

# NORDIC WORKING PAPERS

## Interview and questionnaire guide

Quantification of food losses and waste in  
primary production

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# Preface

This interview guide was developed within the Nordic project “Food losses and waste in primary production” (Franke et al. 2016). The project is financed by the Nordic Council of Ministers through the Nordic Green Growth Programme.

One of the main purposes of the project was to test research methods for the quantification of food losses and waste (in the project called ‘side flow’) from primary production in the Nordic countries. Other aims were to estimate the amount of side flow and to gain knowledge about the reasons behind it, how it can be reduced, how it is treated and how it can be better utilized.

This document contains a catalogue of questions that may be used for interviews and questionnaires with primary producers and other stakeholders within primary production. It also contains the justification behind the questions and some tips on how to conduct interviews.

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# 1. Introduction

We have been involved in Nordic projects on food losses and waste in the primary production sector since 2012, and have adopted the term *side flow* to capture the flows of food waste and production losses in primary production.

By side flow we mean:

- Primary products that are intended to be consumed by humans but never enter the food chain, therefore planned feed production for animals is excluded.
- The parts of the primary products that are intended to be consumed by humans, thus peels and bones are excluded.

By primary production we mean the production of agricultural and horticultural products as well as wild berries, wild game, fishery and aquaculture.

The chosen system boundary has been:

- When cultivated crops, fruit and berries are mature for harvest, wild fruit and berries are harvested, domesticated animals are born and farmed fish are hatched, wild animals or fish are caught, milk when it is drawn from animals, and eggs when laid
- Before the primary products enter the next step of the food chain (slaughter, retail or processing)

However, it is not necessary to use the same definitions in order to use the guide, but the reader should have these definitions in mind when choosing questions for a study.

During the projects, we have used different methods to quantify side flows and to study the reasons behind side flows, possible ways of reducing them and also how side flows are ultimately used (Franke et al. 2016 and Hartikainen et al. 2017).

Our experience is that interviews and questionnaires are very useful tools for gathering information about side flows, but also for quality control and more in-depth investigation of the reality behind collected information. Interviews can also be used, for instance, for quality control of questionnaires before they are used.

We have therefore compiled a library of questions for future researchers and other users to use or be inspired by. We have also included the justification behind the questions and some tips on how to conduct interviews.

## 2. How to use the guide

This guide contains questions that can be used in both questionnaires and interviews. The goal and scope of the study in which the questions are to be used can vary significantly from case to case. Our advice is therefore to use only those questions that are relevant to the study in question. Additionally, it is wise to discuss the chosen questions with experts and to conduct a pilot study, and then make adjustments based on the feedback. The term 'side flow' needs to be thoroughly explained to the persons involved.

The questions may have fixed answer alternatives or be of an open answer character. It is our experience that fixed answer alternatives work better for questionnaires where the aim is to get statistically valid results, but our advice is to have at least one open answer question in the questionnaire. The open answer questions give the interviewees a chance to present their own views about side flows, which is not possible with fixed questions only.

For interviews, we advise taking a more open approach. One option could be to start with a list of fixed questions followed by open questions that can give a more detailed understanding. This may, for instance, give a better understanding of how side flow data is compiled, and what the uncertainty is.

It may also be possible to better understand fundamental reasons behind side flows. For instance, how will the fact that the farmer has or does not have his own harvest machine influence the side flow amount? What is the role of training? In the interview situation, it is also possible to clear up misunderstandings in a way that is not possible in questionnaires. Interviews may also be used for quality control of questionnaires.

When preparing a study, one needs to be aware that farmers or other involved actors often have little time to devote to such a study. Our advice is therefore to choose a time when the work load is low, e.g. winter for plant producers, but also to keep the numbers of questions down.

In the interview situation, it is possible to be flexible about this. If the interviewee seems to have more time than expected, one can ask more questions. In the opposite case, the advice is to just ask the most important questions.

In any case, it is a good idea to gather information from open sources (e.g. statistical data sources) or to ask the interviewee to fill in a questionnaire with some additional questions to be answered at a more convenient time, in order to take up as little of the interviewee's time as possible.

Another important aspect to consider when preparing interviews is to find out where the information that is sought can be found. For example, does the farmer himself have any knowledge about losses during wheat transport, drying and storage? If not, someone else should be asked.

## 3. Questions

The questions are divided into different sections for the different product groups: plants, meat and fish. The reason is that, although some questions are applicable to all product groups, many are only relevant to specific products. This division also makes it easier to find all the relevant questions for a specific product in one place.

### 3.1. Plant production

Plant products include vegetables, cereals, berries and fruit. The first step is to get basic information about the primary production entity, performing the operations being studied (Table 1). One reason for asking this basic information is to help identify underlying structural reasons for product side flow. After that follows questions about the product being grown.

The majority of the questions in this section are general for all plant products, but at the end of this section there are some questions that apply to cereals only.

#### 3.1.1. General questions for plant production

**Table 1. Basic information.**

QUESTION	REASON FOR ASKING
What total land area (ha) is used for agricultural production	Investigate possible correlation between farm area and side flow rates.
Of this area, how much is rented (ha)?	Investigate possible correlation between the proportion of own farm area and side flow rates. A farmer might be more familiar with his own farm land and take a more long-term approach when working his own land.
How many different products are you growing this year?	Investigate the possible link between degree of specialisation and side flow amount.
How much (in %) of your total income comes from agriculture?	Investigate the effect of part time vs full time farming regarding side flow amount.
How much (in %) of your total agricultural income comes from the studied product?	See 1.3. This question looks further into the effects of specialisation. High carrot income could mean that the farmer has more competency in the area.

