Sample of Dutch FADN 2015

Design principles and quality of the sample of agricultural and horticultural holdings

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The purpose of the EU Farm Accountancy Data Network (FADN) is to be able to evaluate the income of agricultural holdings and the impacts of the Common Agricultural Policy. The Netherlands is required to yearly send accounting data of a sample of 1,500 farms to the European Commission to contribute to the FADN. This task is carried out by Wageningen Economic Research on behalf of Centre for Economic Information (CEI). This report explains the background of the farm sample for the year 2015. All phases from the determination of the selection plan, the recruitment of farms to the quality control of the final sample are described in this report.

Het doel van het Europese Bedrijveninformatienet (RICA) is om de inkomens van agrarische bedrijven te evalueren en de impact van het Gemeenschappelijk landbouwbeleid. Nederland dient daarvoor jaarlijks de boekhoudkundige gegevens van een steekproef van 1.500 agrarische bedrijven naar de Europese Commissie te sturen. Deze taak wordt uitgevoerd door Wageningen Economic Research in opdracht van het Centrum voor Economische Informatievoorziening (CEI). Dit rapport geeft een toelichting op de steekproef voor het jaar 2015. Alle fasen van het vaststellen van het selectieplan, de werving van deelnemers tot de kwaliteitscontrole van de uiteindelijke steekproef worden beschreven in dit rapport.

Key words: FADN, sample, population, evaluation, agriculture, financial data

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Preface

The purpose of the EU Farm Accountancy Data Network (FADN) is to be able to evaluate the income of agricultural holdings and the impacts of the Common Agricultural Policy. The Netherlands is required to yearly send accounting data of a sample of 1,500 farms to the European Commission to contribute to the FADN. This task is carried out by Wageningen Economic Research on behalf of Centre for Economic Information (CEI).

This report explains the background of the sample for the year 2015. All phases from the determination of the selection plan, the recruitment of farms to the quality control of the final sample are described in this report. This report provides essential background information for the European Commission, the Dutch Ministry, researchers and other organisations to fully understand the statistical aspects of the Dutch FADN sample.

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Summary

S.1 Key findings

For the accounting year 2015, 1,512 Dutch farm reports have been delivered to the European Commission. The target number of 1,500 farms has been reached. Farm data are of major importance in the evaluation of agricultural policies and the monitoring of the economic developments in the agricultural sector.

In 2015, 63,913 agricultural and horticultural farms operated in the Netherlands according to the Dutch Agricultural census. The Dutch FADN (Farm Accountancy Data Network) aims at farms with a Standard Output (SO) of 25,000 euros or more. This field of observation covers 47,682 farms in 2015. These farms are responsible for 99% of total national production capacity measured in SO.

For the accounting year 2015, 72 new farms were recruited. The average response rate among farmers asked to participate in FADN is 20%. The average is strongly influenced by a few sectors in which it is difficult to motivate farmers to participate.

Based on the monitoring of the results of 2014 and before, an improvement of the sampling plan 2015 has been realised for other field crops and non-organic dairy. Because of the increasing size of the farms in these farming types, the size class larger than 500,000 SO is split into two size classes: 500,000–1,000,000 SO and >1,000,000 SO. From 2015 onwards goat farms are included in the selection plan as a separate group. This is because of the increasing number of goat farms and the relevance for the government with respect to amongst others human health.

S.2 Background

Member states are obliged to have a network for the collection of data on the incomes and business operation of agricultural holdings. This task is carried out by Wageningen Economic Research for the Centre for Economic Information (in Dutch, Centrum voor Economische Informatievoorziening, CEI). The main purpose of the data network is defined as the annual determination of incomes on agricultural holdings and a business analysis of agricultural holdings. For the Netherlands, the European Commission requires the yearly establishment of a selection plan describing the sample of agricultural and horticultural holdings in the Dutch FADN. The selection plan contributes to the harmonisation of the samples from different countries in the EU.

The Agricultural census provides the sampling frame for selecting farms to be included in the FADN. Based on the most recent Agricultural census, farms are assigned to strata, which are defined by type of farming and economic size class. Only farms with a Standard Output greater than 25,000 euros are included in the sampling frame.

For each stratum the number of farms to be included in the Dutch FADN sample is determined. This number depends on the economic importance of a sector, the number of farms in a stratum, the policy relevance of a group and the heterogeneity of the farms.

Samenvatting

S.1 Belangrijkste uitkomsten

Voor het boekjaar 2014 zijn 1.512 bedrijfsverslagen aan de Europese Commissie geleverd. Het streefgetal van 1.500 bedrijven is dus gehaald. Data van agrarische bedrijven zijn van groot belang bij de evaluatie van landbouwbeleid en het monitoren van de economische ontwikkeling in de agrarische sector.

In 2015 zijn er in Nederland 63.913 land- en tuinbouwbedrijven actief volgens de CBS Landbouwtelling. Het Nederlandse FADN (Farm Accountancy Data Network) richt zich op bedrijven met een Standaard Output (SO) van 25.000 euro of meer. Deze populatie bestaat uit 47.682 bedrijven in 2015. Deze bedrijven vertegenwoordigen 99% van de nationale productie capaciteit, gemeten in SO.

Voor het boekjaar 2015 zijn 72 nieuwe bedrijven geworven voor deelname aan het FADN. De gemiddelde respons voor ondernemers die gevraagd werden deel te nemen is 20%. Dit gemiddelde wordt sterk beïnvloed door enkele sectoren waarin ondernemer moeilijk te motiveren zijn voor deelname.

Gebaseerd op de monitoring van de resultaten van 2014 en daarvoor, is een verbetering doorgevoerd in het selectieplan van 2015 voor akkerbouwbedrijven en gangbare melkveebedrijven. Vanwege de toenemende bedrijfsomvang in deze bedrijfstypes, is de grootteklasse >500.000 SO gesplitst in twee grootteklassen: 500.000–1.000.000 SO en groter dan 1.000.000 SO. Vanaf 2015 worden de geitenbedrijven als aparte groep onderscheiden in het selectieplan, vanwege het toenemend aantal bedrijven en de beleidsrelevantie onder andere op het gebied van volksgezondheid.

S.2 Achtergrond

Lidstaten zijn verplicht om een netwerk te hebben voor het verzamelen van de boekhoudkundige gegevens van landbouwbedrijven. Deze taak wordt in Nederland uitgevoerd door Wageningen Economic Research in opdracht van het Centrum voor Economische Informatievoorziening (CEI). De doelen van het netwerk zijn om jaarlijks de inkomens van landbouwbedrijven vast te stellen en bedrijfsanalyses uit te voeren. De Europese Commissie vereist dat jaarlijks een selectieplan wordt opgesteld. Dit selectieplan draagt bij aan de harmonisatie van informatienetten in verschillende EU-landen.

De Landbouwtelling vormt het uitgangspunt voor het vaststellen van de steekproef voor het Bedrijveninformatienet. Op basis van de meest recente Landbouwtelling worden bedrijven ingedeeld in strata, die zijn gevormd op basis van het bedrijfstype en de economische omvang. Alleen bedrijven groter dan 25.000 euro SO vallen binnen het steekproefkader.

Voor elk stratum wordt vastgesteld hoeveel bedrijven in de steekproef moeten worden opgenomen. Dit aantal is afhankelijk van onder andere de economische betekenis van de sector, het aantal bedrijven in de groep, de beleidsrelevantie en de heterogeniteit van de bedrijven.

1 Introduction

1.1 Background

In 1965 the European Commission adopted regulation (no. 79/65/EEG) in which member states were obliged to set up a network for the collection of accountancy data on the incomes and business operation of agricultural holdings in the European Economic Community. The purpose of the data network is defined as the annual determination of incomes on agricultural holdings and a business analysis of agricultural holdings. The Netherlands was required to provide financial economic information on 1,500 farms to the European Commission.

For the management of the system, the EU requires information on the selection of farms that are included in the national FADN system. In particular the regulation prescribes the provision of data on the establishment of a selection plan and the recruitment of farms. With respect to the selection plan, in article 6 the regulation EEG 1859/82 prescribes:

> 'Each Member State shall appoint a liaison agency whose duties shall be: …to draw up and submit to the National Committee for its approval, and thereafter to forward to the Commission: the plan for the selection of returning holdings, which plan shall be drawn up on the basis of the most recent statistical data, presented in accordance with the Community typology of agricultural holdings.'

