NEW METHODS FOR FEASIBILITY STUDIES ON ESTABLISHMENT OF NEW AGRICULTURAL PRODUCTION CHAINS

December 1998

Agricultural Economics Research Institute (LEI-DLO)
# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOREWORD</td>
<td>5</td>
</tr>
<tr>
<td>SUMMARY</td>
<td>7</td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>13</td>
</tr>
<tr>
<td>1.1 Framework of the study</td>
<td>13</td>
</tr>
<tr>
<td>1.2 Objective</td>
<td>18</td>
</tr>
<tr>
<td>1.3 A more detailed definition</td>
<td>20</td>
</tr>
<tr>
<td>1.4 Outline of the report</td>
<td>22</td>
</tr>
<tr>
<td>2. REGION SELECTION METHOD</td>
<td>23</td>
</tr>
<tr>
<td>2.1 Introduction</td>
<td>23</td>
</tr>
<tr>
<td>2.2 Indicators</td>
<td>23</td>
</tr>
<tr>
<td>2.3 Examples</td>
<td>25</td>
</tr>
<tr>
<td>3. COST PRICE CALCULATION FOR AGRICULTURAL RAW MATERIALS</td>
<td>31</td>
</tr>
<tr>
<td>3.1 Introduction</td>
<td>31</td>
</tr>
<tr>
<td>3.2 Description of methods</td>
<td>32</td>
</tr>
<tr>
<td>3.2.1 Summary</td>
<td>32</td>
</tr>
<tr>
<td>3.2.2 Full cost price</td>
<td>33</td>
</tr>
<tr>
<td>3.2.3 Partial cost price in relation to the crop to be replaced</td>
<td>35</td>
</tr>
<tr>
<td>3.3 Valuation of labour and capital</td>
<td>37</td>
</tr>
<tr>
<td>3.3.1 Labour</td>
<td>37</td>
</tr>
<tr>
<td>3.3.2 Capital</td>
<td>38</td>
</tr>
<tr>
<td>3.3.3 Valuation of 'in-house' resources</td>
<td>39</td>
</tr>
<tr>
<td>3.4 Examples</td>
<td>39</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>45</td>
</tr>
<tr>
<td>APPENDIX</td>
<td>46</td>
</tr>
<tr>
<td>1. The ETSU method</td>
<td>47</td>
</tr>
</tbody>
</table>
The objective of EU project Renewpack is to develop new packaging materials which are based on agricultural raw materials. A precondition for the development of new packaging materials is the cost price of the end product. This is largely determined by the cost price of agricultural raw materials. The production location would therefore have to be wherever the agricultural raw material is available in large quantities for a relatively low price. This report describes a procedure by which an initial selection of regions which fulfil these criteria can be made. In addition, a summary of price-calculation methods is also given.

The Hague, December 1998

L.C. Zachariasse
SUMMARY

In order to determine the viability of new production chains a number of consecutive steps are necessary. Each step is a further refinement of the previous one and demands more detailed information. Once it has been established which products have to be produced, using which processes, which raw materials, on what kind of scale, the next question is: how can this be achieved; where to establish the new activities? In the case of the establishment of production chains which use agricultural based raw material, one of the questions which arises is: where can the processing company obtain the agricultural raw materials? The issue of which regions are capable of supplying agricultural products which meet the required criteria, is to a large extent determined by the competitiveness of the agricultural sector. This is largely determined by four factors: the market orientation, the appropriateness of the supply chain, the costs and efficiency and the strategic potential. The importance of each of these factors depends largely on the market (Hack et al., 1998).

This report has been written in the context of the EU project RENEWPACK, which is investigating the possibilities of developing new packaging materials from agricultural raw materials. The cost price of the end product is one of the most significant determining factors acting on the market chances of a newly developed packaging product. Packaging materials have to find a place in the so-called bulk market. In markets such as this, it is essential that large quantities of agricultural raw materials are made available at a minimum price; otherwise it is difficult to develop a market position. Processing therefore has to take place wherever the agricultural raw materials is available at relatively low prices. The main factor that has to be considered as decisive importance in the competitiveness of the agricultural sector in bulk market is: costs and efficiency. The costs of agricultural production differ greatly from country to country and even from region to region. This report will describe the procedure how to select the regions which are potentially attractive as supplier for the processing company.

This is just one of the steps to be made; the problem of location is dealt with as a number of steps. First, the product has to be defined. Secondly, a rough selection of the regions has to be made which is expected to provide insight into the question of whether it is possible to generate the necessary quantities of agricultural raw materials at an acceptable market price. This step results in short list of regions that are potentially attractive locations. This list is subsequently defined in more detail: an outline of costs is made for each region (step three). The outline of the costs are based on three cost items: the cost price of agricultural raw material, the transport and storage costs and the processing costs. There is an inverse relationship amongst these components: while the costs per unit of supply, storage and transport actually increase with
an increase in scale, the processing costs per unit actually decrease with larger scale production. Finally (step four) the total costs for each region will be compared and the optimum situation will be chosen: there where the total costs are minimal.

Figure 1 shows the different phases.

This report deals with the two following issues:

1) what information is required to select regions which are potentially attractive as business locations?
2) what methods can be chosen to calculate the cost price of the agricultural raw materials?

These two items seemed to be difficult to handle. Especially the issue of how to calculate the cost price of the agricultural raw materials requires some explanations.

The analysis focuses on those chains which require large quantities of agricultural raw materials at as low a price as possible.

What information is required to select regions which are potentially attractive as business locations?

Once the basic requirements for the agricultural raw materials are known, an initial selection can be made of those regions which could be potentially
attractive for the supply of agricultural raw materials. This selection actually constitutes an initial indication of the project's feasibility: is it possible to purchase the required agricultural raw materials 'anywhere' at the desired (low) price? In order to answer this question, it is important to find an indication of the economic viability of the agricultural sector. This is determined on the basis of the following list of factors:

<table>
<thead>
<tr>
<th>Environmental factors</th>
<th>Soils</th>
<th>Climate</th>
<th>Water supply</th>
<th>Relief</th>
<th>Altitude</th>
<th>Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic location</td>
<td>Distance from markets and sources of supply</td>
<td>Physical factors affecting the potential for generating non-agricultural income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural structures</td>
<td>Structure of holdings</td>
<td>Land ownership and tenancy structures</td>
<td>Rural infrastructure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social factors</td>
<td>Age of farmers</td>
<td>Availability of successors and laws of inheritance</td>
<td>Attitudes to farming</td>
<td>Rural population trends</td>
<td>Provision of training and advice to farmers</td>
<td>Social facilities</td>
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<tr>
<td>Economic factors</td>
<td>Competition from other production systems</td>
<td>Competition from other land uses</td>
<td>Rising cost of living and rising income aspirations</td>
<td>Alternative employment possibilities</td>
<td>Relative costs of inputs, especially labour</td>
<td>Changes in demand for farm products</td>
</tr>
<tr>
<td>Policy factors</td>
<td>Trade policy</td>
<td>CAP agricultural support measures</td>
<td>National and regional agricultural support measures</td>
<td>Special support measures, particularly in designated areas</td>
<td>Restrictions on agriculture, particularly in designated areas</td>
<td>EU regional policy</td>
</tr>
</tbody>
</table>

Figure 2  List of factors relating to the economic state of the agricultural industry in a region
Source: Baldock et al., 1996.

