N = 2469 Authors' computation from 2012 FS dataset obtained from the UK Data Service (http://ukdataservice.ac.uk/)

Table 3: The Results of the Logit Model for the Adoption of CA

	Coefficient	Std. error	Z	p-value	
Const	-1.58792	0.438126	-3.6243	0.00029	***
Farmerage	0.0130992	0.0044379	2.9517	0.00316	***
Fgender	-0.0564823	0.227792	-0.2480	0.80417	
Farmsize	0.947269	0.0644112	14.7066	<0.00001	***
Cattleowned	-0.0012236	0.000356641	-3.4309	0.00060	***
Unpaidwks	-0.154273	0.0563301	-2.7387	0.00617	***
Offfaminc	-9.26573e-07	4.33132e-06	-0.2139	0.83061	
Hholdnumb	0.127588	0.0628343	2.0306	0.04230	**
Membership	-0.162102	0.129124	-1.2554	0.20933	
EduptoAlevel	-0.0074063	0.261542	-0.0283	0.97741	
EduptoPG	0.460826	0.262398	1.7562	0.07905	*

N= 2469 R-squared= 0.100729 Log likelihood= -1419.404
Number of cases correctly predicted = 1738 (70.4%)
Likelihood ratio test: Chi-square (10) = 317.98
Source: Authors' computation from 2012 FBS dataset obtained from the UK Data Service (http://ukdataservice.ac.uk/).

Table 3, the model which estimates the adoption of CA comprises of 10 estimated parameters, of which 4 are statistically significant at 1 percent level of significance, while the remaining 2 parameters are significant at 5 percent and 10 percent respectively.

The Value of the constant is statistically significant, indicating that there are other variables not mentioned in the model that may influence the likelihood of the adoption of Conservation Practice by UK farmers *ceteris paribus*. The result also shows that gender of the farmers, off farm income, membership of professional organization, and level of education are not statistically significant, indicating that they are not determinant of the adoption of Conservation Practice by UK farmers (p-value >0.05). Farmer age is significant at 1% level of significance (p-value <0.01) it shows that older farmers in the UK are more likely to adopt

CA than the younger ones. The variables of number of cattle owned, and number of unpaid workers, though statistically significant, have an inverse relationship with the adoption of CA. Furthermore, the result indicated that, with every increase in the number of household members, there would be a likelihood of the adoption CA by the UK farmers by 12.75 percent. Edupto PG, level of education is also considered as a determinant of the adoption of CA by the UK farmers according to the result.

The logit regression has revealed that not all the coefficients are in line with the hypothesis. The model parameter estimated at the 5 percent level of significance helped in the explanation of the adoption of CA in the UK. Thus, the model is estimated as:

$$\ln L = exp(-1.59 - 0.056fgender - 0.0012cattleowned - 0.15unpaidwks - 9.27offfaminc - 0.16membership - 0.007eduptoAlevel + 0.013farmerage + 0.94farmsize + 0.12hholdnumber + 0.46eduptoPG + e$$

4. Discussion

Farmers' age is statistically significant to the adoption of CA, which is in line with our expectations. This could be attributed to the years of experience attained by older farmers, which may grant them the flexibility of utilizing new technology to measure its effect. This contrast with younger farmers who may not like to take the risk involved in new technologies. However, arguably, the decision to adopt or not to adopt a given technology could occur at any time regardless of the age of a farmer. This demonstrates similarities to the findings of [45], who expressed the possibilities of entry or exit into CA systems at any time. Similarly, [32], reviewed synthesis studies conducted on the adoption of CA, categorically reported difficulties in linking the age of a farmer and the adoption of CA technologies.

There is no significance in the effect of gender on the adoption of CA, which is contrary to our a priori expectations. It was assumed that plowing the soil is laborious and may negatively affect the participation of women in agriculture. There, the invention of CA reduces the drudgery involved in the cultivation of crops. Therefore more women might be expected to become involved in the practice. However, this result is not so surprising, as many scholars reported insignificant effects of gender on adoption of technology [11, 40, 20]. According to [53], the share of employed women in the non-agricultural sector in the year 2012 is 49%. This implies that women are employed in various sectors of the economy, such as banking, mining, academics, transportation and energy to mention a few. This also shows that the UK, being a developed country is active in eradicating gender inequalities.