The FADN system was built upon classical survey methodology used to infer population characteristics when limited data were available. The system employs rigorous sampling and bookkeeping methods to ensure the quality and consistency of data and statistical inferences. Such a system requires large amounts of financial and human resources to maintain and often grapples with the problem of nonresponse. Furthermore, due to the lengthy process of sampling and data processing, statistics of the population can only be obtained much later than the reporting period. In the current age of big data and open data, where the advancement of digitalisation and internet based technologies has made more and more data available at relatively lower costs and close to real time, many data scientists now believe that 'big data statistics' may be a better alternative. Proponents of big data believe that big data statistics will eventually replace traditionally survey methods (see e.g., Mayer-Schönberger and Cukier, 2018, p.31). Without knowledge of the EU obligations to maintain the FADN system, one may argue whether it is still necessary to maintain such a system while population statistics can be derived from existing data sources.

Methods based on big data and open data certainly promise to be a good alternative in obtaining more timely population statistics at lower costs. There are however also notable limitations of big data in producing reliable and consistent population statistics due to issues such as selection bias, privacy and opportunity for mischief (see e.g., Couper, 2014). In the current state of development, therefore, large-scale probabilistic survey remains the best approach to obtaining population statistics. It is however important to monitor and evaluate the quality of the sample and at the same time test and evaluate big data methods as well.

1.2 Objective and structure of the report

The objective of this report is to provide background information on the population, the selection plan, the implementation of the selection plan and the quality of the sample of data that are to be provided to the European Commission for the year 2015. The data are the basis for a wide range of national and international research projects.

Chapter 2 gives a description of the background of the Dutch FADN system. Chapter 3 describes the agricultural population. This chapter will also consider the demarcation of the population as used in the Dutch FADN. Also the design of the sample of the Dutch FADN system is described. Chapter 4 gives a detailed account of the selection plan. Chapter 5 provides information on the recruitment of new farms. Chapter 6 provides a qualitative and quantitative evaluation of the sample.

2 Statistical background of the Dutch FADN sample

2.1 Introduction

In the Dutch FADN detailed records of a minimum of 1,500 agricultural and horticultural farms are kept. Besides financial information, a broad set of technical, socio-economic and environmental data are collected. A reason for the Dutch FADN system is the legal obligation to provide information on the financial economic situation of farms to the European Commission. However, an even more important use of the data can be found at the national level. Data from the FADN system are used for many national and international policy evaluations and research projects.

Based on a sample of farms, estimations are made for the whole population. This might raise the question how conclusions can be drawn for the whole population if only a limited number of farms are observed. The answer to this question can be found in proper sampling techniques such as stratified random sampling (Cochran, 1977). The same is true for the FADN sample. Farms that are included in the FADN should be representative of the whole population. In this way a sample can provide even better information than a census (in which all units are observed). With a fixed budget it is much easier to collect good data on a limited number of farms instead of collecting information on all farms. With a limited number of farms and thus a limited number of data collectors, it is easier to ensure good procedures and good training to collect reliable data.

An important issue is how to ensure that the farms in the FADN sample are representative of the whole population. To this end, the Dutch FADN makes use of a disproportional stratified random sample. A *stratified* sample implies that the population is divided into a number of groups (strata). Subsequently farms are selected from each of the groups. The variables that define these groups should be chosen such that the farms within one group are similar (at least with respect to the important aspects). The FADN sample distinguishes groups based on economic size and type of farming. Sampling farms from each group ensures that the sample includes farms from all groups consequently with different characteristics.

Disproportional means that not all farms have the same chance of being included in the sample. Groups which are relatively homogeneous, i.e. having farms that show a high degree of similarity, will have a lower chance of being included in the sample. After all, if all the farms are very similar, a limited number of observations would be sufficient to draw reliable conclusions (in the extreme case that all farms are exactly identical, it would be enough to have only one observation). In case of less homogeneous groups it is important to have a larger number of observations to make reliable estimates. The choice of the stratification variables has therefore an important impact on the quality of the sample.

This way of sampling enables unbiased estimates to be made for the whole population of farms. Stratification assures that all groups are properly represented, thereby allowing separate estimations for all groups. All groups together make up the whole population. In the FADN this is achieved by assigning a weight to each sample farm. The weight is calculated by dividing the number of farms in a group in the population by the number of sample farms in the same group.

Stratification also improves the representativeness of the sample in case of non-response. If a farm which is asked to join the FADN system refuses, another farm in the same size class and of the same type of farming is selected. If there is a difference between the selection plan and the actual implementation, stratification helps to improve the representativeness by taking into account the real sampling fraction.

Finally, stratification makes maintenance of the sample easier. Due to attrition and changes in the population it is sometimes necessary to supplement certain groups. Stratification makes a more focused replacement possible.

The relationship between the agricultural population and the FADN sample is presented in Figure 2.1. The Agricultural census provides an almost complete description of the agricultural population. Part of this census or part of this population is defined as the field of observation in the FADN.

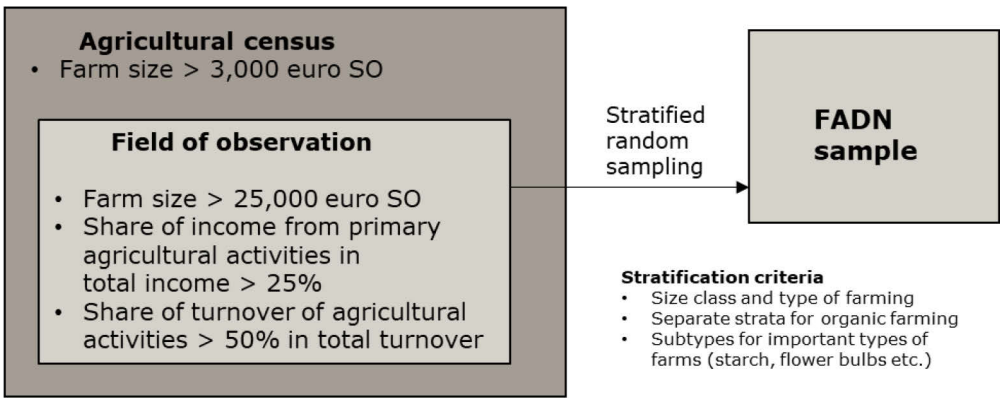

Figure 2.1 *Agricultural population and the FADN sample*
Source: Based on Vrolijk et al. (2009).

Output measure
For determining the economic size of a farm, the Standard Output is used. Standard Output refers to the standard value of gross production. The Standard Output (SO) of an agricultural product (crop or livestock) is the average monetary value of the agricultural output at farm gate price, in euros per hectare or per head of livestock. The sum of all the SO per hectare of crop and per head of livestock in a farm is a measure of its overall economic size, expressed in euros. At the EU level, there is a regional SO coefficient for each product, as the average value over a reference period (5 years). The Netherlands consists of one region.

Lower threshold
A lower threshold of 25,000 euros of SO is applied for the field of observation. This threshold has been specified in the legislation underlying the FADN. The historical background was to distinguish small farms which were only held as a hobby or as a side activity from real commercial farms producing for the market. Although the number of farms excluded from the field of survey is quite substantial, the percentage of production value which is not covered due to this threshold is very limited (Table 3.1).

Other income sources
For practical and methodological reasons a limitation on 'other income of the holding' is used. Clear rules have been specified whether a firm belongs to the field of observation or not. A firm should have at least 25% of the turnover from primary agricultural activities. And agricultural activities - in the broadest sense, including other gainful activities - should be the largest share of turnover of the holding.

Stratification criteria
Given the abovementioned criteria, the field of observation of the FADN system is defined. Within this field of observation a stratification scheme is used. The stratification of the Dutch FADN is based on the economic size of the farm and type of farming. Although these criteria are similar to those used by the Commission, a more detailed look reveals substantial differences with the EU stratification. Differences are for example the use of separate strata for organic farming, and in several types of farming more detailed subtypes of farming are specified which are relevant for Dutch Agriculture (for example starch potato farms, flower bulb farms and horticultural farms by type of production).

The size classes for the strata vary across types of farming. The size distribution of, for example, horticultural farms is completely different from the size distribution of arable farms. For 2015 this is illustrated in Figure 2.2. This figure shows that 99% of all arable farms are smaller than 1,000,000 euros of SO, while almost 88% of the tomato firms are larger than 1,000,000 euros of SO (the dashed line marks the 1,000,000 euros of SO level). To take these differences into account, the borders of the size classes have been established for each type of farming separately. The borders have to meet the criteria prescribed by the EU. Despite this complication the strata are still a cross section between types of farming and size classes.