A significant amount of information about these indicators can be obtained from three European databases:
1) Farm Structure Survey (FSS), collecting data on the structure of farms: size categories, acreage, livestock numbers and worker numbers. FSS functions at a very detailed level: 424 sub-regions across the EU 12;

2) Farm Accountancy Data Network (FADN): a random sample focusing primarily on financial (farm) data. The balance sheet and the profit and loss account of the agricultural business are central features. It also contains a lot of technical data, such as livestock numbers, the number of workers and the land use. FADN differentiates between 91 regions;

3) Regional database (REGIO), covering the principal aspects of the economic and social life of the EU at regional level. REGIO offers demographic, economic accounting and employment data.

**Method for calculating the cost price of agricultural raw materials**

The ex-farm cost price constitutes an important factor - in addition to the costs of storage and transport - in the cost price for the factory. The cost price for the factory is the price which the processor has to pay for agricultural raw materials in order to guarantee supply. There are a number of methods for calculating the cost price. In the context of a feasibility study focusing on the long term, it is important that all the costs are included: both the variable costs and the fixed costs. It is then obvious what the full cost price is. This cost price comprises the following components.

<table>
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<th>Direct costs</th>
<th>Labour costs</th>
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<tr>
<td>costs of sowing seed/planting material</td>
<td>costs of machinery</td>
</tr>
<tr>
<td>costs of fertilizer</td>
<td>costs of buildings</td>
</tr>
<tr>
<td>costs of crop protection agents</td>
<td>costs for use of land (ground rent or interest, water and sewerage charges) and</td>
</tr>
<tr>
<td>other directly attributable costs (insurance, levies, certification costs, etc.)</td>
<td>General expenses</td>
</tr>
<tr>
<td>interest on circulating assets</td>
<td></td>
</tr>
<tr>
<td>costs of work carried out by third parties</td>
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![Figure 3 Composition of the full cost price](image)

There may also be reasons for relating the cost price of a new crop to be cultivated to another crop which is to be replaced. In that case, the cost price can be regarded as a partial cost price.

Each criteria consists of two components: (1) the physical input of the means of production (the quantity component) and (2) the value, the price of the means of production.

The first component should be supplied primarily by the agronomists. This component is an important one as it has a significant influence on the cost price. Given that feasibility studies have shown this technical input, as a rule,
to be associated with uncertainty and/or the subject of further study, attention should be paid to sensitivity studies focusing on the technical variables. An important aspect is that the arguments for the level of the physical input are clear and that these are seen in the light of the cultivation procedures from beginning to end.

The 'background information' is also important for the second, economic, component, i.e. the value or the price of the means of production. This is particularly true in the context of labour and capital, as the various ways of allocating labour and capital - which can differ (greatly) from one region to another - determine the price.

Consequently, a cost price as a singular piece of information does not mean very much; only prices related to a chain and organization structure, which takes into account the circumstantial factors influencing production, are meaningful.
1. INTRODUCTION

1.1 Framework of the study

The development of new product chains based on agricultural raw materials involves a variety of different steps. First there is the supplier, who supplies goods to the farmer who produces the agricultural raw materials. He then sells the raw materials (produce) to an industrial processor who then further processes the produce - possibly via a number of intermediate steps involving semi-manufactured products - into an end product that is supplied to the consumer or the industrial end user. Trade may also have its place in this chain. The product chain therefore comprises a number of links which must be coordinated and which must operate in sync so that a product is eventually brought onto the market which the end user actually demands (see figure 1.1).

![Figure 1.1 Outline of a chain organization](image)

Various (research) phases can be distinguished in the procedure leading from project idea to commercialization of new agricultural production chains.
Each phase is followed by another which in turn is the basis for a subsequent phase. If necessary, feedback is given and (parts of) phases are subjected to a review, because the ways of thinking on other phases have changed. This procedure also applies to agrification projects. Agrification means: the use of agriculturally based renewable resources for new, non-food applications.

During the development procedure for new agricultural production chains, preconditions and requirements for the links in the production chains are developed, keeping in mind the end product to be produced. These requirements include the quality, the quantity to be supplied, the costs, the organization, the means of production, etc. These requirements then undergo refinement and fine-tuning in each phase of the decision-making process. The first phases comprise requirements with plenty of leeway which are honed further and further until the definitive demands and conditions are laid down in the contracts between the links in the product chain.

The processing industries often play a key role. They have to be able to translate the market requirements into technical requirements for their processes as well as requirements for the agricultural raw materials used. Whether and to what extent the conditions and requirements which have been developed can be met depends very much on factors such as the supply and the availability of labour and other inputs, the political situation, infrastructure, the distance to the market, the availability of produce and the market structure. These factors differ from country to country and from region to region, but are all relevant when selecting a business location.

In the context of agrification projects, the most important raw materials are of agricultural origin. Whether and to what extent the market requirements for the agricultural raw materials are achieved is therefore largely determined by the competitiveness of the agricultural sector in a particular region.

What factors determine the competitiveness of the agricultural sector? Hack et al. (1998) developed an instrument to measure the competitiveness of the Dutch agricultural sector: the Competitiveness Monitor. The framework of the Competitiveness Monitor consists of four key factors:

1) the market orientation;
2) the appropriateness of the supply chain;
3) the costs and efficiency; and
4) the strategic potential.

Each factor consists of several underlying factors. These factors are displayed in figure 1.2.
1) **Market orientation**: the extent to which industries succeed in acquiring a good competitive position by meeting the wishes and needs from the market

1.1 Product innovation
- number of product introductions
- number of successful product innovations
- quality of product introductions

1.2 Differentiation of products
- position of brands
- land of origin as differentiating feature
- packaging

1.3 Service
- logistic service meeting buyers' wishes
- other service meeting buyers' wishes
- keeping in touch with the main customers
- response time to changing wishes

1.4 Quality

1.5 Product range
- size of the product range
- adaptation of the product range

2) **Supply chain appropriateness**: the extent of coordination between the parties in the supply chain to organize the flow of goods and information more suitably in order to meet the needs of the market adequately. The more suitable the flows of information and goods, the better the competitiveness.