**Table 2. Product information.**

QUESTION	REASON FOR ASKING
Studied product	Essential because side flow rates vary between products.
When did you plant or sow this year? ( <i>not for perennials, see next question</i> )	The time of sowing might have an impact on side flow rates, e.g. late sowing might give smaller products, and consequently more side flow if small products cannot be sold.
If fruit or berry, when where they planted?	Fruits and berries are from perennial plants which give little or no produce early in the lifespan, then some years of peak production followed by some years of declining production before the plant dies or is removed.
If fruit: What is the number of trees per ha?	The number of trees gives a clue to understand whether the trees are planted closely. If yes, there might be an increased vulnerability to plant illnesses.
Production system: Conventional/organic/other?	Different production systems often give different side flow rates. Production systems will often vary slightly from farmer to farmer, but the most profound differences are between organic and conventional. If there are other important technological distinctions, please write them here (e.g. the farmer has on-farm CA (controlled atmosphere) storage).
Area (number of hectares on which you grow the product in question)	This question relates to questions on part-time/full-time work and degree of specialisation in section 1. It also serves as a control for a similar question in table 1.
How much of this product is being grown on rented land this year?	Similar to a question in table 1 but specifically relates to the product or products we want to investigate in the interview.
Do you normally grow this product on rented land? If not, how often?	In Norway there is a problem with pests that forces farmers to rent land in other parts of the country without the pest. The farming of land in other places probably means that supervision is not as good as when farming land close to the home. Thus side flow rates can vary.
What is the predominant soil type in the area where the product is grown?	Some vegetable crops grow better in certain types of soil. This question looks at the effects of soil type on yield and side flow amount.
How many years until the crop is grown again in the same soil?	The use of crop rotation is an important technique to avoid pests. Information on crop rotation is important. Evaluate whether to ask the farmer to describe crop rotation further, e.g. next question.
Do you have a crop rotation plan?	The question is intended to make the farmer elaborate on crop rotation.
Do you use a pesticide plan recommended by agricultural advisory services?	Find reasons for side flow. The question is more important for very sensitive products like strawberries. If a pesticide plan is followed it can indicate that the farmer is likely to monitor his crops closely. If such a plan is not followed it might be that the farmer has his own plan. The question could perhaps be elaborated on.
Type of cultivar (early/summer/autumn/industry)	Different cultivars serve different purposes and mature at different times of year. They might give different side flow amount rates. For many products there are varieties that are planted to mature early in the season. These are often only sold fresh whereas autumn varieties are stored. (Advice: These types of cultivar have different side flow amount rates, so it is important to distinguish between them.)
What cultivar(s) do you use?	Even within a certain main product type (e.g. storage carrot or early carrot) the cultivars might give different side flow amounts based on the carrot's properties. Often there is a trade-off between taste (or other desirable properties) and shelf-life.

**Table 3. Harvest information.**

QUESTION	REASON FOR ASKING
Approximately how many workers are employed? (full time/part time/only in season)	The number of workers can indicate whether the work is in a concentrated period or spread over a long time.
When did you harvest? (For berries and fruit: Which period?)	The question can be used to find a correlation between certain harvest times and side flow rates, e.g. products could be harvested in late September in a certain year when there was heavy rainfall, giving a less efficient harvest.
Did you notice any deviations in growing any of your crops this year? Which?	Find reasons for side flow. Here we ask for things not going as planned, in order to find explanations for very different (mostly very high) side flow rates in a certain year related to the average of previous years.
Manual harvesting/harvesting with hired workers/automated? (Fruit/berries)	Harvesting techniques can be important for side flow rates. With manual harvesting, it is more likely that sorting is done during harvesting than with automated harvesting.
Did you do the harvesting yourself with your own equipment?	Find reasons for side flow. A farmer might be more careful when harvesting his own crop than somebody who is hired to harvest another person's crop.
Which equipment did you use?	Finding reasons for side flow. The question is intended to find a correlation between harvesting equipment and side flow rates.
Would you regard the harvest as being diligent (careful, with an eye for detail, and taking enough time to get things right)?	Finding reasons for side flow. The question intends to find out whether the farmer is taking care to choose the right time and equipment to do the harvesting as well as possible. As opposed to being "sloppy" or unprepared, but we cannot use such words in an interview.
Harvest conditions this year (good/medium/bad). If medium or bad then explain	Find reasons for side flow. Bad harvest conditions can give large side flow rates and vice versa.
Total tonnes harvested (gross harvest) per ha.	Quantification. Can be used to find relative side flow amount (side flow amount as % of total crop ready for harvest) or to find side flow amount through mass balance.
How would you evaluate the harvest?	Side flow reasons. The question should cover all aspects of the harvest, such as weather, equipment, work force, etc. Connected to previous questions.
Temporary storage (in bulk or in crates)?	The temporary storage can give clues to the quantification (often the farmer does not weigh harvested amount but simply knows "number of bins") and possibly the reasons behind side flow.
How precise is this number? +/- amount of tonnes or kg?	Intended to find accuracy of quantification. This information can be used in the quantification to determine uncertainty of quantified numbers.
How many tonnes would you say were fit for sale?	This question is intended for crops where no sorting occurs after harvesting, i.e. all harvested crop is stored and sorting takes place later. It is interesting to know what the farmer thinks of the crop he has harvested.
Did you get any deduction in price because of quality?	This question is intended to give a picture of crop quality which can be used to find reasons for side flow. Advice: The harvest will often be split into several different fractions with different quality and prices. Get us much information as possible on this.
How much do you harvest in a normal year (per ha)?	Important quantification. Can give a more representative picture of side flow than the previous question on total tonnes harvested.