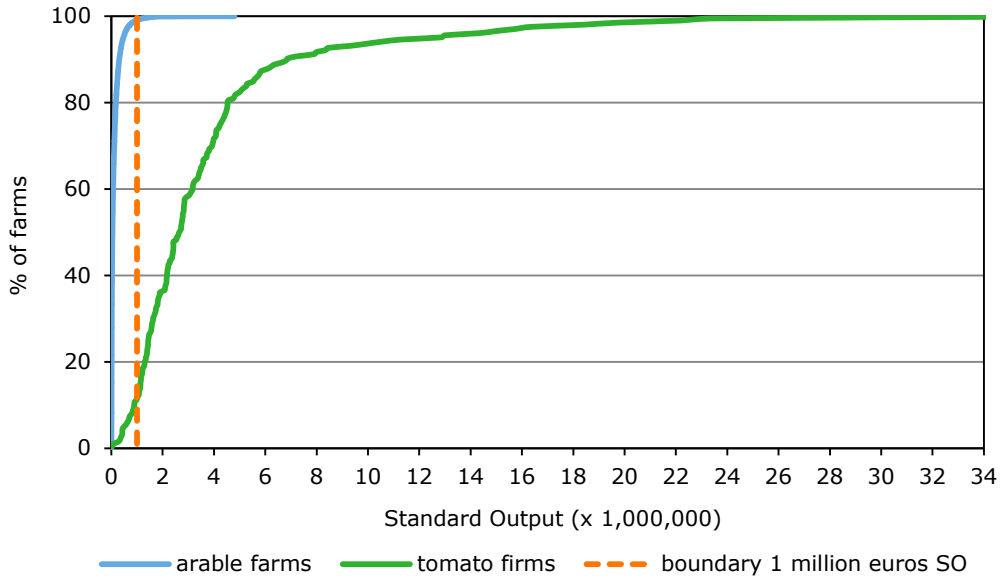

Figure 2.2 *Distribution of arable farms and tomato firms in 2015*
Source: Agricultural census, Statistics Netherlands, calculations Wageningen Economic Research.

2.2 Sampling and recruitment processes

Figure 2.3 presents an overview of the sampling and recruitment processes. The Agricultural census from Statistics Netherlands (CBS) is the starting point for the random sampling of farms. The random sampling takes place based on the selection plan as submitted to the European Commission. The selection plan will be further described in Chapter 4. Based on the selection plan, farms from the Agricultural census are randomly drawn. This census (as available to researchers) does not contain addresses but only farm identifiers. The farm addresses from the selected farms are provided by the Ministry of Agriculture, Nature and Food Quality. Farm identifiers are coupled to their addresses and forwarded to the regional offices that are responsible for contacting farmers to request their participation. The farmers may refuse or accept the request to participate. If farmers agree to participate, authorisations are collected and forwarded to the central office in The Hague. These authorisations are used to receive electronically available information from banks, suppliers, governmental institutions and others. The information on the acceptance and refusal of farmers is also used to verify the quality of the sample (see Chapter 6).

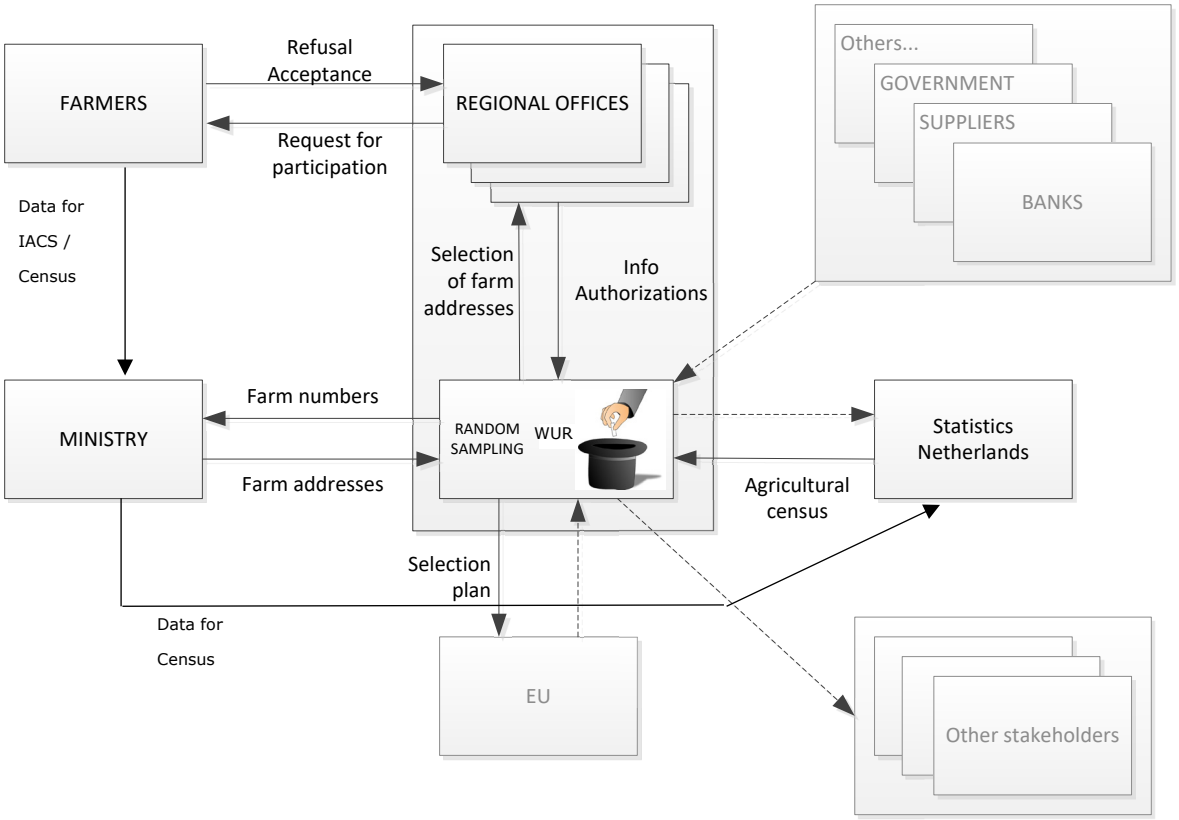

Figure 2.3 *Sampling and recruitment processes*
Source: Vrolijk et al. (2009).

3 Population

3.1 Introduction

This chapter describes the population or, more precisely, the field of observation as covered by the FADN sample. Section 3.2 covers the lower threshold and the consequences of its application. Section 3.3 describes the strata which are used to divide the population and reports the number of farms in each of the strata in the population.

3.2 Field of observation

Collecting detailed information at farm level requires considerable time and money. To assure an efficient and effective allocation of the available budget, the sample design focuses on certain groups in the population.

In 2015, a lower threshold of 25,000 euros of SO implied that more than 16,000 farms were not covered by the FADN sample. Although the number of these farms is large, they are only responsible for less than 1% of the total production capacity expressed in SO. The 2015 population (field of observation) of the Dutch contribution to the EU FADN system is presented in Table 3.1.

Table 3.1 *Number of farms and their relative economic importance (measured in Standard Output - SO) in the 2015 Agricultural census*

	Number of farms	Percentage of farms (%)	Percentage of SO (%)
All farms in the Agricultural census (a)	63,913	100.00	100.00
Farms less than 25,000 euros of SO (b)	16,231	25.40	0.86
Total of covered farms (a) - (b)	47,682	74.60	99.14

Source: Agricultural census, Statistics Netherlands and FADN, calculations by Wageningen Economic Research.

3.3 Stratification scheme

The Dutch FADN farm types differ in its degree of details from the European FADN (FADN, 2012): some farm types are not present in Dutch agriculture (e.g. olives, citrus fruits) and some types are further detailed (such as starch potatoes within arable farming). For a number of types of farming a distinction is made between organic farming and non-organic farming. In line with the existing stratification, a number of types of farming were selected where organic farming is especially relevant. Because the number of organic farms is low in several strata of the population, a number of organic strata have been combined: 'field crops', 'field vegetables' and 'combined crops' have been integrated in one farm type 'organic crops'.

Farming type 'field crops' has been itemised in 'starch potatoes', 'organic crops' and 'other field crops'. The dairy farms are split into 'organic dairy farms' and 'non-organic dairy farms'.

Table 3.2 presents the number of farms in the 2015 population according to size class and type of farming. In total 23 types of farming are distinguished. The number of size classes within a type of farming in 2015 ranges from 4 to 6. The table shows that 47,682 farms fall within the field of observation. Dairy farms are clearly the largest group of farms. About one in every three farms is classified as a dairy farm.