2.1 Information exchange
- prompt provision of information
- completeness
- relevance

2.2 Logistics
- integrated approach
- reliability
- unnecessary logistic costs

2.3 Coordination and cooperation
- way of coordination
- supply chain manager
- reliability of the product and risks

3) **Costs and efficiency**: the extent to which companies and industries control costs and utilise resources efficiently

3.1 Price quality
3.2 Factor costs
3.3 Productivity
3.4 Purchase price

4) **Strategic potential**: the extent to which companies and industries are able to strengthen their position, create new ideas and withstand difficult times.

4.1 Core competence
- presence of core competence
- possible unique combination of core competence
- possibilities for developing a new core competence
4) **Strategic potential**: the extent to which companies and industries are able to strengthen their position, create new ideas and withstand difficult times.

(continuation)

<table>
<thead>
<tr>
<th>4.2 Solvability/vulnerability</th>
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<tbody>
<tr>
<td>- financial position of the industry or business</td>
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<tr>
<td>- market risks and opportunities</td>
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<tr>
<td>- dependence on the environment</td>
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<th>4.3 Flexibility and strategy</th>
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<tbody>
<tr>
<td>- flexibility to change the production process</td>
</tr>
<tr>
<td>- presence of a long-term strategy</td>
</tr>
<tr>
<td>- external orientation</td>
</tr>
<tr>
<td>- market intelligence</td>
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<tr>
<td>- competitor intelligence</td>
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*Figure 1.2 The factors which determine the competitiveness of the agricultural sector*

The factors mentioned vary in degree of importance. In production chains which are characterized by an abundance of innovation, rapidly changing markets and clients' wishes, elements such as market orientation and supply chain appropriateness are the most important factors. In production chains where the accent is on the requirement 'large quantities of produce for the lowest possible costs', it is primarily the third element, costs and efficiency, which dominates.

This report focuses primarily on the so-called (bulk) markets. These are markets which require large quantities of agricultural raw materials at a minimum price. The above shows that in the context of this type of market, the cost and efficiency element is of primary significance. The other factors referred to are also important, but the accent is on costs and efficiency. This report concentrates on a closer examination of this element in particular.

Different phases of the decision-making process regarding the choice of location for new production chains require different sorts of information. Figure 1.3 illustrates these various phases. These phases can be described as follows:

1) **The identification phase**

   The first phase - the identification phase - provides an insight into which products can be produced, how they are produced and in what quantities. A broad list of demands has also been drawn up relating to the costs of the agricultural raw materials. This list of demands forms the basis for an initial, rough selection of potentially attractive product regions, and is the focus of phase two.

2) **The initial, rough selection of regions**

   The aim of the second phase is to make an initial, rough selection of the regions by drawing up and analysing data at a general, regional level. General agricultural data provides an indication of the possibilities of producing the
quantity demanded at the required cost level. When the accent is on other elements in the product chain - for example on innovation and logistics - the initial selection of regions should be based primarily on these elements.

3) **The construction of supply curves per region**

Once the initial selection of potentially interesting regions has been made, a further refinement of the selection process such as costs estimates has to be made. These are based on three cost items: acquisition costs of the agricultural raw materials, transport and storage costs and processing costs. Together these costs give the cost price of the end product that is to be brought onto the market. This cost price must not exceed the expected market price.

![Diagram](image_url)

**Figure 1.3 Outline of the decision-making process**

The supply curve has to be interpreted in relation to the curve depicting the processing costs in relation to the scale of production. These curves often show an opposite trend: while the costs of processing decline when the scale of production increases, the costs of production increase as the scale of production increases (see figure 1.4). Increased scale of production is the result of the farmer's conversion to more land. Furthermore, costs of storage and transport increase if production takes place on a larger scale. One has to define the ideal situation in which the sum of the processing costs and production costs for the raw material is at a minimum (see figure 1.4)
4) **Definitive selection of business location**

The comparison of the supply curves forms the basis for the definitive selection of regions, with additional considerations possibly also playing a role.

### 1.2 Objective

The aim of this report is to provide insight into two questions which are essential for completion of the above-mentioned phases:

1) what information is required and when is it required in order to select the regions which are potentially interesting as business locations?

2) what method can be selected in order to calculate the cost price of the agricultural raw materials?

The following is a brief explanation.

**Sub 1) What information is required in order to select the regions?**

The problem of the business location is dealt with in the second, third and fourth phases. Information about the situation at regional level is a precondition to being able to answer this question properly. The costs of crops differ per country and even at regional level. Neither the profit per hectare nor the costs per hectare are the same for farmers in the various regions of the EU.
There are several reasons for this. First, the spatial variations in geological, topographical and meteorological conditions cause differences in the yields and costs per hectare. One can imagine that agricultural production in dry climates results in a lower profit per hectare or higher costs per hectare (irrigation). The economic and marketing climate of the agricultural sector also affects profits and costs per hectare. One might expect that a well-developed marketing structure results in higher prices and/or lower costs due to agricultural production being more efficient. Furthermore, it is related to the price of land leases. A well-developed agricultural sector with high yields per hectare and satisfactory returns leads to relatively high land lease prices. The latter also depends on the pressure of other economic activities and the scarcity of land. That the costs of crops differ per country and per region speaks for itself. Therefore, an average price (at EU or country level) would not help alleviate the problem of production; a regional stock-take would have to be made in order to answer the question of feasibility.

It is, therefore, essential that information is collected at regional level, in particular on the aspects which determine the costs of agricultural raw materials. This report is intended to provide a basis for supporting this selection process: what information is required and where can this information be obtained?

**Sub 2) What method can be selected for calculating the cost price of the agricultural raw materials?**

As has been demonstrated above, it is important to create a supply curve. This means that insight is required into the way in which the cost price of agricultural raw materials can be calculated. There is some confusion about the costing method of the ex-farm price because different methods with different starting points, both technical and economical, are used. This leads to different results, which cannot easily be compared and which are difficult to interpret. An essential element of the approach is that farmers are required to convert their agricultural land and their labour from the production of conventional crops to the production of new crops, for new outlets. This conversion can only be made when the price offered for the new crops is high enough to compensate the loss of income from the conventional crops; prices for new crops have to compete with those of conventional crops, otherwise the conversion will not occur. This approach will be explained in the report.

We shall illustrate the approach with the results of the RENEWPACK project (AIR2 CT94 1796). The aim of RENEWPACK is to improve packaging products made from paper-based and cardboard-based sheet material and forms, starting from renewable resources such as agricultural fibres. Figure 1.5 provides a brief explanation of the project.
The RENEWPACK project focuses on case-making materials. This is the largest packaging category. Case-making materials refers to [a] test and kraft liner and [b] corrugated medium (fluting). The ‘sandwich’ of the test and kraft liner and the fluting produces the corrugated box. Within Europe there is a trend towards substitution of kraft liner with test liner. Test liner is a waste-based sheet, as is the corrugating medium. RENEWPACK’s aim is to produce a pulp which fits in with this trend of increased use of recycled waste fibre. Therefore, RENEWPACK focuses on a pulp for test liner: a pulp based on agricultural fibres and recycled waste fibre. Besides the corrugated box, case-making materials include solid board boxes. RENEWPACK also considers solid board boxes such as a multi-layered, laminated sheet. Consequently, one can distinguish two components in case-making materials: the test liner and the fluting.