**Table 4. Overview of the value chain.**

QUESTION	REASON FOR ASKING
<p>How do you handle the product from harvest until you sell or deliver it?</p> <ul style="list-style-type: none"> <li>• Unsorted/unwashed, direct to industry/packing house</li> <li>• Intermediate storage without cooling</li> <li>• Intermediate storage with cooling</li> <li>• Rapid cooling (fruit, berries, salad and other vulnerable products)</li> <li>• Other, please specify:</li> </ul>	<p>Used for getting a picture of the value chain. Who does what? Good for understanding side flow reasons and doing quantification.</p>
<p>How do you treat the product before delivery to the next stage?</p> <ul style="list-style-type: none"> <li>• Sorted at harvest? (fruit/berries)</li> <li>• Sorted after harvest, before delivery?</li> <li>• Sorting/washing/packing in own facility</li> <li>• Sorting/washing/packing in other facility, e.g. packing house.</li> </ul>	<p>Finding side flow reasons. If sorting takes place early, e.g. right after harvest, it is likely that side flow amounts will be reduced.</p>
<p>Packaging and unit size at the time of delivery.</p>	<p>Used when mapping side flow in later stages. How does packaging affect side flow amounts and how are products of lower quality packed?</p>
<p>Next stage in the value chain?</p> <ul style="list-style-type: none"> <li>• Packing plant/factory</li> <li>• Direct to wholesaler</li> <li>• Farm sales</li> <li>• Farmer's market, or similar</li> <li>• Other, please specify</li> </ul>	<p>Quantification. When quantifying side flow amount across the value chain from producer to consumer, it is important to know which parts of the value chain the producer deals with.</p>

**Table 5. The most important questions for plant production.**

QUESTION	REASON FOR ASKING
Total side flow, % of predicted harvest	Quantification, total side flow amount.
Partial side flows, in % of total harvest: <ul style="list-style-type: none"> <li>• Harvest side flow %</li> <li>• Sorted out in the field</li> <li>• Sorted out in pre-processing (washing, packing drying)</li> <li>• Side flow during storage (if product is stored)</li> <li>• How long is the product stored?</li> </ul>	Quantification, side flow divided into partial side flows.
What are the main reasons why products are sorted out? (Use number 1-5 after degree of importance, 1 = most important, list not complete): <ul style="list-style-type: none"> <li>• Wrong size and shape</li> <li>• Spots and discolouring</li> <li>• Rot</li> <li>• Mechanical damage</li> <li>• Other, please specify</li> <li>• Underlying reasons</li> <li>• Plant diseases, insects, badly adjusted harvester, etc.</li> <li>• Fundamental reasons</li> <li>• Price, consumer demand</li> </ul>	Finding side flow reasons and suggesting possibilities for reducing side flow amounts.
Is there any other factor beyond your control that influences the amount sorted out? <ul style="list-style-type: none"> <li>• Price</li> <li>• Subsidies</li> <li>• Government regulations</li> <li>• Demands from wholesale or retail</li> <li>• Consumer demands</li> <li>• Weather conditions during the growth phase</li> <li>• Weather conditions during harvest</li> <li>• Other, please specify</li> </ul>	Finding (fundamental) reasons for side flows.
How can side flow be prevented? (Please give different options and prioritize by giving a number from 1 to 5 according to degree of importance, 1 = most important)	Finding options for reducing side flow. Try to distinguish between apparent reasons (e.g. rot), underlying reasons (e.g. too high humidity in storage) and fundamental reasons (e.g. low prices making it impossible to invest in new storage facility).
Does the side flow currently constitute an income? If yes, how much?	
Does the side flow currently constitute a cost? If yes, how much?	
What do you do with the fraction that is sorted out? (If time is limited please ask this as an open question without specifying the alternatives below.) <ul style="list-style-type: none"> <li>• Used for/delivered to animal feed</li> <li>• Used for controlled composting</li> <li>• Left/spread in the field</li> <li>• In the waste bin</li> <li>• Other, please specify</li> </ul>	Determining side flow handling and thus determining if the flow is a side flow or not. Can also be important when looking for ways to use the side flow in a better way.
Could this fraction have been used differently? If yes: how?	
Is something preventing you from applying other kinds of value-adding strategies (e.g. better storage, further use in processing, etc.)?	

**Table 6. Harvest and post-harvest side flows.**

QUESTION	REASON FOR ASKING
Would you rate the quality of this year's harvest as better than/similar to/worse than a normal year?	Quantification. This question gives an impression of whether the current year is representative.
How much of the total harvest is left on the field after harvest (percent)?	Quantification.
How do you estimate this number?	Quantification. Indicates how reliable the side flow estimate number is.
What is the reason for the harvest side flow? (If time is limited, please ask this as an open question without specifying the alternatives below.)	Finding side flow reasons.
<ul style="list-style-type: none"> <li>• Too small fields, a lot of the space needed to turn the tractor</li> <li>• Harvesting equipment worn/does not function properly (Why?)</li> <li>• Improper adjustment of harvesting equipment (Why?)</li> <li>• Harvesting under difficult circumstances</li> <li>• Deliberately set the harvesting equipment so that small and/or large products were automatically sorted out (Why?)</li> <li>• Other, please specify (Why?)</li> </ul>	
What can be done to reduce the harvest side flow amount?	Finding side flow reduction options.
Do you regard the harvest side flow as production loss?	Question for determining farmer's attitudes, which can be used when finding options to reduce side flows. Is the side flow seen as inevitable and unavoidable or does the farmer see possibilities to reduce the side flow?
Do you take the loss into account when planning farming next year, e.g. fertilization? (If yes, ask about details of this.)	Finding side flow amount reduction options. The question is intended to find out whether the farmer sees side flow amount as a problem that can be reduced, e.g. by better fertilization.
Do you sort out products in the field during harvesting?	Quantification, finding side flow reasons and reduction possibilities. If sorting is done at an early stage, the total amount of side flow may be reduced.
How much (in percentage) is being sorted out during harvesting?	Quantification.
How do you carry out this sorting?	Question for understanding side flow reasons.
Why do you carry out this sorting?	The questions are intended to reveal whether the sorting is aimed at eliminating rot or pests in the stored product, eliminate products that have a low sale price, save storage space or other reasons. It can be helpful to explain differences in side flow rates between farmers. It can also be interesting when looking for reduction possibilities.
<ul style="list-style-type: none"> <li>• Reduce rot in storage</li> <li>• Reduce storage space</li> <li>• Customer requirements</li> <li>• Other reason, please specify.</li> </ul>	