Table 3.2 *Stratification of the Dutch FADN sample 2015, including the number of farms per stratum according to the 2015 Agricultural census*

Lower boundary (k€ SO)	25	50	100	250	500	1,000	1,500	3,000	Total
Upper boundary (k€ SO)	**50**	**100**	**250**	**500**	**1,000**	**1,500**	**3,000**	**infinity**	
Type of farming									
Field crop farms									
- Starch potatoes	295		320	92	29				736
- Organic crops	86		106	61	41				294
- Other field crops	3,065		1,938	1,010	388	110			6,511
Horticulture									
Vegetables under glass	76		239		181	110	181	149	936
Flowers under glass	76		362		234	121	169	92	1,054
Plants under glass	34		169		128	85	143	155	714
Field vegetables	237		368		109	87			801
Fruit	341		449	414	171				1,375
Tree nursery	636		987		255	190			2,068
Flower bulbs	98		247		104	123			572
Other horticulture	357		694		217	250			1,518
Grazing livestock									
Dairy organic	10		141	160	47				358
Dairy non-organic	621		4,598	8,406	2,331	247			16,203
Calf fattening	166		531		356	168			1,221
Goats	14	20	92	146	58				330
Other grazing livestock	2,953	1,548	596	119	62				5,278
Intensive livestock									
Pig rearing	26		82	247	310	228			893
Pig fattening	319		488	316	319	274			1,716
Combined pig rearing and fattening	14		40	109	259	304			726
Consumption eggs	28		221		205	208			662
Broilers	7		74		131	251			463
Other intensive livestock	21		192		211	184			608
Other									
Combined	757		629	595	489	175			2,645
Total									47,682

4 Selection plan

4.1 Introduction

For the Dutch FADN, the allocation of the total capacity of sample farms is based on the relative importance and the heterogeneity of the different types of farming (see Dijk et al., 1995 and Vrolijk and Lodder, 2002). To ensure that the FADN sample adequately reflects the heterogeneity of farms in the field of observation, the field of observation is stratified before the sample of farms is selected.

4.2 Selection plan

The EU selection plan guidelines[1] specify the clustering rules, i.e. the aggregations of cells per type of farming when they contain very few or no farms in the field of observation. Following the guidelines, several adjacent economic size classes have been combined. Optimal allocation (distribution of sample capacity over the different strata based on the heterogeneity and number of farms within a strata) has been applied (Levy and Lemeshow, 1991).

The selection plan 2015 is provided in Table 4.1. Given the goals of the FADN system the numbers provided in the table are the required number of observations per type of farming. Compared to the previous year, the distribution of vegetables under glass over the sub-types has changed. This is related to changes in the distribution in the population.

Due to changes in the scale of production of the farms, the distribution of the farms over the size classes has changed slightly compared to 2014. For the farm types 'other field crops' and 'non-organic dairy', the size class >500,000 SO is split into two size classes: 500,000 – 1,000,000 SO and > 1,000,000 SO.

From 2015 onwards goat farms are separated from the other grazing livestock. This is because of the increasing number of goat farms in The Netherlands and the policy relevance for the government with regard to human health.

[1] http://ec.europa.eu/agriculture/rica/annex004_en.cfm#clustering

Table 4.1 *Selection plan per stratum*

Lower boundary (K€ SO)	Code	25	50	100	250	500	750	1,000	1,500	3,000	Total
Upper boundary (K€ SO)		50	100	250	500	750	1,000	1,500	3,000	infinity	
Type of farming											
Field crop farms	*1*										*210*
- Starch potatoes		5		12	11		2				30
- Organic crops		6		13	6		5				30
- Other field crops		28		38	48		25	11			150
Horticulture	*2 + 3*										
Vegetables under glass	2111	3		32			24	17	24	30	130
Plants under glass	2122	3		7			14	8	14	19	65
Flowers under glass	2121	5		25			33	17	24	14	118
Field vegetables	2210	6		23			10	11			50
Fruit	3630	4		7	15		12				38
Tree nurseries	2320	5		18			14	23			60
Flower bulbs	2221	3		8			10	16			37
Other horticulture	2131, 2310, 2331, 3500, 3699	5		6			18	16			45
Grazing livestock	*4*										
Dairy	*4500*										*330*
Dairy organic		1		15	10		4				30
Dairy non-organic		5		73	135		67	20			300
Calf fattening	4611	3		9			16	12			40
Goats	4830	2	2	11	4		4				23
Other grazing livestock	4612, 4810, 4841, 4842, 4843	10	10	2	14		4				40
Intensive livestock	*5*										
Pig rearing	5111	1		4	13		17	13			48
Pig fattening	5121	1		12	7		11	17			48
Combined pig rearing and fattening	5131	1		6	5		10	16			38
Consumption eggs	5211	3		5			10	12			30
Broilers	5221	1		4			10	15			30
Other intensive livestock	5231, 5301	1		9			10	10			30
Combined	6, 7, 8	8		13	22		25	22			90
Total											1,500

5 Recruitment of farms

5.1 Basic principles

In October 2014, an assessment was made of the farms available for the FADN system for 2015 (considering farms dropping out of the system). The recruitment of new farms for the year 2015 took place from November 2014 to January 2015.

5.2 Recruitment of farms

Based on the available number of farms in the FADN sample and the expected number of farms ending their participation before or during the period of data collection an estimate was made of the number of farms to be recruited. Furthermore, the variant of accounting has been explicitly considered. Poppe (2004) described that the introduction of a new accounting system and budget cuts resulted in a large pressure on available capacity. To deal with this pressure, a flexible data collection system has been introduced with two main variants in the data collection: the EU variant and the Corporate Social Performance (CSP) variant. In the EU farm-income variant the most essential financial economic information is collected. This is the information that each member state is obliged to provide to the EU FADN. The information covered in this variant mainly focuses on family farm income, the balance sheet, a limited number of technical data (cropping pattern, livestock) and information on EU subsidies. In the second variant, the CSP variant, a wide range of data is collected for EU and national purposes. It covers all the topics that are nowadays considered relevant in a report on the sustainability of a company or a farm. Therefore, besides the financial economic information as collected in the EU variant, a wide range of data is collected such as environmental data, other farm incomes, animal welfare, animal health and the level of innovation of firms. The relevance for these topics is widely recognised. The FLINT project investigated the position of the FADN with respect to these topics and made a plan to implement the indicators in the FADN (Poppe and Vrolijk, 2016).

An evaluation has been made of the policy and research relevance of sectors and based on this importance a decision has been made whether a type of farming is assigned to the EU variant, the CSP variant or a combination of both.

Based on the number of farms to be recruited in the CSP variant, the 2015 farms were randomly selected from the 2014 Agricultural census. The random draw of farms took place per stratum. The number of farms drawn per stratum was 10 times higher than the required number of farms to ensure enough addresses, even with a high non-response rate in specific types of farming. Using these addresses, farms were contacted and asked to participate in the FADN.

For the accounting year 2015, 72 new farms were recruited in the CSP variant. The average response rate is 20%. The reasons behind the non-response are diverse, ranging from no interest or no time to privacy issues. As shown in Table 5.1, 40 farms (10% of farms that were contacted) were considered unsuitable for various reasons (for example the farm has stopped or will stop, or the farm is very complex). The response rate is on average 20%, but varies significantly per farm type.

Table 5.1 *Response rate in different types of farming, recruitment for CSP variant, 2015*

Farming types a)	Number of refusals	Recruited farms	Unsuitable farms	Total farms	Unsuitable %	Response %
Field crops						
- Starch potatoes	13	2	6	21	29	13
- Organic crops	6	3	2	11	18	33
- Other field crops	41	14	8	63	13	25
Horticulture						
Vegetables under glass						
- Sweet pepper	3	0	0	3	0	0
- Tomato	25	4	1	30	3	14
Flowers under glass	84	25	11	120	9	23
Plants under glass	31	8	3	42	7	21
Field vegetables	37	2	3	42	7	5
Intensive livestock						
Pig rearing	1	2	0	3	0	67
Pig fattening	33	5	5	43	12	13
Combined pig rearing and fattening	17	7	1	25	4	29
Total	291	72	40	403	10	20

a) Only farming types with recruiting activities are displayed.

To develop a better understanding of the reasons for non-response, a number of questions were asked to all farmers approached. Figure 5.1 shows the results for the questions asked during the recruitment for 2015. In these questions the farmer had to indicate to which extent he/she agrees with a statement about his/her knowledge or attitude. The graph shows a clear difference between those farmers who are willing to cooperate and those who are not (all differences are significant). The ones who are willing to participate are more informed about the activities of Wageningen Economic Research. Providing data and the FADN system are considered more useful by those who are willing to participate. The opinion about Wageningen Economic Research with respect to objectivity and carefulness is higher among the participants.

Using the same variables, discriminant analysis was applied to find the factors that are most discriminating between farmers who are willing to participate and farmers who refuse to participate. The analyses of the attitude of farmers show that 'usefulness of providing data' is the most important factor in predicting the participation of an individual farmer. The next important factors are 'Usefulness of FADN system' and 'Carefulness of Wageningen Economic Research'; collected data are handled confidentially. These results are in line with previous recruitments (Vrolijk et al., 2009). Compared to some other years trust in the government is not a strong predictor.