What are the consequences for the selection of fibrous produce? The pulp has to meet the requirements for case-making materials. This has direct consequences for the use of fibrous raw materials, which have been assessed on the most important pulp properties: strength (required for the test liner) and stiffness (required for the fluting), technical properties and costs have led to the selection of four fibrous raw materials:

[a] wheat straw;
[b] miscanthus; and
[c] short Rotation Coppice (SRC) poplar.

These fibrous raw materials enhance the fibre bonding in the furnish for the fluting. Wheat straw and miscanthus maintain the sheet properties, while SRC poplar is expected to improve the sheet properties. They will be used in the furnish with predominantly recycled waste paper.

The fourth fibrous raw material is:
[d] hemp; hemp is expected to enhance the tearing properties and improve the sheet properties in the furnish with waste-recycled fibre for the test liner.

Figure 1.5 Framework of the RENEWPACK project

1.3 A more detailed definition

At the heart of the selection of locations and the costs estimates lies the producer of the raw materials. Is the processing company to produce the agricultural raw materials itself? Or would the processing company prefer just to purchase the agricultural raw materials and therefore place the responsibility for production in the hands of the farmers? The first scenario would involve an integration of activities and internal deliveries. The requirements for the region would then be different than when the production of agricultural raw materials is contracted out to farmers. In the latter case, cultivation has to generate profit and fit into the farming system in which other products are cultivated. There are advantages and disadvantages to both options. Given the development towards ‘back to core activities’ and the trend of contracting out as many non-core business activities as possible, we shall restrict ourselves here to this type product chain.

Crops that are selected for the new product chain may differ with regard to their stage of development. It is possible to make a distinction amongst the well-established crops that have been produced for many years. On the other hand, there are crops that as yet, are not grown on a commercial basis. Some-
where in between there are crops with a limited commercial relevance which could expand further. It is apparent that the state of development largely determines the approach to estimating the costs of crops and also the quality of the estimates. When the cultivation and marketing of the crop is well established, data about market price and costing are more reliable than in the case of estimates based on pilot plant demonstrations. In this report we take this fact into account and we provide insight, based on a variety of examples, into how this can be handled.

Another item requiring attention is the decision-making process of the individual farm in relation to that of the processing industry. The time scale for decisions taken by the farmer may differ from the time scale for decisions taken by the processing industry. The farmer growing annual crops often only considers the short-term returns. When the contribution the crop makes to his income is considered to be too low, the farmer will switch over to other crops. However, the processing industry is often characterized by major investment (costs). Therefore, the investment decision has to be based on the assurance of supply (at least) during the period of depreciation (20 years). This report assumes the necessity of creating a guaranteed supply of agricultural raw materials in the long term. The cost price of the agricultural raw materials is calculated on the basis of long-term considerations by the farmer. The cost price has to be such that the grower finds the crop attractive enough to include it in the growing plan for (many) years 1).

In the context of long-term decisions, it is important to explicitly include any available (government) subsidies in the considerations. Subsidies have a less stable character, due to the fact that they are to a large extent determined by politics and this factor has to be recognized. It goes without saying that subsidies can influence the selection of a location and the cost price, but due to the difference in time scale this influence must not be given (too) much weight, and they should be explicitly stated.

As mentioned in the introduction in section 1.1, important market and organizational considerations may also influence the selection of a location. Is the agricultural sector capable of following and translating the (changed) requirements of the market? Is the agricultural sector organized in such a way that innovative techniques can be introduced quickly? What is the market position in relation to other links in the product column? These institutional elements are always important for the creation of new production chains. However, in the initial selection of locations for production chains requiring large quantities of agricultural raw materials for as low a price as possible, preferably as large batches, the expected cost of the agricultural raw materials in particular is the most important factor. And so this report will devote some detailed

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1) This cost price can serve as a basis for the price paid by the processing industry. If it concerns existing crops the factory also has to take existing market prices into account: the price paid should be at least equal to the price which the grower would get elsewhere.
attention to this element. The procedure proposed here therefore applies in particular to those production chains which demand so-called bulk products.

1.4 Outline of the report

Chapter two describes the procedure for making an initial selection of regions: which regions are potentially interesting as business locations for the processing and production of new products based on agricultural raw materials? After the initial selection of regions (using the procedure detailed in chapter two) additional insight into the cost price of agricultural raw materials is required for further decision-making concerning the business location. Chapter three outlines methods which are useful when determining the cost price.
2. REGION SELECTION METHOD

2.1 Introduction

This chapter contains a checklist of factors which provide indications of the economic situation of agriculture in a particular region. This is an important factor when determining whether, and to what extent, agricultural raw materials can be supplied at an acceptable market price. This provides an initial insight into the attractiveness of a region as a business location and potential market. The procedure described here serves as a general guide for making an initial selection of a number of potentially interesting regions. The definitive location is selected during a later phase when more detailed information is available.

Besides outlining the procedure, this chapter also explains where information about the indicators can be obtained: which sources of information are available to give more substance to the relevant indicators. The checklist is illustrated using examples from the RENEWPACK project.

2.2 Indicators

Important issues in the assessment of regions include the economic viability of farming, the social structures of farm holders, the viability of rural development, the socio-economic structures of farming and environmental conditions (Baldock et al., 1996).

In Baldock et al. (1996) a variety of factors are referred to which determine the process of (marginalisation and) land use, with marginalisation being described as 'a process, driven by a combination of social, economic, political and environmental factors, by which in certain areas farming ceases to be viable under an existing land use and socio-economic structure'. The factors therefore provide information about the economic situation with regard to agriculture in the region and accordingly they are relevant to the selection of regions as potential markets for agricultural raw materials. Figure 2.1 lists the various factors and provides more detailed information.