**Table 7. Pre-processing.**

QUESTION	REASON FOR ASKING
How much of the product is sorted out during pre-processing (washing/sorting/packing)?	Quantification. It is important to have data on the stage at which the product is sorted out. This can help explain side flow reason, find out how side flows can be better utilized and find possibilities to reduce side flows.
How is the sorting done (automatic, manual, using optical instruments, etc.)?	Finding side flow reasons. Good sorting systems and procedures can reduce side flow amounts considerably.
<p>What are the most important reasons for the product being sorted out? (If time is limited please ask this as an open question without specifying the alternatives below):</p> <p><u>Apparent reasons:</u></p> <ul style="list-style-type: none"> <li>• Wrong size and shape</li> <li>• Spots and discolouration (e.g. green colour in potato)</li> <li>• Mechanical damage</li> <li>• Rot</li> <li>• Other, please specify</li> </ul> <p><u>Underlying reasons</u></p> <ul style="list-style-type: none"> <li>• Requirements from wholesaler, retail, consumer</li> <li>• Pests, plant illnesses</li> <li>• Insects and microorganisms</li> <li>• Weather</li> <li>• Too early/too late harvest</li> </ul> <p><u>Fundamental reasons</u></p> <ul style="list-style-type: none"> <li>• Competency</li> <li>• Price</li> <li>• consumer demand</li> <li>• Other, please specify</li> </ul>	Finding side flow reasons. In order to be able to reduce side flow we need to know not only apparent reasons (e.g. spots, wrong size, rot, damage) but also underlying reasons (weather, pests, etc.) and fundamental reasons (price, consumer demand, training etc.) behind side flow.

### 3.1.2. Specific questions for cereals.

**Table 8. Side flow amounts for cereals.**

QUESTION	REASONS FOR ASKING
<p>Amount of side flow at different stages (estimate in percentage of total yield):</p> <ul style="list-style-type: none"> <li>• Side flow in the field before harvest</li> <li>• Side flow generated during harvest</li> <li>• Side flow generated during storage</li> <li>• Side flow generated during drying, but not related to reduced water content.</li> <li>• Side flow generated during transport to next stage</li> <li>• Other, please specify</li> </ul>	<p>Quantification.</p> <p>This question specifically aims to find side flow reasons that are clearly visible, such as extent of “lay down”. It is not intended or expected that the farmer will have an overview of what happens with each individual plant.</p>

**Table 9. Side flow reasons for cereals.**

QUESTION	REASONS FOR ASKING
<p>Amount of side flow due to different reasons (% of total side flow, % of total harvest or in tonnes):</p> <p>If time is limited, please ask this as an open question without specifying the alternatives below.</p> <p>For each reason given, please ask for underlying and fundamental reasons. Note that it is important to distinguish between different layers of reasons, otherwise this may result in double counting or confusing answers.</p> <p>Side flow due to (please prioritize by applying a number 1 to 5, 1 being most important):</p> <ul style="list-style-type: none"> <li>• Worn/poorly functioning harvester</li> <li>• Poorly adjusted harvester or harvester not driven optimally</li> <li>• The cereal is laying down</li> <li>• Fungus</li> <li>• Pests</li> <li>• Bad conditions during harvest</li> <li>• Non-optimal storage conditions</li> <li>• Weed mixed with the cereal</li> <li>• Inferior starch quality</li> <li>• Inferior protein quality</li> <li>• Too low protein content</li> <li>• Wrong density</li> <li>• Other, please specify</li> </ul>	<p>Side flow reasons</p>

**Table 10. Use of cereal side flow**

QUESTION	REASONS FOR ASKING
<p>How is the side flow used? (% of total side flow, % of total harvest or in tonnes)</p> <p>Please try to connect the side flow at each stage with a usage. E.g. the side flow during drying was used for energy purposes at the farm.</p> <p>If time is limited, please ask this as an open question without specifying the alternatives below:</p> <ul style="list-style-type: none"> <li>• Not harvested</li> <li>• Animal feed</li> <li>• Energy/fuel – please specify whether it is used at the farm or externally</li> <li>• Other, please specify</li> </ul>	<p>The question is necessary to identify whether a material is side flow or not. It can also give an insight into reasons for side flows.</p>