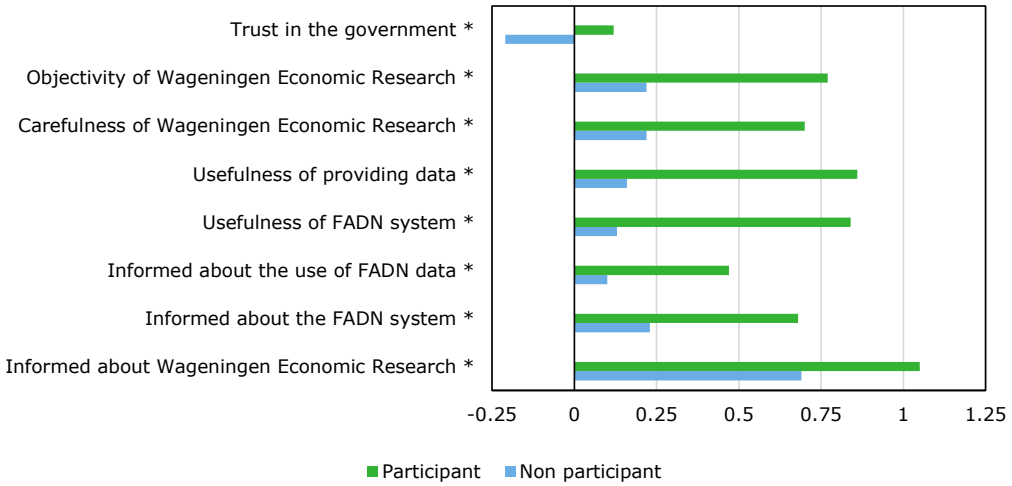

Figure 5.1 *Attitude of farmers (-2 = disagree, 2 = agree), 2015*
** = Significant difference*

Table 5.2 describes the number of farms where accounts were completed for the first time for the accounting year 2015. Due to several factors this is not exactly the same as the number of newly recruited farms. There are three reasons for these differences. First, farms can drop out during the first year of participation or even right after recruitment. On second thought farms who were recruited, withdraw their participation. Or the quality of their accounting is too poor to process. Second, this table includes the farms in the EU variant as well. And third, the farm type and size can be different in the year of accounting compared to the year of selection.

Table 5.2 *Number of farms with 2015 as first year of completion of accounting, recruited for EU or CSP variant*

lower boundary (k€ SO)	25	50	100	250	500	1,000	1,500	3,000	Total
upper boundary (k€ SO)	50	100	250	500	1,000	1,500	3,000	infinity	
Type of farming									
Field crops									
- Starch potatoes	1		0	1	0				2
- Organic crops	0		2	0	0				2
- Other field crops	3		3	2	0	0			8
Horticulture									
Vegetables under glass									
- Sweet pepper	0		0		0	0	2	0	2
- Tomato	0		0		0	0	3	1	4
- Other	0		0		1	2	0	0	3
Flowers under glass	1		1		2	1	0	3	8
Plants under glass	0		0		2	0	2	0	4
Field vegetables	0		7		2	1			10
Fruit	0		0	0	2				2
Tree nursery	0		4		0	1			5
Flower bulbs	0		1		0	0			1
Other horticulture	0		0		1	0			1
Grazing livestock									
Dairy organic	0		0	16	0	0			16
Calf fattening	0		0		0	1			1
Goats	0	0	1	1	0				2
Intensive livestock									
Pig rearing	0		0	0	0	1			1
Pig fattening	0		0	0	2	2			4
Combined pig rearing and fattening	0		1	0	2	1			4
Broilers	1		1		0	0			2
Other									
Combined	1		0	1	1	0			3
Total									85

a) Only farming types with farms with first year of completion of accounting are displayed.

A comparison of the field of observation (population) and the sample available for research purposes in 2015 is presented in Table 5.3. In 2015, the total number of farms which are available for research is 1,513. This means that there is one extra farm available for research in comparison with the number of farms delivered to the EU. This is because one farm was not sent to the EU because its farm report was finalised after the deadline of the EU. More detailed data available for research can be drawn from a sample of 1,247 farms (CSP variant).

Table 5.3 *Number of farms in the population and sample according to the EU and CSP variant, 2015*

Type of farming	Number of farms		
	Population	Total sample (EU+CSP)	CSP
Field crops			
- Starch potatoes	736	29	28
- Organic crops	294	34	33
- Other field crops	6,511	149	144
Horticulture			
Vegetables under glass			
- Sweet pepper	175	23	23
- Cucumber	143	23	23
- Tomato	205	27	26
- Other vegetables under glass	413	35	34
Flowers under glass	1,054	115	110
Plants under glass	714	62	59
Field vegetables	801	45	35
Fruit	1,375	47	38
Tree nursery	2,068	55	26
Flower bulbs	572	38	34
Other horticulture	1,518	58	26
Grazing livestock			
Dairy			
- Organic	358	35	35
- Non-organic	16,203	316	261
Calf fattening	1,221	48	37
Goats	330	30	29
Other grazing livestock	5,278	37	20
Intensive livestock			
Pig rearing	893	44	42
Fattening pigs	1,716	50	44
Pig fattening	726	42	40
Consumption eggs	662	31	28
Broilers	463	29	29
Other intensive livestock	608	25	1
Combined	2,645	86	42
Total	47,682	1,513	1,247

5.3 Delivery of farm results to the European Commission

The final delivery of 2015 data to the EU has taken place in December 2016. The target number of 1,500 farms has been reached. Data of 1,512 farms for the accounting year 2015 have been provided to and have been accepted by the European Commission (Figure 5.2). The total number of farms in the sample was 1,513 (Table 5.3). The difference between the number of farms in the sample and the number of farms delivered to the European Commission, was caused by one farm which was delivered after the deadline.

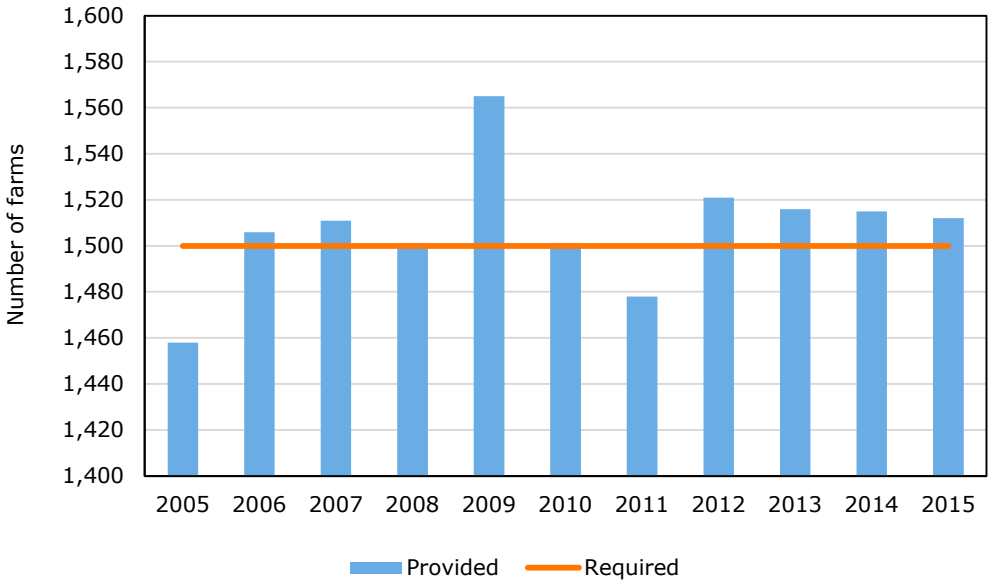

Figure 5.2 *Number of farms with completed farm reports provided to the European Commission*

6 Evaluation of the sample

6.1 Introduction

In this chapter the FADN sample for the year 2015 is evaluated both qualitatively and quantitatively. Section 6.2 provides an evaluation of the methodology of stratification and weighting. A crucial element is the calculation of weights. Section 6.3 provides the quantitative evaluation. This section focuses on the quality of the estimations based on the sample. This chapter is based on the standard approach of making estimations based on weights assigned to farms.

6.2 Evaluation of stratification and weighting

6.2.1 Introduction

This section deals with some practical problems related to the estimation process. Weights of individual farms are used to make estimations of frequencies, totals and averages of groups of farms (aggregated results) based on the data from the Agricultural census and the FADN data.

The method to calculate the weights of individual farms is crucial. The goal is to achieve unbiased estimates with a minimal variance. This enables the estimation of the confidence interval of the real population value and the minimisation of the total error. This is true for direct estimators. In the case of a ratio estimator this is not necessarily true, but ratio estimators are outside the scope of this publication (see Vrolijk et al., 2002, for a more extensive description of ratio estimators and other estimators).