The factors listed in figure 2.1 are among those that should be taken into consideration when selecting regions. Statistics from European databases can be used to back up a number of the factors. A brief explanation of these databases is given below.
Farm Structure Survey (FSS)

The FSS is conducted periodically to collect data on the structure of farms. Depending in the country, such surveys are carried out yearly, one every three years, or at random.

| Environmental factors                      | Soil                      |
|                                          | Climate                   |
|                                          | Water supply              |
|                                          | Relief                    |
|                                          | Altitude                  |
|                                          | Pollution                 |
| Geographic location                      | Distance from markets and sources of supply |
|                                          | Physical factors affecting the potential for generating non-agricultural income |
| Agricultural structures                  | Structure of holdings     |
|                                          | Land ownership and tenancy structures |
|                                          | Rural infrastructure      |
| Social factors                           | Age of farmers            |
|                                          | Availability of successors and laws of inheritance |
|                                          | Attitudes to farming      |
|                                          | Rural population trends   |
|                                          | Provision of training and advice to farmers |
|                                          | Social facilities         |
| Economic factors                         | Competition from other production systems |
|                                          | Competition from other land uses |
|                                          | Rising cost of living and rising income aspirations |
|                                          | Alternative employment possibilities |
|                                          | Relative costs of inputs, especially labour |
|                                          | Changes in demand for farm products |
|                                          | Market prices             |
|                                          | Developments in agricultural technology |
|                                          | Availability of capital/loans |
| Policy factors                           | Trade policy              |
|                                          | CAP agricultural support measures |
|                                          | National and regional agricultural support measures |
|                                          | Special support measures, particularly in designated areas |
|                                          | Restrictions on agriculture, particularly in designated areas |
|                                          | EU regional policy        |
|                                          | Land use planning         |
|                                          | Land taxes                |
|                                          | Environment and nature conservation policy |

**Figure 2.1 List of factors indicative of the economic situation of agriculture in a region**

The FSS contains a list of the farms according to size category, acreage, livestock numbers and employee numbers.

The FSS distinguishes 91 regions and provides periodic statistics on the 424 sub-regions. By way of illustration, figure 2.2 lists the regions and sub-regions in Germany. In Germany, the division into regions corresponds with the division into Bundesländer (federal states).
Figure 2.2 List of regions in Germany and the sub-regions of Lower Saxony

Farm Accountancy Data Network (FADN)

The FADN lists approximately 57,000 agricultural farms in the EU which together represent 3.6 million farms from the twelve EU countries which existed before 1995. One must take into account that FADN is less representative of small farms. Inclusion in the FADN is subject to farms being of a minimum economic size and being used for the farm holder’s main activity. Consequently, small farmers, marginal farms and part-time farmers are also less well represented.

The data are collected in each Member State and sent to the EU. There it is compiled into a single database.

The FADN primarily collects financial (operating) data. The basis is the balance sheet and the profit and loss account of the agricultural farms. It also contains a lot of technical information, such as the herd, the number of employees and the land use. The FADN is based on a classification into 91 regions.

Regional data bank (REGIO)

REGIO covers the principal aspects of the economic and social life of the EU at regional level. REGIO can be used to gain insight into rural and regional development across the EU and it also contains demographic, financial and employment data.

2.3 Examples

This paragraph contains a more detailed analysis of a number of examples, thereby providing more insight into the use of the indicators referred to when selecting regions.
Example 1 Environmental factors: 'biophysical conditions' for miscanthus

For miscanthus the requirements with regard to climatic, soil and other conditions limit the number of regions in which the crop can be grown commercially. The European Miscanthus Network has generated information on the potential for Miscanthus in Europe. One of the aims of the project was to determine the sustainable yield and quality of Miscanthus at different locations in the EU. Therefore, standard productivity trials of *M. sinensis* 'giganteus' have been established and monitored by fourteen partners in ten countries throughout Europe. There is a wide variation in miscanthus yields: the yield per hectare varies considerably according to the site and the climate. Furthermore, it is obvious that in the southern European countries the yield per hectare is higher than in the northern part of Europe. In Greece, Italy and Portugal yields of more than 24 ton Dry Matter (DM) per hectare were recorded, while the yields per hectare in Belgium, Germany, Ireland, the Netherlands and the United Kingdom did not exceed 17 ton DM per hectare. It seems that miscanthus growth is restricted by low temperatures. Furthermore, the northern European countries faced winter mortality in the first year of plant growth. However, it must be kept in mind that these high yields per hectare can only be achieved on plots where water is not a limiting factor. Crop production may be largely limited in regions with low rainfall levels unless these areas are irrigated.

Based on the criterion 'potential yield of miscanthus per hectare' the southern European countries (Greece, Italy, Portugal and Spain) can be selected as potentially interesting for the production of miscanthus.

Example 2 Geographic location: distance from the market and sources of supply

In the case of cereal straw, the distance from the market to the supplier can be deduced from the concentration of cereals. When considering the concentration of wheat, two items are relevant:
1) the area of wheat production in relation to the total area in the region;
2) the straw yield per hectare.

The area of wheat production in 71 EU regions in the period 1986-1992 has been examined. This area has been related to the total acreage in the region. Table 2.1 shows that in four wheat covers more than 20% of the total area.

Straw yield differs per region. Assuming the Netherlands and Belgium are more or less representative for the northern EU countries and Spain for the southern countries, the northern EU countries yield about twice as much as the southern Member States. This means that this criterion does not give any additional results. This criterion deselects the countries of the southern EU; the same regions that have been thrown out by using the (first) criterion 'concentration of wheat production'.
Table 2.1 Regions where wheat coverage is more than 20% of the total area - in the period 1986-1992

<table>
<thead>
<tr>
<th>Region</th>
<th>Wheat coverage (1,000 ha)</th>
<th>Total area (km²)</th>
<th>Wheat coverage/total area ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ile-de-France (F)</td>
<td>266</td>
<td>12,012</td>
<td>0.22</td>
</tr>
<tr>
<td>Nord-Pas de Calais (F)</td>
<td>256</td>
<td>12,414</td>
<td>0.20</td>
</tr>
<tr>
<td>East Midlands (UK)</td>
<td>390</td>
<td>15,630</td>
<td>0.25</td>
</tr>
<tr>
<td>East Anglia (UK)</td>
<td>341</td>
<td>12,573</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Sources: Eurostat, several volumes; Eurostat 1994.

Example 3 Economic factors: costs of agricultural production

For the countries with the highest ratio (more than 10% of the area is accounted for by wheat production) the farms which specialize in growing wheat have been selected. The countries which were involved in this assessment were Germany, France, Italy, Greece, and the United Kingdom. For the farms in these countries the total agricultural area and the acreage of wheat are related to the total costs per farm. These ratios give an impression of the cost efficiency of the farms. The assessment has shown that the costs per hectare (wheat) are relatively low in Italy and Greece. However, in these countries the average size of the farms is (very) small. Of the large farms in Germany, France, and the United Kingdom, Ile-de-France and East Anglia score highest on costs. The results are shown in table 2.2.

Table 2.2 Costs of wheat farms, per hectare of wheat and per hectare in 1990

<table>
<thead>
<tr>
<th></th>
<th>Total area (ha/farm)</th>
<th>Wheat area (ha/farm)</th>
<th>Costs (ECU/farm)</th>
<th>Costs (ECU/ha)</th>
<th>Costs (ECU/ha wheat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ile-de-France</td>
<td>91</td>
<td>42</td>
<td>84,760</td>
<td>2,014</td>
<td>933</td>
</tr>
<tr>
<td>East Anglia</td>
<td>125</td>
<td>66</td>
<td>122,976</td>
<td>1,849</td>
<td>981</td>
</tr>
</tbody>
</table>

Source: FADN.