**Table 11. Possibilities for reducing cereal side flows**

QUESTION	REASONS FOR ASKING
<p>What can/should be done to reduce side flow? (Numbered according to importance, where 1 is most important and 5 is least important.)</p> <p>If time is limited, please ask this as an open question without specifying the alternatives below:</p> <p>Better cultivars, more adapted to local conditions</p> <p>Better agronomy:</p> <ul style="list-style-type: none"> <li>• Better fertilization (e.g. easier for stalks to stay upright?)</li> <li>• More optimal pest control</li> <li>• Better knowledge of how to adjust and drive harvester</li> <li>• Improved drying conditions</li> <li>• Improved storage conditions</li> <li>• Other, please specify</li> </ul> <p>Other, more fundamental possibilities:</p> <ul style="list-style-type: none"> <li>• Increased product prices</li> <li>• More subsidies</li> <li>• Better training</li> <li>• Harvest your own crops, not rely on contractor</li> <li>• Other, please specify</li> </ul> <p>Does the side flow currently constitute an income? If yes, how much?</p> <p>Does the side flow currently constitute a cost? If yes, how much?</p> <p>Is something preventing you from applying other kinds of value-adding strategies (e.g. better storage, further use in processing, etc.)?</p>	<p>Reduction possibilities</p> <p>This question is vital when planning side flow reduction options. If the fundamental reasons are taken into account, it will be easier to find good options for reducing side flow.</p>

## 3.2. Meat production

**Table 12. Type of meat production.**

QUESTION	REASONS FOR ASKING
What type of meat production do you carry out? <ul style="list-style-type: none"> <li>• Pork</li> <li>• Beef, specialized meat production</li> <li>• Beef, combined meat and milk production</li> <li>• Poultry</li> <li>• Mutton</li> <li>• Other, please specify</li> </ul>	Essential question because side flow rates vary between products.

### 3.2.1. Beef production

**Table 13. Basic information about beef production.**

QUESTION	REASONS FOR ASKING
Herd size and production:	
How many animals do you have (cows, bull calves, heifer calves)?	Size of production might influence amount of side flow. Big farm = economy of scale? Small farm = easier to notice animals' health conditions?
What is the yearly output (only meat) in kg and number of slaughter animals?	Quantification. Finding relative side flow amount.
Fertility index: What is your average new born calf per cow ratio?	Mortality is probably linked to this ratio. High number of births can partly explain high side flow amount.
Technology/farming methods:	Technology questions for quantification.
Living conditions: To what extent are the animals kept inside as opposed to allowed outside e.g. to pasture?	Stratified sampling of each group might be necessary.
How much feed is used per kg of meat produced? Please specify the feed in percentage: <ul style="list-style-type: none"> <li>• Silage</li> <li>• Grass</li> <li>• Legumes</li> <li>• Concentrate feed (soy, maize, etc.)</li> </ul>	Quantification: These questions are intended to map side flow amounts for different production technologies. Feed is an important factor for animal health.
Was the feed that you used last year wet because of rain during growth or harvest?	

### 3.2.2. Pork production

**Table 14. Basic information about pork production.**

QUESTION	REASONS FOR ASKING
Number of animals and production	
How many animals do you have? Sows/finishers produced	Size of production might influence side flow. Big farm= economy of scale?
What is the yearly output (only meat) in kg and number of slaughtered animals?	Quantification. Finding relative side flow amount. Mortality is probably linked to this ratio. High number of births can partly explain high side flow amount.
Yearly average number of piglets weaned per sow	
Technology/farming methods	Technology questions for quantification. Stratified sampling of each group might be necessary.
Please give an outline of farming technology	
Feed	The feed might be connected to animal health and thus side flow amounts.
How much feed is used per kg of meat produced?	
Please specify the feed composition: <ul style="list-style-type: none"> <li>• Grain, please specify main types.</li> <li>• Food side flow, please specify main types</li> <li>• Concentrate feed, please specify main ingredients</li> </ul>	

### 3.2.3. Beef and pork production

**Table 15. Quantification of beef and pork side flows.**

QUESTION	REASONS FOR ASKING
How many animals died before reaching slaughter weight?	Quantification. Total number and kg.
Please indicate the number that died at each age and approximate weight at the time of death.	Quantification. Total number, year and weight.
How many animals died at slaughter weight during transportation to the slaughterhouse/were rejected at slaughterhouse?	Quantification. Total number and kg.
How many of the dead animals were killed/slaughtered because of low weight gain or other reasons such as accidents or diseases (% of total)?	Finding reasons for side flow.
How many of these animals died of themselves (% of total)?	Finding reasons for side flow. Quantification.
How many of these animals died during transportation to slaughterhouse/were rejected by the slaughterhouse?	Quantification.
Distance to slaughterhouse (km)	Finding reasons for side flow. Large distance can explain high mortality.
Transport mode	Finding reasons for side flow.
Are there any other factors that are important for surviving the transportation to slaughter?	Finding reasons for side flow.

**Table 16. Handling of pork and beef side flows.**

QUESTION	REASONS FOR ASKING
<p>Handling of side flow</p> <p>What happened to the dead animals at the farm?</p> <ul style="list-style-type: none"> <li>• Sent for incineration</li> <li>• Sent to national company handling dead animals (in Norway 'Norsk Protein')</li> <li>• Other, please specify</li> </ul>	<p>Quantification, finding side flow reasons and options for improvement.</p>

**Table 17. Reasons for pork and beef side flows and how to reduce these flows.**

QUESTION	REASONS FOR ASKING
<p>What are the main causes for side flow?</p> <ul style="list-style-type: none"> <li>• Disease, please specify</li> <li>• Accident, e.g. the mother lay on top of a piglet and suffocated it.</li> <li>• Aggressive behaviour by other animals</li> <li>• Other, please specify</li> </ul>	<p>Finding side flow reasons</p>
<p>Can you comment on the reasons behind the side flow?</p> <ul style="list-style-type: none"> <li>• No specific reason, they just died</li> <li>• I got a sick animal from another herd</li> <li>• Other, please specify</li> </ul>	
<p>Can you identify fundamental structural problems behind the side flow?</p> <ul style="list-style-type: none"> <li>• The economy of producing meat is so bad that I am understaffed and cannot look after the animals as much as I would have liked.</li> <li>• Other reasons, please specify</li> </ul>	
<p>Possibilities for reducing side flow: please list options and prioritize them with a number 1 to 5, with 1 being most important.</p> <p>What can be done to reduce side flow amounts?</p> <p>Does the side flow currently constitute an income? If yes, how much?</p> <p>Does the side flow currently constitute a cost? If yes, how much?</p> <p>Is something preventing you from applying other kinds of value-adding strategies (e.g. better storage, further use in processing, etc.)?</p>	<p>Finding options for reducing side flow</p>

### 3.2.4. Mutton (lamb and sheep) production

The table below contains basic questions that aim to give more detailed knowledge of the primary production. It may be possible to correlate this information with data on side flow amounts, handling, reason, and possible reduction possibilities.