6.2.2 Method of calculation of weights

The objective of the Dutch FADN system is to give a representative view of the total population. The question is therefore how to draw conclusions on totals, averages and frequencies that are valid for the whole population based on individual farm data. For example, how much is the average family farm income of all farms in agriculture and horticulture? The practical solution is found in weighting: the individual farm data are raised to the population level (for some variables the estimated values can be compared to the data that are available for the whole population, i.e. data which are included in the yearly Agricultural census). A weight is assigned to every observed farm in the FADN system. The weight is defined as the ratio between the number of farms in a stratum according to the Agricultural census and the number of farms in the sample (in the FADN system). The population in a specific stratum is continuously changing. Therefore the sample and population farms that belong to a stratum in year 2015 are not exactly the same as the farms that belong to that stratum in year 2014. The stratification and post-stratification of the farms in 2015 is based on the 2015 Agricultural census. Due to these changes, farms included in one stratum could have had different inclusion probabilities at the time of recruitment. In theory, to achieve unbiased estimators these differences in inclusion probabilities should be taken into account in the estimation process. However, the consequence of this would be a very complicated system with many different substrata with different inclusion probabilities. Therefore this complicated procedure is not applied. As a result, the theoretical assumption of a strictly random sample cannot be validated.

Although the calculation method applied in practice can lead to systematic distortions between estimated values and true values, the assumption of a random sample is made. This leads to several practical advantages. The method to calculate weights is relatively easy, involving a limited set of homogeneous strata and resulting in a more effective use of data. A detailed discussion on the calculation of different weights and the resulting population estimates can be found in Appendix 1 of the 2012 report (Van der Veen et al., 2014).

Because of the applied sampling procedure (see Section 2.1) the different strata have different sampling fractions. Strata with relatively homogeneous units have a lower sampling fraction than very heterogeneous strata. This also implies that farms have very diverging weights. Farms from a homogeneous cluster will have a larger weight (in principle the reciprocal of the sampling fraction) and therefore represent a larger number of farms. The differences in sampling fractions are shown in Table 6.1. These percentages are calculated by dividing the required number of farms in the selection plan (Table 4.1) by the number of population units (Table 3.2).

Table 6.1 *Sampling fractions in different strata (2015 sample)*

lower boundary (k€ SO)	25	50	100	250	500	1,000	1,500	3,000
upper boundary (k€ SO)	50	100	250	500	1,000	1,500	3,000	infinity
Type of farming								
Field crops								
- Starch potatoes	0.02		0.04	0.12	0.07			
- Organic crops	0.07		0.12	0.10	0.12			
- Other field crops	0.01		0.02	0.05	0.06	0.10		
Horticulture								
Vegetables under glass	0.04		0.13		0.13	0.00	0.09	0.16
Plants under glass	0.04		0.02		0.06	0.00	0.05	0.15
Flowers under glass	0.15		0.15		0.26	0.00	0.12	0.15
Field vegetables	0.03		0.06		0.09	0.13		
Fruit	0.01		0.02	0.04	0.07			
Tree nursery	0.01		0.02		0.05	0.12		
Flower bulbs	0.03		0.03		0.10	0.13		
Other horticulture	0.01		0.01		0.08	0.06		
Grazing livestock								
Dairy organic	0.10		0.11	0.06	0.09			
Dairy non-organic	0.01		0.02	0.02	0.03	0.08		
Calf fattening	0.02		0.02		0.04	0.07		
Goats	0.14	0.10	0.12	0.03	0.07			
Other grazing livestock	0.00	0.01	0.00	0.12	0.06			
Intensive livestock								
Pig rearing	0.04		0.05	0.05	0.05	0.06		
Pig fattening	0.00		0.02	0.02	0.03	0.06		
Combined pig rearing and fattening	0.07		0.15	0.05	0.04	0.05		
Consumption eggs	0.11		0.02		0.05	0.06		
Broilers	0.14		0.05		0.08	0.06		
Other intensive livestock	0.05		0.05		0.05	0.05		
Combined	0.01		0.02	0.04	0.05	0.13		
Total								

6.2.3 Remarks on the weights

In the calculation of aggregate results (averages, frequencies and totals) for the year 2015, the 2015 Agricultural census is the starting point. Because of the registration of farms in the population (almost all farms are registered in the Agricultural census) the aggregate numbers of farms are exactly the same as the numbers of farms in the census. However, in using these numbers in the calculation of weights for estimations for 2015 two remarks should be made.

First, the registration of horticultural and agricultural farms in the Agricultural census represents the situation at a certain moment during the year. The actual number of farms may therefore differ from the number of farms registered in the census for various reasons. For example, it is possible that farms are missing from this registration, even though the statistical office tries to correct for that. This can cause underestimations of aggregates. Furthermore, the number of farms tends to decrease significantly during a year (this trend is not as strong for all types of farms), which can cause overestimation of aggregates.

Second, the typology of farms according to the Agricultural census might differ from the typology according to the FADN data as well, due to the same fact that the census reflects the situation at a certain point in time, while the FADN system describes the farm during a whole year.

In order to take these differences into account two weighting methodologies are available in the Dutch FADN system: one based on the typology according to the census and the other based on the typology according to the FADN system. From a theoretical point of view, weighting based on the characteristics of the farm in the census is more appropriate: since the census is used as the sampling frame, the weights should reflect information from this sampling process. This essentially ignores differences in the typology and size of farms registered in the census and in FADN. In the quantitative evaluation of the sample the weighting is based on the typology according to the census.

6.3 Quantitative evaluation of the 2015 sample

6.3.1 Introduction

This section focuses on the quality aspects of the 2015 FADN sample like coverage, representativeness and reliability of estimates. Section 6.3.2 provides information on the coverage of the sample; the coverage compares the total population as described by the census and the field of observation of the FADN sample. Section 6.3.3 analyses the extent to which distortions might occur between the sample and the population due to over or under representation of farms with specific characteristics; it compares the characteristics of the field of observation and the actual FADN sample. Section 6.3.4 provides information on the reliability of estimates based on the FADN sample.

6.3.2 Coverage

It is desirable to have a sample that represents the population as accurate as possible. A clear distinction should be made between the coverage and the representativeness. This section describes the coverage, Section 6.3.3 deals with the representativeness. To get an idea about the extent to which the total population is covered by the sample it is relevant to distinguish several aspects. Farms that are too small or are not registered in time are not part of the Agricultural census. The sampling frame is the basis for the choice of sample farms and consists of farms registered in the Agricultural census that fulfil the size criteria: larger than 25,000 euros of SO. From this sampling frame the sample is drawn (compare Figure 2.1).

Table 6.2 presents some characteristics for the total sample for example: area of crops, number of animals and labour. A comparison is made between the farms in the sampling frame (all the farms that have a chance of being included in the FADN sample) and the total population as described by the Agricultural census. The sampling frame covers the population to a large extent. For example with respect to size (calculated in euros of SO), the coverage is 99% (Table 3.1).

Table 6.2 *Coverage of the sample compared to Agricultural census, 2015*

Selected characteristics of the sample a)	Number according to census	Covered by sampling frame ≥25,000 SO (%)
Farms	63.913	74,6
Standard output (million euro)	21.434	99,1
Total labour (AWU)	156.409	91,2
Family labour (AWU)	91.208	87,2
Paid labour (AWU)	65.201	96,8
Area (hectare)		
Agricultural area	1.858.860	94,9
Grassland	779.141	93,0
Arable crops	980.047	96,0
Vegetables open air	23.315	99,6
Tree nurseries	9.051	99,0
Flower bulbs	24.842	99,9
Fruit growing	19.708	99,4
Vegetables under glass	4.755	100,0
Ornamental plants	3.727	100,0
Number		
Dairy cows	1.621.767	100,0
Fattening calves	909.230	99,9
Breeding pigs	1.201.385	100,0
Fattening pigs	5.803.696	100,0
Broilers	49.107.172	100,0
Laying hens	47.684.421	100,0

a) Main crops and livestock are listed, not farming types.

Source: Agricultural census, Statistics Netherlands, processed by Wageningen Economic Research.

6.3.3 Representativeness

Because of the stratification scheme, the sample will provide a good representation of the population on the main characteristics (stratification variables) at the beginning of a year. During the year farms might drop out of the sample and changes might occur in the population. Despite these changes the representativeness is maintained by applying post-stratification on the resulting sample and the changed population. Representativeness with respect to the stratification variables does not necessarily imply that the sample is representative for all variables. Such full representativeness is impossible unless the sample size approximates the whole population or all variables highly correlate with the stratification variables.