Example 4 Economic factors: market prices of hemp

As discussed in Fibres in the European Union (Meeusen-van Onna and Boers, 1996) there is only a limited amount of useful information on the market price of hemp. Eurostat statistics show a wide range of prices per year and per country. This can be explained by the heterogeneity of the group 'hemp', which includes unprocessed hemp, shives and long bast fibres, and hemp products such as rope. This diversity hampers the interpretation of the data. Consequently, hemp producers' organizations had to be consulted: the Fédération
National des Producteurs de Chanvre in France, Hemp Core in the UK and Hemp-Flax in the Netherlands.

The Fédération National des Producteurs de Chanvre has provided the market price of hemp straw (both long bast fibre and shives): see table 2.3.

The market prices given in table 2.3 refer to hemp straw, including the bast fibre and the shives. Table 2.3 shows that the average market price in this period is 60 ECU per tonne for hemp straw. Hemp Core in the United Kingdom and Hemp-Flax in the Netherlands pay similar prices. The market price for hemp does not differ very much between countries and regions. It is a world market price.

### Table 2.3  Market price of hemp straw (bast fibre and shives) in the period 1990-1995 (ECU per tonne)

<table>
<thead>
<tr>
<th>Year</th>
<th>Price (ECU/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>66</td>
</tr>
<tr>
<td>1991</td>
<td>64</td>
</tr>
<tr>
<td>1992</td>
<td>60</td>
</tr>
<tr>
<td>1993</td>
<td>56</td>
</tr>
<tr>
<td>1994</td>
<td>50</td>
</tr>
<tr>
<td>1995</td>
<td>60</td>
</tr>
</tbody>
</table>


**Example 5  Economic factors: Standard Gross Margin per hectare of Utilised Area**

The average Standard Gross Margin per hectare of Utilised Area (SGM/ha) in EU 12 is 960 ECU. However, there are significant variations within the EU 12. The Standard Gross Margin per hectare UAA is the lowest in the central parts of Spain, in Portugal (Alentejo-Algarve) in a few regions in France (parts of Corsica, Midi-Pyrénées, Limousin and Auvergne and parts of Rhône-Alpes) and Italy (Valle d’Aosta and parts of Sardinia) and in Scotland. In these areas, the SGM is less than 500 ECU per hectare. In intensive (market gardening) regions such as the Netherlands and Nigeria (Italy) the SGM is more than 5,000 ECU per hectare.

Whenever crops have to be available at a low price, regions with a lower average yield are considered sooner than those regions where the land can produce high yields. After all, the grower will compare the yield obtained from his new crops with that of the crops which he already cultivates. He will want to achieve at least a comparable yield. On the other hand, the question has to be asked why the yields in certain areas are so low. In parts of Spain the drought is one of the causes. It cannot be expected that there will be a high yield in those regions. So, are those regions still interesting as future supply areas for new crops? In short, the Standard Gross Margin per hectare of Utilised Area provides an *initial* impression of the economic attractiveness of a region and must be considered in combination with other factors.
Example 6  Economic factors: Price of land

The price of land is highest in the northern part of Europe, for example in Denmark, Germany, the Netherlands, Belgium, Luxembourg and the southern part of England. In contrast to this, the price of land is low in regions with low economic returns from agriculture. It is below 3,000 ECU per hectare in the central parts of Spain, in France (Centre, Lorraine, Pays de la Loire, Poitou-Charentes, Limousin, Bourgogne and Franche-Comté, Auvergne and Corsica), in most of Italy (except the areas Lombardy and Veneto) and in parts of the United Kingdom (Scotland and Wales).

In areas with a low land price, the cost price of the agricultural raw materials is also lower. Whenever this is an important requirement, the regions mentioned here will be considered first.
3. COST PRICE CALCULATING FOR AGRICULTURAL RAW MATERIALS

3.1 Introduction

The cost price of agricultural raw materials can be calculated in various ways, but not all of these automatically qualify as a basis for feasibility studies. The circumstances under which the production takes place, the length of time to which the decision refers and the consequences of further production for the rest of the cropping plan determine to a large extent which method is most suitable. Relevant issues are whether the new crops involve fundamental changes in the farming system, and whether crop production involves (substantial) changes in fixed costs. The grower will also have to ask himself whether the new crop fits onto his labour plan. The key question is: 'Which cost items should be taken into consideration?' This is examined in section 3.2. Furthermore, these questions are of overriding importance in the valuation of the labour and capital input. It is clear that the farmer will not automatically value the assets and capital he has put in at the market value, or the labour of his staff at the collective labour agreement wage levels. Other factors also play a role in his decision to 'stay in farming', and ensure that the valuation of labour and capital is somewhat lower. Just how much lower and under which circumstances the lower valuation can be used in calculations is a topic which is discussed in more detail in section 3.3.

This chapter presents an outline of the methods used to arrive at a cost price for agricultural raw materials. There are three questions at the core of this:

- when should certain cost items be included, when not, and what are these?
- how should the input of labour and capital be dealt with?
- how should the farmer's own resources in terms of labour and capital be valued?

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1) Based on the report Cost price analysis for new agricultural raw materials: Approaches to feasibility studies (Dutch title: Kostprijsberekening voor nieuwe landbouwgrondstoffen; Methoden ten behoeve van haalbaarheidsstudies) (Meeusen-van Onna, 1997).
3.2 Description of methods

3.2.1 Summary

A number of factors determine which calculation method is most suitable. First of all, there is the question of whether the agricultural production is to be undertaken place for profit or not, i.e. that the produce is seen as an internal supply by the processor of the raw materials or by the farmer who generates income through the cultivation of the product. A second factor is the period of time the decision refers to. In the context of long-term decisions, the changes in the fixed costs should also be taken into consideration, while for short-term decisions, this element does not have to be considered. A third factor is whether the crop is to be positioned in relation to one single crop or not. The grower might be considering dropping one or more crops from the cropping plan and replacing these with another crop. These considerations could be of a financial nature (when, for instance the existing crop yields a low profit) or of an environmental nature (such as a broader cropping plan). A fourth factor is whether the growing of new crops is linked to changes in the farming system. These factors collectively determine which cost items should be considered in the cost price calculations, as well as the way in which the costs should be calculated. In figure 3.1 the most common situations - combinations of factors - are presented. Although many different situations and combinations of factors (even as many as sixteen) can be imagined, a lot of these are largely theoretical. If, for example, the processor is producing the crop, it is not very likely that he will only be doing this for one year while he has to write off the processing facilities over several years. Neither would a processor wish to keep the emphasis on his core activities and give shape to the agricultural activities in the 'traditional' way, with a cropping plan, etc. Consequently the only option included in figure 3.1 involves the processor examining the long-term effects without keeping other crops as a reference and without him being confronted with the consequences for the cropping plan. If a farmer only examines the short-term effects, the most common reference is 'another crop' and the changes in the fixed costs are not taken into consideration. This is why other options have not been included in the outline.