**Table 18. Basic information about mutton production.**

QUESTION	REASONS FOR ASKING
Herd size and production (number of mother animals):	Quantification, reasons, reduction possibilities. Herd size may have an influence on side flow amounts. It may also help when understanding reasons and finding reduction possibilities.
Number of animals in the summer.	
Output: Only lamb?	
Yearly production of meat (head slaughtered and kg LW/head)	
Technology/living conditions	These factors may influence side flow rates.
Duration of pasture	
Kind of pasture	
Composition of feed: <ul style="list-style-type: none"> <li>• Forage</li> <li>• Concentrate</li> </ul>	

**Table 19. Mutton side flow amounts, reasons and reduction possibilities.**

QUESTION	REASONS FOR ASKING
Side flow amounts	Quantification
Number of dead animals per year, at different life stages.	
Total weight of dead animals per year.	
Mortality during transport to slaughterhouse.	
What are the main causes for side flow? If possible, ask for the amount of side flow related to each factor.	Reasons
<ul style="list-style-type: none"> <li>• Disease, please specify</li> <li>• Accident, e.g. fall</li> <li>• Taken by wild animals at pasture</li> <li>• Eating poisonous plants at pasture</li> <li>• Other reasons, please specify</li> </ul>	
Can you comment on the reasons behind the side flow?	Reasons
<ul style="list-style-type: none"> <li>• No specific reason, they just died</li> <li>• I got a sick animal from another herd</li> </ul>	
Can you indicate fundamental structural problems behind the side flow?	Reasons
<ul style="list-style-type: none"> <li>• The economy of producing meat is so bad that I am understaffed and cannot look after the animals as much as I would have liked.</li> <li>• Other reasons, please specify</li> </ul>	
What can be done to reduce side flows?	Reduction possibilities
Usage of side flows	Reduction possibilities
What can be done to utilize side flows in a better way?	
Does the side flow currently constitute an income? If yes, how much?	
Does the side flow currently constitute a cost? If yes, how much?	
Is something preventing you from applying other kinds of value-adding strategies (e.g. better storage, further use in processing, etc.)?	

### 3.2.5. Poultry production

The table below contains basic questions that aim to give more detailed knowledge of the primary production. It may be possible to correlate this information with data on side flow amounts, handling, reasons and possibilities for reducing side flows.

**Table 20. Basic information about poultry production.**

QUESTION	REASONS FOR ASKING
Number of animals in each production period (input and output numbers) and number of production periods per year	The produced amount and technology may correlate with side flow amounts and have importance possibilities for reducing side flows or using them in a better way.
How many chicken do you have per unit area, in kg/m <sup>2</sup> ?	
What is your yearly production amount in animals' live weight?	
Technology/production methods/conditions for the animals	See above
<ul style="list-style-type: none"> <li>• Open area</li> <li>• Cages</li> <li>• Combination of cages and open area</li> </ul>	

**Table 21. Poultry side flow quantification.**

QUESTION	REASONS FOR ASKING
Side flow amounts	Quantification
Please indicate:	
<ul style="list-style-type: none"> <li>• The number of dead animals</li> <li>• Age and weight at time of death</li> </ul>	
or	
<ul style="list-style-type: none"> <li>• % of production amount going to side flow</li> </ul>	

**Table 22. Reasons for poultry side flows.**

QUESTION	REASONS FOR ASKING
Apparent reason, see answer alternative above	Side flow reasons
<ul style="list-style-type: none"> <li>• Aggressive behaviour by other animals</li> <li>• Small living area</li> <li>• Other, please specify</li> </ul>	
Underlying, structural reasons, see answer alternatives below	Side flow reasons
<ul style="list-style-type: none"> <li>• Low profitability</li> <li>• Insufficient training of farmers</li> <li>• Other, please specify</li> </ul>	

**Table 23. Poultry side flow reduction possibilities.**

QUESTION	REASONS FOR ASKING
<p>What possibilities do you see for reducing poultry side flow amounts?</p> <ul style="list-style-type: none"> <li>• Look after the animals more carefully</li> <li>• Remove animals that are victims of aggressive behaviour to separate cages</li> <li>• Other possibility, please specify</li> </ul>	<p>Reduction possibilities</p>
<p>Please ask open question about reduction possibilities. The answer alternatives listed above are just examples. Other measures that can be carried out include changing management practices in general. E.g. establishing routines for mopping when the animals are vulnerable for disease. This can also include new routines or feeding. Better training of staff can be another measure, and staff may also be rewarded financially for reducing side flow amounts. Thus, reduction possibilities can be about purely “physical” measures, better organisation, economic incentives, and other things the poultry producer can do, but we can also think about government regulations.</p>	<p>Reduction possibilities</p>
<p>Does the side flow currently constitute an income? If yes, how much?</p> <p>Does the side flow currently constitute a cost? If yes, how much?</p> <p>Is something preventing you from applying other kinds of value-adding strategies (e.g. better storage, further use in processing, etc.)?</p>	

### 3.3. Fish, shellfish and mollusc production

The questions are divided into fishery (3.3.1) and aquaculture (3.3.2.)