It appeared that the number of farms within horticulture under glass has diminished. However we know that part of these farms still exist, but are not registered in the Dutch Agricultural census. This implies that they are not part of the sample population of the census. The reason for this is that from 2015 onwards farms are identified based on the register of the Chamber of Commerce. Not all farms are recognisable as a farm in this register (especially greenhouse farms). The identification based on Chamber of Commerce data started in 2015, but was implemented fully in 2016. This development is monitored and action will be taken if necessary. The expectation is that from 2017 onwards the situation will improve. Because of the CO_2 emission registration, greenhouse farms do have an incentive to register in the Agricultural census as well.
In FADN, farms with multiple registration numbers are treated as one farm if this farm cannot be separated administratively. In the Agricultural census these farms appear as multiple farms.
The representativeness can be analysed by comparing the results estimated from the sample using the post-stratification weights (based on the census typology) and the results calculated based on the census. For example the average size of a farm measured in SO (as registered in the census) can be compared, or the average acreage of different crops or number of animals.

Table 6.4 shows to what extent the sample is representative for a number of variables in the Agricultural census. The variables analysed are the size of different agricultural activities per farm measured in SO or physical units. The averages per farm of these variables calculated from the census are compared with the averages estimated from the sample using the post-stratification weights. If the absolute difference between the calculated population average and the estimated average is greater than twice the standard error of the estimates, the difference is considered statistically significant and indicated by an asterisk next to the specific variable. When this occurs, i.e., the estimates significantly differ from the population average, it is considered less likely that the difference can be explained by sampling errors alone with regard to these variables. Attention should then be paid to the assessment and control of non-sampling errors such as non-response bias and data-handling errors.

Table 6.4 shows some significant differences between the census and sample. Although the absolute differences are small in most cases, they are nevertheless significant. The cause can be due to the small standard error of the estimates. This suggests the possibility of non-sampling error. Consider the relatively low responses in certain farm types and strata, the possibility and extent of non-response bias should be assessed using recruitment records. Estimates from the sample using the post-stratification weights and the results calculated based on the census can be used for monitoring the quality of the sample. For example the average size of a farm measured in SO can be compared or the average acreage of different crops or number of animals. Based on the monitoring of the results of 2014 and before, an improvement for accounting year 2015 onwards is made for dairy and arable farms. In tree nurseries an improvement has to be made as well. Some subtypes of tree nurseries are less represented in the sample than others. This is caused because sampling is based on types and not on subtypes. To improve the representativeness for tree nursery, the process of the actual recruitment of farms will be adopted and not the selection plan, since this is based on farm types and not on subtypes. So comparing the census results and sample estimates can provide insights into potential improvement of representativeness.

Table 6.4 gives a description for the whole population without distinguishing farm types and assuming that the activities are carried out by all farms. As farms typically produce only a limited number of products, the average sizes do not reflect the actual situation of any particular type of farming. In case of research projects on specific types of farming, similar tables could however be generated for farms of that particular type of farming.

A comparison between the sample and the population as registered in the Agricultural census does not fully answer the question whether estimations of financial, economic and technical characteristics are bias free. Quality of farm management for example is not recorded in the data and thus cannot be statistically tested. Thus it is possible that farms with relatively good or bad management skills and therefore performance are over represented in the sample.

Table 6.3 *Comparison of farms in the Agricultural census and farms in the sample (Dutch FADN)*

Variable	Average size per farm 2015		Significant (5%)
	Census (≥ 25,000 euro SO)	Sample	
Size in standard output (SO)			
Total	445,659	447,095	
Arable crops	46,925	49,428	*
Grassland	16,564	16,301	
Horticulture open air	52,752	55,758	
Horticulture under glass	99,737	83,964	*
Dairy	97,919	105,080	*
Veal	14,073	14,910	
Fattening pigs	29,935	30,022	
Breeding pigs	23,475	23,713	
Broilers	13,491	14,151	
Laying hens	13,922	12,196	
Size in hectare (ha)			
Total area	37.01	38.14	
Arable crops	19.73	21.11	*
Tuberous and root crops	4.48	4.78	
Permanent grassland	13.92	13.70	
Horticulture open air	1.89	2.11	*
Vegetables open air	0.43	0.48	
Tree nursery	0.33	0.26	
Flower bulbs	0.52	0.74	*
Fruits	0.41	0.39	
Horticulture under glass	0.19	0.16	*
Vegetables under glass	0.10	0.07	*
Ornamental plants	0.04	0.04	
Annual working hours			
Total paid labour	1.76	1.75	
Total male labour	1.32	1.13	*

Source: Agricultural census, Statistics Netherlands and FADN, calculations by Wageningen Economic Research.

Figure 6.1 compares the average farm size (SO or hectare) in the sample and the census for multiple years (Appendix 1 shows a more detailed table). Last couple of years, the farms size in the sample is overestimated (grassland and horticulture under glass exempted). It appeared that a bigger share of the farms in the sample have a farm size closer to the upper limit of a stratum than to the lower limit. In 2015 the difference came closer to 100%, meaning that the representativeness improved. For horticulture under glass the sample is an underestimation. This is because it is hard to recruit the big horticultural firms for participation in FADN. This development will be monitored. If necessary action will be taken to improve this.

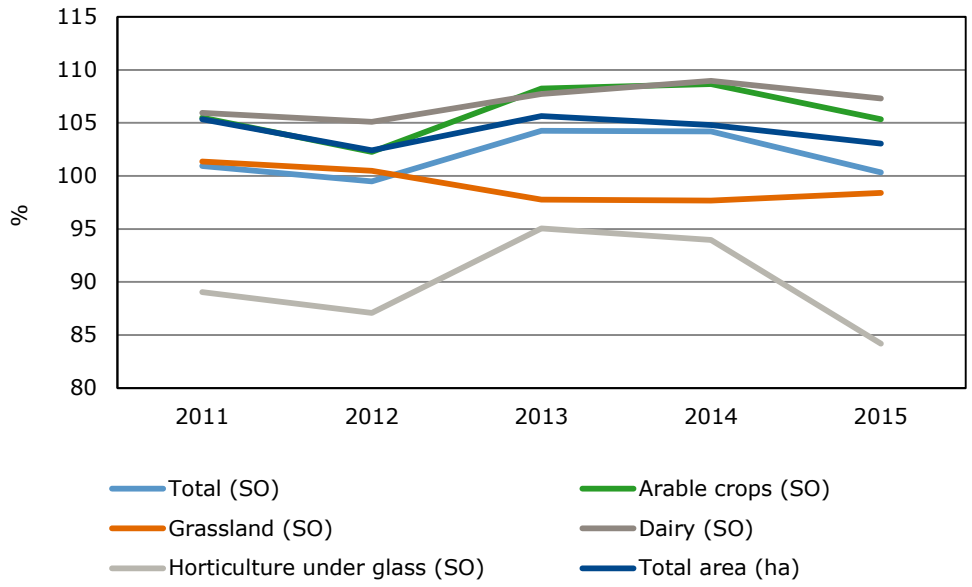

Figure 6.1 *Relative difference in farm size in Dutch FADN in comparison with the Agricultural census*

6.3.4 Reliability

The previous subsection provides some indicators whether there are systematic differences between the sample and the population (representativeness of sample). This section focuses on the reliability of the estimates.

The calculation of averages of groups based on sampling units implies that there can be differences between the estimated value and the true population value. These differences may occur due to the random selection of units to be included in the sample. Table 6.4 provides an indication of the level of precision of the estimates for a set of important goal variables in the 2015 sample.

This section provides the reliability of estimates for a number of important goal variables for different types of farming. This calculation is based on the available CSP observations (see Section 5.3). Table 6.4 and Table 6.5 present the standard errors of estimated goal variables as well as their relative standard error (coefficient of variation). The coefficient of variation is defined as the standard error divided by the group average. A higher coefficient of variation implies less reliable estimates, but the value is strongly affected by the absolute value of the average. If the average value approaches zero, the coefficient of variation can become very large. If the average value is negative, the coefficient of variation is negative as well.

The precision of estimates is determined by the standard error of the estimate of a variable. The standard error is used to calculate the confidence interval. This confidence interval describes the range in which the true population value will be given a certain level of certainty. The 95% confidence interval (with a critical t-value of 1.96) ranges from the calculated average minus 1.96 times the standard error to the calculated average plus 1.96 times the standard error. For example, the standard error 8,678 for starch potatoes farms signals that average farm income on such farms can vary within the confidence interval 77,400 +/- 1.96* 8,678, i.e. (€60,400 - €94,400).