The methods are described one by one. Attention is first of all paid to the question which cost items should be taken into consideration and when. Next, the question is raised of the valuation of the input of labour and capital in particular. The method developed by Moore et al. (1996) is a mixture of elements from the summary above. This method is described separately in Appendix 1.

Many of the cost items that are discussed in the subsequent sections are expressed in ECU per hectare, regardless of the methodology selected. In order to arrive at a cost price in ECU per unit product it is necessary to have an estimate of the yield per hectare. This factor is of major influence on the ultimate cost price. Assessment of the cost price therefore requires a critical examination of the estimated hectare-yield.
A second point of special attention which applies to all methodologies is how to deal with subsidies. Subsidies are very common in the agricultural industry. Do we want to integrate these into the cost price? Or do we want to keep the cost price 'clean'? The recommendation is for a cost price which has been stripped of subsidies as far as possible, because these are subject to political decision-making and are therefore sensitive to change. If an investment decision needs to be taken, continuity is an important basic criterion. Subsidies would not fit into this very well. If (at least in the short term) it is fair to take subsidies or other grants into account, it is worth considering calculating and presenting one cost price with subsidies and one without subsidies. This also applies in the case of the set-aside scheme allowance.

3.2.2 Full cost price

Horring (1948) gives the following definition of cost price:

'On the one hand, the cost price is the relationship between the standardized quantities of the means of production multiplied by their monetary value in the next-best application available locally which no longer qualifies and in the period to which the cost price refers, and on the other hand, the non-monetary yields standardized according to quantity and quality corresponding to these quantities of the means of production, these yields being in a certain stage of production.'

This definition refers to 'standardized' quantities of means of production and products. 'Standardization' of this data means that the quantities are averaged out over a number of years. In this way 'chance' effects and influences are flattened out as far as possible. However, in the case of new (agrification) crops, these data are only 'provisional', based on experimental field results. It is therefore not generally possible to meet the 'standardization' condition at the feasibility studies stage, but this is not such a big problem. It is more important for the technical research to take anticipated technical developments that determine the kilogram yield into account.

<table>
<thead>
<tr>
<th>Producer</th>
<th>Term</th>
<th>Positioning in relation to one crop</th>
<th>Consequences for cropping plan and/or farming system</th>
<th>Method for calculating costs price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>long</td>
<td>not applicable</td>
<td>not applicable</td>
<td>full cost price</td>
</tr>
<tr>
<td>Farmer</td>
<td>long</td>
<td>yes</td>
<td>yes</td>
<td>partial cost price (II) a)</td>
</tr>
<tr>
<td>Farmer</td>
<td>long</td>
<td>yes</td>
<td>no/few</td>
<td>partial cost price (II)</td>
</tr>
<tr>
<td>Farmer</td>
<td>long</td>
<td>no</td>
<td>yes</td>
<td>full cost price</td>
</tr>
<tr>
<td>Farmer</td>
<td>long</td>
<td>no</td>
<td>no/few</td>
<td>full cost price</td>
</tr>
<tr>
<td>Farmer</td>
<td>short</td>
<td>yes</td>
<td>yes</td>
<td>partial cost price (I) a)</td>
</tr>
<tr>
<td>Farmer</td>
<td>short</td>
<td>yes</td>
<td>no/few</td>
<td>partial cost price (I)</td>
</tr>
</tbody>
</table>

Figure 3.1 Breakdown of the factors that determine methodology selection

a) It should be taken into account here that a short-term decision - by definition - does not take the consequences of changes in the farming system and the fixed costs into consideration.
A second element which Horring touches upon in his definition is the valuation of means of production in the next-best applications that no longer qualify. These alternative applications and the corresponding valuations are an important point of interest in particular in relation to labour and land. It is for this reason that this topic is dealt with extensively in section 3.3.

- Direct costs:
  - costs of sowing seed/planting materials;
  - costs of fertilizers;
  - costs of crop protection agents;
  - other directly attributable costs (insurance, levies, certification costs, etc.);
  - interest on circulating assets;
  - costs of labour carried out by third parties.
- Labour costs
- Costs of implements
- Costs of buildings
- Costs of land use (lease or interest, water and sewerage charges) and
- General expenses

Figure 3.2 Composition of the full cost price

An explanation is given of how the various cost items are calculated.

- The directly attributable costs (the first six items) for a new crop are derived from agronomic research, which provides the quantity component, and the price component is added to this.
- The costs of labour, implements and buildings as well as the general expenses, also consists of a quantity and price component. The quantity component is also derived from agronomic research, and the price component is - as explained earlier - focused on extensively in section 3.3. In the costs of implements and buildings another aspect also plays a role. It is possible for one machine to be used for several processes. In that case we are dealing with apportionment. In this instance, the following rules apply:
  - the costs of storage places in which more than one crop is stored can be divided up according to the amount of time and space taken up;
  - the costs of buildings, excluding storage charges and storage space are apportioned to the various crops according to surface area;
  - the costs of machines that are deployed for more than one crop are broken down with the aid of work schedules and job times;
  - the fuel costs are also apportioned in the latter manner;
  - the general expenses are divided in proportion to the surface area covered by the cultivated crop, in the same manner as for buildings.
- For the costs of land use there is a choice between costs on a lease or ownership basis. The costs of land use may vary greatly per region and, as a result, a cost price is largely dependent on and linked to a particular region. The example in section 2.4 illustrates the major differences in the price of land.
3.2.3 Partial cost price in relation to the crop to be replaced

As already discussed, it may be reasoned that the crop should be compared with a single other crop that is to be replaced in order to gain insight into the (microeconomic) advantages and disadvantages of that crop. In that case, the partial cost price is the most obvious approach. It quickly provides insight into the position of the new crop in relation to the crops to be replaced. In this we make a distinction between:
1. the partial cost price in the short term: profit comparisons;
2. the partial cost price in the long term.

For the sake of completeness, in the case of a partial cost price all costs are charged, too. The cost price does not therefore only cover part of the overall cost price.


In agricultural (micro) economics, 'profit comparisons' are most commonly used to determine to what extent the cultivation of a new crop has advantages and is attractive for inclusion in the cropping plan. The basic premise in this profit comparison is that a farmer will only take up new crops when the income (profit) that can be generated with that new crop is higher or at least equal to that of the crop to be replaced. The profit comparison largely forms the basis for the short-term decision on which crops should be included in next year's cropping plan. A profit comparison alone therefore provides insufficient indication of the attractiveness of a crop over a longer period of time. To this end, any changes that might have to be made to the farming system should also be considered. The following sections will go into this in more detail.