#### **3.3.1. Fishery**

The questions in this section relate to fish, shellfish and molluscs. For the sake of simplicity, only the word fish is used, but all categories listed above are included. Seaweed is not included.

**Table 24. Basic questions for fishermen.**

QUESTION	REASONS FOR ASKING
Basic information	These basic questions aim to give a more detailed knowledge of primary production. It may be possible to correlate this information with data on side flow amounts, handling, reasons and possibilities for reducing side flows.
What is your main activity? <ul style="list-style-type: none"> <li>• Coastal fishery</li> <li>• Ocean fishery</li> <li>• Freshwater fishery</li> <li>• Transport</li> <li>• Pre-processing</li> <li>• Other</li> </ul>	Quantification. Different fisheries will most likely have different side flow rates. E.g. ocean fishery probably means that catch is frozen at sea and side flow rate will probably be lower than fresh fish boats.
Size of boat	
Who owns the boat?	Quantification and explaining reasons: Boat size can influence side flow amount.
What is your permitted catch quota?	Quantification and finding side flow reasons: Ownership can influence side flow amount. People are more careful with the catch when it directly influences their own finances.
What equipment do you use (trawl, purse-seine, longline, etc.)	See "Size of boat" question.
What fishery do you take part in? (e.g. winter fishery for cod in Northern Norway) If you take part in several fisheries, please choose the two main fisheries.	Quantification and explaining reason: Equipment type has a big influence on product side flow. Different equipment and different fisheries should be sampled separately.
Please indicate: <ul style="list-style-type: none"> <li>• Most important fishery</li> <li>• Second most important fishery</li> </ul>	See initial questions
	The reason for asking about the two most important fisheries is that the second most important fishery might have a higher side flow and may be more interesting to study.
Please answer the remaining questions for the most important fishery you take part in, or other fishery if this is more important because of e.g. high side flow rates.	
How much of your total income comes from the fishery (%)?	Finding reasons for side flow. High income means important fishery. If the fishery is important, side flow rates might be lower.
What processes do you do at sea (gutting, freezing, packing, boiling, etc.)?	Quantification: Important to map who does the different processes in the value chain and when they are done. If processing is done immediately after catch, the quality of the fish might be higher and side flow amounts lower.
How much time passes between when the catch is taken aboard and when it is processed, on average?	The time from when fish is taken aboard to when it is gutted is critical to the quality of the fish and thus side flow rates.
Do you land mostly fresh fish or frozen fish?	
What is your yearly catch, in tonnes, divided by species for last year?	Quantification. Used to calculate relative side flow amount in % of total catch. Choose 3 most important species, unless one of these species is negligible (< 1 %)

**Table 25. Wild fish side flow amounts, causes and reduction possibilities.**

QUESTION	REASONS FOR ASKING
Side flow amounts	
How much fish do you lose in the catch phase, as a % of the total catch?	Quantification. Can also be expressed as number of fish, then ask for typical weight per fish and total catch weight.
How much of landed catch was rejected, as a % of the total catch?	Quantification. Can also be expressed as number of fish, then ask for typical weight per fish and total catch weight.
Causes for side flow	Finding side flow reasons.
<p>What is/are the main reason(s) for catch phase side flows/loss? Please prioritize reasons by giving a number from 1 to 5, 1 being most important.</p> <ul style="list-style-type: none"> <li>• Fell off the hook</li> <li>• Lost from trawl or other equipment.</li> <li>• Damaged by the equipment.</li> <li>• Wrong type of fish – side catch??</li> <li>• Other, please specify</li> </ul>	
Can you say something more about the reasons for this loss?	Elaborating side flow reasons.
<ul style="list-style-type: none"> <li>• Haddock in general, easily fall off hooks.</li> <li>• During a big haul, compression damage is inevitable.</li> <li>• At certain times of the year, quality is not good. Ask for reasons.</li> </ul>	
Underlying structural reasons	Further elaborating side flow reasons.
<ul style="list-style-type: none"> <li>• Low profitability</li> <li>• Few people in the crew</li> <li>• High quota, little time</li> <li>• Bad weather</li> <li>• Other reason, please specify</li> </ul>	
Side flow prevention	Finding reduction options.
What can be done to prevent loss in the catch phase and later on board?	
Is something preventing you from applying other kinds of value-adding strategies (e.g. better storage, further use in processing, etc.)?	Reduction possibilities

### 3.3.2. Aquaculture

**Table 26. Basic questions on aquaculture.**

QUESTION	REASONS FOR ASKING
<b>Basic information</b>	
What species do you farm?	Quantification. Different species may have different side flow rates.
Licence (permitted yearly production)?	Quantification. Is the production close to the permitted quota or not? May give an indication of supply and demand situation which might explain low or high side flow rates.
Actual yearly production	See comment above on question.
How many people are employed at the facility (full time/part time/seasonal)	Finding side flow reasons. Gives indication of degree of supervision and automation, which might influence side flow rates.
Do you have your own fry production?	Quantification. Mapping the value chain is important for quantification. Mortality is high in the fry phase.
If you buy fry: When do you get new fry? Twice a year?	Finding side flow reasons. Mapping production flow is important when analysing reasons for side flows.
Which vaccines do you use?	Finding side flow reasons. Illnesses are a big problem. Type of vaccine might influence side flow amounts.
<b>Slaughter</b>	
What is the average age of the fish at the time of slaughter?	Quantification. Mapping the production flows is necessary when carrying out quantification.
What is the average weight of the fish at the time of slaughter?	See above. Must know slaughter weight to find lost biomass if only the number of fish lost is known.