The assertion of the significance of the level of education of a farmer to the adoption of technology has been supported by the result of this study, although not all levels of education are significant to adoption. Up to A level of education has no relationship with adoption, while up to PG has some level of significance. It is expected that from college up to postgraduate studies are the stages at which an individual will gain more technical knowledge on land degradation and preventive measures, as well as possible solutions. However, passing through that level of education does not necessarily mean the knowledge gained will be put into practice. Nevertheless, it could be acceptable to conclude that educated farmers are more likely to adopt CA. This finding is consistent with the outcomes of the work of [10] in their study of the factors influencing conservation tillage in Australia. [33] also reported the significance of the level of education in their work on US farm households adopting conservation practices. Moreover, [50] also made comparable conclusions.

Farm size showed a high significance (positive influence on adoption), which is in line with our expectations. Larger farms have more chances of adopting technology because of the opportunity of spreading the risk involved or even the ability to practice the new technology in a small part of the farm area, which could be expanded gradually. Therefore, it could be expressed that the larger the farm size, the more likely the adoption of CA. Several studies are consistent with this finding [1, 23, 16]. However, contrary findings were also made by [8]. And [49]; thus compelling [32] to declare an inconclusive report on the effect of farm size on adoption of CA.

Crop residues, as one of the basic principles of CA, tend to create competition regarding either feeding the cows or feeding the soil (mulch cover); as such the negative influence (though significant to adoption) fits perfectly with our expectations. Obviously, crop residues provide a considerable amount of feed for the livestock, which is more economical for the farmer, so the greater the number of cattle owned, the less likelihood of adoption. However, [39] have conflicting findings on the effect of the number of cattle owned on adoption of CA.

Number of Unpaid workers and that of a number of cattle owned. Though statistically significant, have a negative influence on the adoption of CA by the UK farmers. This is contrary to our hypothesis. We opined that the number of unpaid labor could significantly contribute towards the reduction of the economic cost of production. Consequently, farmers in their attempt to reduce the cost of production and maximize profit, they deploy a substantial number of unpaid labor into the farm and most members of the family. These findings collaborate with the opinions of many scholars [9, 5, 14].

It was assumed that off-farm income would influence adoption because the extra income separate from that of the farm business could permit risk-taking regarding adopting new technology. It could also permit farmers to meet the cost of inputs needed for implementation of the technology. However, this was not supported by the findings of the research.

The hypothesis made for the number of household members has been disproven by the results, as adoption is significant. The decision to adopt or not to adopt CA is made based on the constraints enforced by the socio-economic, and on-farm resources. This could be due to the variation in the economic status of different households, and the degree to which they are integrated into the farming business. Furthermore, some household members, if not all, may diversify the sources of livelihood and take part in off-farm activities to raise more income, while others may decide to change their ways of farming. [21] also reported similar findings.

The result is not consistent with the hypothesis made on membership of farmer's associations. It is expected that the membership of a farmer's association could positively influence adoption because CA is knowledge-intensive and farmers may gain access to information on CA through seminars, extension events, and fellow farmers. However, we cannot conclude the outcome of the membership; more research needs to be conducted on this.

Conclusively, it was discovered that gender, off-farm income, and membership of farmers association have no role to play in the decision making of the adoption of CA in the UK. Farmer's age, farm size, household number, and education are positive and significant in influencing adoption. However, the number of cattle owned, and unpaid workers negatively influence CA adoption in the UK.

5. Conclusion

The factors that may influence the adoption of CA in the UK were analyzed using a logit model. The results obtained were based on the analysis of the dataset of 2,469 farm units downloaded from the UK Data Service database. The summary statistics revealed that male farmers dominated the population of farmers in the UK; they had an average age of 56, and most owned a medium-sized farm with about 122 cattle. The majority of the farmers are members of farmers' associations and also have some level of education.

It was also discovered that the coefficients of age, farm size, household number, and education are significant and positively influence adoption. While the number of cattle owned and the number of unpaid workers are also significant, they negatively influence adoption. Therefore, it can be concluded that adoption increases if there is an increase in age, farm size, members of the household, and level of education. Conversely, the higher the number of cattle owned the less likely the adoption of CA becomes. There is no relationship between CA adoption and the effects of gender, off-farm income, and membership of farmers associations.

It has been revealed that the number of cattle owned negatively affects the adoption of CA, and this could be attributed to the need for feeding cattle with crop residues. This significantly affects adoption of CA because permanent soil cover must be maintained. This brought about the recommendation for the government to improve the subsidy of livestock feed. Improving the subsidy will affect reducing the cost of production inputs; this will lead to an increase in profitability of the business and enhance the affordability of payment of wages to farm workers. These will positively affect the adoption of CA in the UK.

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