Table 6.4 *Standard error of estimates and coefficient of variation (in italics) of important goal variables per type of farming (based on CSP variant, 2015)*

Type of farming	Goal variable			
	Farm income, €	Total revenues, €	Profitability, a)	Total income, €
Field crops				
- Starch potatoes	8,678	21,126	2.3	10,590
	0.11	*0.07*	*0.02*	*0.11*
- Organic crops	13,377	76,365	4.5	14,290
	0.12	*0.14*	*0.04*	*0.12*
- Other field crops	6,613	24,316	1.9	7,537
	0.08	*0.07*	*0.02*	*0.08*
Horticulture				
Vegetables under glass				
- Sweet pepper	47,883	112,947	2.9	48,265
	0.04	*0.02*	*0.02*	*0.04*
- Cucumber	23,482	68,012	2.0	23,563
	0.04	*0.03*	*0.02*	*0.04*
- Tomato	218,809	1,069,437	2.2	220,741
	0.27	*0.21*	*0.02*	*0.27*
- Other	24,492	58,032	3.3	24,529
	0.13	*0.07*	*0.03*	*0.13*
Flowers under glass	21,035	89,316	2.2	20,502
	0.10	*0.06*	*0.02*	*0.10*
Plants under glass	48,665	291,306	2.3	48,487
	0.21	*0.13*	*0.02*	*0.21*
Field vegetables	34,752	100,131	2.9	34,462
	0.27	*0.14*	*0.03*	*0.26*
Fruit	22,053	53,461	8.0	27,895
	0.72	*0.14*	*0.10*	*0.63*
Tree nurseries	17,124	47,999	6.2	17,096
	0.29	*0.15*	*0.08*	*0.27*
Flower bulbs	54,997	224,467	2.8	54,855
	0.26	*0.16*	*0.03*	*0.25*
Other horticulture	80,183	405,934	4.2	79,703
	0.38	*0.35*	*0.04*	*0.37*
Grazing livestock				
Dairy organic	12,408	18,951	2.3	12,083
	0.18	*0.06*	*0.03*	*0.15*
Dairy non-organic	3,655	8,607	0.8	4,157
	0.11	*0.02*	*0.01*	*0.09*
Calf fattening	8,687	54,891	3.1	9,587
	0.18	*0.15*	*0.04*	*0.16*
Goats	19,320	73,765	3.0	19,446
	0.10	*0.10*	*0.03*	*0.09*
Other grazing livestock	7,307	19,957	5.5	7,030
	-0.93	*0.19*	*0.10*	*0.30*
Intensive livestock				
Pig rearing	20,972	70,340	1.4	19,674
	-0.23	*0.09*	*0.02*	*-0.23*
Pig fattening	6,050	30,661	1.5	6,441
	0.41	*0.06*	*0.02*	*0.21*
Combined pig rearing and fattening	16,523	95,672	1.0	15,659
	-0.29	*0.08*	*0.01*	*-0.38*
Consumption eggs	25,164	76,096	3.5	25,302
	0.40	*0.10*	*0.04*	*0.32*
Broilers	16,969	173,600	1.4	17,544
	0.14	*0.11*	*0.01*	*0.13*
Other				
Combined	11,695	28,081	2.7	11,600
	0.18	*0.06*	*0.03*	*0.16*

a) Revenues per 100 euros costs.

Table 6.5 *Reliability of estimates (coefficient of variation in italics) of important goal variables per main type of farming, based on CSP variant (2015)*

Type of farming	Goal variable			
	Farm income, €	Total revenues, €	Profitability a)	Total income, €
Field crops	5,796	21,305	1.7	6,613
	0.07	0.06	0.02	0.07
Vegetables under glass	50,139	237,506	1.6	50,561
	0.09	0.09	0.01	0.09
Flowers under glass	21,035	89,316	2.2	20,502
	0.10	0.06	0.02	0.10
Pigs	7,360	32,209	0.9	7,096
	-0.25	0.04	0.01	-0.43
Poultry	16,372	84,319	2.2	16,547
	0.19	0.08	0.02	0.16
Grazing livestock	3,055	8,007	1.3	3,346
	0.10	0.02	0.02	0.07
All farms	3,656	15,777	0.8	3,773
	0.05	0.03	0.01	0.05

a) Revenues per 100 euros costs.

There are clear differences in the reliability of estimates between different types of farming. The estimates for the non-organic dairy sector (Table 6.4) are amongst the most reliable estimates (the lowest coefficient of variation). This is because of the large number of farms included in the sample, which reflects the importance of the dairy sector in Dutch agriculture. The field crops farms (Table 6.5) have a low coefficient of variation as well.

The previous tables give an indication of the reliability of estimates for certain types of farming. These tables are used to evaluate the allocation of sampling capacity to the different types of farming. Also in research projects the tables give an indication of the reliability of estimates and should therefore be considered before drawing statistical conclusions.

The tables also give an indication of the dispersion (variability) of observations. A large dispersion makes it more difficult to make precise estimates of group characteristics. Dispersion is however also one of the main advantages of the FADN system. The micro economic information at farm level makes it possible to show and analyse differences between farms, for example research about sustainability performance (Dolman et al., 2012) and the impact of Dutch and EU agricultural mineral policies (Goffau et al., 2012). The European Commission has no requirements regarding the reliability. However, it is one of the factors that is taken into account by determining the distribution of farms over the farm-types and size classes.

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Appendix 1 Comparison of farms in Agricultural census and farms in Dutch FADN multiple years

Table A1.1 *Comparison of farms in the Agricultural census and farms in the Dutch FADN, multiple year (continues next page)*

	2015			2014			2013			2012			2011		
	Census	FADN	S	Census	FADN	S	Census	FADN	S	Census	FADN	S	Census	FADN	S
Size in standard output (SO)															
Total	445,659	447,095		433,438	451,661	*	423,541	441,550	*	396,497	394,450		381,675	385,270	
Arable crops	46,925	49,428	*	46,651	50,699	*	45,121	48,833	*	38,605	39,476		37,144	39,187	
Grassland	16,564	16,301		16,037	15,666		15,962	15,606		10,825	10,877		10,590	10,734	
Horticulture open air	52,752	55,758		50,580	54,490	*	49,061	52,239		49,260	51,758		47,464	50,826	
Horticulture under glass	99,737	83,964	*	100,952	94,869	*	101,676	96,650		102,763	89,475	*	100,152	89,169	*
Dairy	97,919	105,080	*	93,300	101,656	*	90,061	97,033	*	79,244	83,292	*	74,545	78,974	*
Veal	14,073	14,910		14,093	14,372		13,955	14,823		14,636	13,761		14,116	13,874	
Fattening pigs	29,935	30,022		28,682	29,710		28,507	30,718		27,160	28,856		25,935	26,791	
Breeding pigs	23,475	23,713		22,814	23,238		22,047	21,390		22,653	23,593		22,434	23,530	
Broilers	13,491	14,151		12,698	13,240		11,676	11,387		9,775	9,864		9,298	9,180	
Laying hens	13,922	12,196		13,366	12,460	*	12,752	12,568		9,888	10,681		9,774	10,703	

Table A1.2 *Comparison of farms in the Agricultural census and farms in the Dutch FADN, multiple year (continued)*

	2015			2014			2013			2012			2011		
	Census	FADN	S	Census	FADN	S	Census	FADN	S	Census	FADN	S	Census	FADN	S
Size in hectare (ha)															
Total area	37.01	38.14		35.94	37.67	*	35.19	37.18	*	36.03	36.90		34.60	36.45	*
Arable crops	19.73	21.11	*	19.50	21.56	*	18.91	20.92	*	18.95	19.61		17.90	19.27	*
Tuberous and root crops	4.48	4.78		4.73	5.13	*	4.58	5.15	*	4.63	4.84		4.60	4.89	
Permanent grassland	13.92	13.70		13.48	13.16		13.41	13.11		14.15	14.22		13.84	14.03	
Horticulture open air	1.89	2.11	*	1.76	2.12	*	1.71	1.92	*	1.78	1.92		1.74	1.97	*
Vegetables open air	0.43	0.48		0.48	0.59	*	0.46	0.52		0.49	0.50		0.48	0.54	
Tree nursery	0.33	0.26		0.32	0.31		0.31	0.30		0.33	0.32		0.31	0.33	
Flower bulbs	0.52	0.74	*	0.49	0.75	*	0.47	0.64	*	0.49	0.62		0.48	0.58	*
Horticulture under glass	0.19	0.16	*	0.20	0.19		0.20	0.19		0.21	0.18	*	0.20	0.18	*
Vegetables under glass	0.10	0.07	*	0.10	0.09	*	0.10	0.09		0.10	0.09	*	0.10	0.09	*
Annual working hours															
Total paid labour	1.76	1.75		1.33	1.25		1.33	1.15	*	1.37	1.11	*	1.32	1.12	*
Total male labour	1.32	1.13	*	1.77	1.77		1.78	1.74		1.83	1.73	*	1.79	1.76	

S = Significant, * significant at 5% level

Source: Agricultural census, Statistics Netherlands and FADN, calculations by Wageningen Economic Research.

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