**Table 27. Farmed fish side flow treatment.**

QUESTION	REASONS FOR ASKING
<b>Side flow treatment</b>	
How is the side flow stored and treated? <ul style="list-style-type: none"> <li>• Composted</li> <li>• Used in biodiesel production</li> <li>• Discarded at sea</li> <li>• Sent for waste treatment</li> <li>• Other, please specify</li> </ul>	Quantification. Necessary to know how material flows are treated in order to know if they are side flows.
Who is the receiver of the side flows today?	Finding possibilities for reduction.
Is something preventing you from applying other kinds of value-adding strategies (e.g. better storage, further use in processing, etc.)?	Understanding side flow reasons, finding possibilities for reduction.

**Table 28. Reasons for farmed fish side flow amounts and reduction possibilities.**

QUESTION	REASONS FOR ASKING
<p>Please reflect on the causes behind the side flow. Please differentiate between:</p> <ul style="list-style-type: none"> <li>- apparent cause (e.g. mechanical damage)</li> <li>- underlying cause (e.g. the fish got stuck in the pump)</li> <li>- fundamental cause/structural cause (e.g. investments needed to modify the production equipment but not done because of low profitability).</li> </ul>	<p>Quantification: It is likely that only the number of fish lost at each stage is noted. The table is then good for registering the amount of fish side flow.</p>
<p>What is the total loss of fish from when you receive the fry until slaughter, in % of the total number of fry?</p>	<p>Quantification: It is likely that only the number of fish lost at each stage is noted. The table is then good for registering the amount of fish side flow.</p>
<p>What is the total side flow amount of fish from when you receive the fry until slaughter, in kg of fish?</p>	<p>Please fill in the number of individuals and average weight!</p>
<p>If the operator has not calculated the amount in kg, please ask for average side flow amount per period (number of individuals) and average weight per period, see table below.</p>	
<p>How can side flow amounts be reduced?</p>	<p>Reduction possibilities.</p>
<p>How can your side flows be better utilized to generate a higher value?</p>	
<p>Does the side flow currently constitute an income? If yes, how much?</p>	
<p>Does the side flow currently constitute a cost? If yes, how much?</p>	
<p>Is something preventing you from applying other kinds of value-adding strategies (e.g. better storage, further use in processing, etc.)?</p>	

**Table 29. Suggested form for collecting data on total side flow amounts.**

	Total loss (no. of fish)	Average weight
0-3 months		
3-6 months		
6-9 months		
9-12 months		
12-15 months		
15-18 months		
18-21 months		
21-24 months		

**Table 30. Suggested form for collecting data on farmed fish partial side flow amounts and reasons behind these.**

How much is lost and what is the reason behind this?							
	Infections, please specify	Smolt weaning	Mechanical damage	Environmental causes, please specify	Found dead, reason not found	Other causes, please specify	Average weight
0-3 months							
3-6 months							
6-9 months							
9-12 months							
12-15 months							
15-18 months							
18-21 months							
21-24 months							

### 3.3.2. Fish processing company (only pre-processing)

These questions cover both wild caught fish and aquaculture fish.

**Table 31. Questions for basic information, side flow amounts, reasons and treatment, fish pre-processing company.**

QUESTION	REASONS FOR ASKING
Basic information	
What species do you handle?	Quantification. Side flow rates may vary from species to species.
Which unit operations do you do (gutting, fileting, packing, etc.)?	Quantification. Question to map the value chain.
How much is your yearly production?	
Side flow amounts	
How much product (in % of total incoming amount) is removed during processing?	Relates to 'unplanned' side flow, e.g. because of dropping fish on the ground, etc.
What types of side flow do you have?	
How much of this is inedible and edible at the time of sorting out?	Edible means that it would have been safe to eat at the time the product is sorted out.
% edible % inedible	
It might be a good idea to quantify all side flows in one question if the company has a good overview of edible side flows.	
How much product is lost during processing?	Quantification.
Please indicate reasons for loss of edible material.	Side flow reasons
<ul style="list-style-type: none"> <li>• Too expensive to recover all of the edible material.</li> <li>• Accidents</li> <li>• Fluctuation in demand</li> <li>• Improper cool storage conditions</li> </ul>	
Explaining reasons. Different vehicles might give different side flow rates. Cooling machinery in particular might be important.	Side flow reasons.

**Table 32. Side flow treatment and reduction possibilities, fish pre-processing company.**

QUESTION	REASONS FOR ASKING
<p>Side flow treatment</p> <p>How is side flow treated/stored?</p> <ul style="list-style-type: none"> <li>• Composted</li> <li>• Anaerobic digestion</li> <li>• Made into bait</li> <li>• Other treatment, please specify</li> </ul>	<p>Quantification and side flow treatment. It is necessary to know how side flows are treated in order to carry out quantification.</p>
<p>What can be done to reduce side flow?</p> <ul style="list-style-type: none"> <li>• Improve cool chain</li> <li>• Better production planning</li> <li>• Improving processing equipment to get a higher yield for human consumption</li> <li>• Other, please specify</li> </ul>	<p>Reduction possibilities</p>
<p>Are there any hurdles today preventing you from reducing the side flows, or for using them for upgrading/value-adding?</p> <p>Who is currently the receiver of the side flows?</p> <p>Does the side flow currently constitute an income? If yes, how much?</p> <p>Does the side flow currently constitute a cost? If yes, how much?</p> <p>Is something preventing you from applying other kinds of value-adding strategies (e.g. better storage, further use in processing, etc.)?</p>	<p>Reduction possibilities</p>

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