- Direct costs:
  - costs of sowing seed/planting material;
  - costs of fertilizers;
  - costs of crop protection agents;
  - other directly attributable costs (insurance, levies, certification costs, etc.);
  - interest on circulating assets;
  - costs of labour carried out by third parties.

| Profit on the crop to be replaced |

Figure 3.3 Composition of the partial cost price (I): short term

For the calculation of the attributable costs, see section 3.2.2. The profit on the crop to be replaced is calculated as the yield minus the attributable costs (the first six items). A choice is made here for a standardized profit in order to cancel out 'chance' influence factors (such as the weather) as far as possible and to give the key figure a more structural character. Past profits may differ from future profits, however. This method offers possibilities for introducing differ-
ent scenarios with respect to the future anticipated price and cost developments for the crop to be replaced and for determining the consequences of these for the competitiveness of the new crop in relation to the crop to be replaced in the cropping plan.


The partial cost price which is described in this section (also) assumes that a grower wants to make at least as much money on a new crop as he does on the existing crop to be replaced, with the long-term effects also being taken into consideration. From this point of view, it is possible to distinguish three groups of elements in the cost price: the directly attributable costs, the difference in demand on the fixed costs and the difference in profit (see figure 3.4). This method is particularly useful when the changes in fixed costs are not that considerable and are therefore easy to estimate.

The costs of labour, implements and buildings as well as the general costs of the new crop are compared with those of the crop to be replaced, after which the difference is included in the cost price as an additional or deductible item. Here the same rules apply as in the calculation of the full cost price when it comes to apportionment. The costs of land are, for that matter, also relevant if the replacement of the new crop has a noticeable effect on the land price.

<table>
<thead>
<tr>
<th>- Direct costs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- costs of sowing seed/planting material;</td>
</tr>
<tr>
<td>- costs of fertilizers;</td>
</tr>
<tr>
<td>- costs of crop protection agents;</td>
</tr>
<tr>
<td>- other directly attributable costs (insurance, levies, certification costs, etc.);</td>
</tr>
<tr>
<td>- interest on circulating assets;</td>
</tr>
<tr>
<td>- costs of labour carried out by third parties;</td>
</tr>
<tr>
<td>- Difference in demand on labour between the new crop and the crop to be replaced;</td>
</tr>
<tr>
<td>- Difference in demand on implements between the new crop and the crop to be replaced;</td>
</tr>
<tr>
<td>- Difference in demand on buildings between the new crop and the crop to be replaced;</td>
</tr>
<tr>
<td>- Difference in demand on general expenses between the new crop and the crop to be replaced.</td>
</tr>
<tr>
<td>- Profit on the crop to be replaced</td>
</tr>
</tbody>
</table>

Figure 3.4 Composition of the partial cost price (II): long term
3.3 Valuation of labour and capital

The valuation of labour and capital is a particular point for discussion if the cultivation is carried out by farmers; if the cultivation is in the hands of the industrial processor, valuation of the resources employed should be made on the basis of the collective labour agreement wage and the market interest rates. If the production is in the hands of the growers this is not necessarily the case. The first question therefore is whether the labour and capital are bought in at the market value or come from the farmer's own resources.

If labour and capital is being put in by third parties, the going market prices are decisive for the valuation. The future market price of labour and capital should preferably be used in this instance because the decisions are for the long term. It is of course impossible to make predictions about the market price of labour and capital over a period of ten or maybe twenty years.

The valuation currently applicable serves as a guide, possibly supplemented with variants or scenarios in which expectations with respect to future developments are considered.

If labour and capital are not supplied by third parties but by the farmer himself then it is not the market price that is relevant but the value that farmer himself attaches to his labour and capital. The processor can take into consideration the fact that the farmer will value his own labour and capital below the going market prices. He then does not have to pay such high yield prices. It is however clear that there are some risks attached to this. If (in an extreme case) the processor assumes that the farmer will put in his own labour and capital 'free of charge', the long-term guarantee of supply will be endangered; the higher the valuation for the labour and capital input, the more assurance the farmer has and the greater the guarantee that there will be sufficient supply.

This paragraph deals with two themes. First of all attention is focused on the following questions: 'Under which circumstances should labour and capital be input at the market price and under which circumstances can labour and capital be valued at the (lower) reward for the farmer?' And subsequently, in section 3.3.3, the following question is raised: 'How much lower can the reward for the farmer be in comparison with the reward for third parties?' In both paragraphs, the argument is based on the definition of cost price according to Horring (1948): '(...) means of production should be valued at their value in the next-best application available locally which no longer qualifies and in the period to which the cost price refers (...)' But what does this mean in practice?

3.3.1 Labour

With regard to the labour factor, it should first of all be checked whether and how the additional labour to deployed fits into the labour picture and can therefore be 'supplied' by the farmer himself or not. If there is a surplus of labour, the question is whether this can be converted into cash and if so, how. The different possibilities are briefly outlined below.
Situation (a) Additional labour is required

If the new crop requires more labour in comparison with the old situation, there are two possibilities.
(a.1) The new crop requires labour in an otherwise quiet period which is otherwise quiet and demands little input of labour on the part of the farmer, in other words the labour situation allows the additional input of labour. In that case, valuation of the farmer's own labour below the market value is appropriate.
(a.2) The new crop requires labour in a period which is very busy and in which the farmer has little scope to put in work for the new crop: the result is a blockage in the labour situation which can only be solved by the deployment of third parties, for example an agricultural contractor. In this scenario, valuation of the labour at the applicable collective labour agreement rate is essential.

Situation (b) There is a surplus of labour

If the new crop requires less work in comparison with the old situation, there are two possibilities.
(b.1) The labour is in surplus in a period during which there is a great demand for labour in the region and the farmer can convert his labour into cash there. The surplus labour can then be valued at the collective labour agreement rate.
(b.2) If the surplus labour can be deployed profitably on the farmer's own holding, in other words: the labour will make a positive contribution to income, then the rate of reward for work the farmer carries out himself can serve as a guideline.

Theoretically speaking, there is still a third possibility, a valuation at 'nil'. But this is not realistic because this choice offers virtually no security for the future.

3.3.2 Capital

The costs of implements and buildings are made up of three components: depreciation, interest and maintenance. Depreciation costs depend on the new value and the final value, the useful life and the method of depreciation. The costs of maintenance are annual expenses for replacements and repairs. In the case of the interest charges, the situation is a little more complicated. This is because the question of the valuation of the capital input comes up, if the farmer's own capital is put in.

In the valuation of capital, consideration should be given to who will carry the costs of machines and buildings. A number of options can be identified. One option is that the farmer could consider buying the machines himself and fully deploy these on his own holding. Examples are when he cultivates a large acreage, when the machines are relatively cheap or when he does not
wish to be dependent on others. But there are also possibilities for sharing the costs of a machine with other growers, for example, by buying a machine in a cooperative and dividing the cost of the machine among the various parties. Another option is to have work involving capital-intensive cultivation carried out by an agricultural contractor, who charges the collective labour agreement wage and includes the market rate of interest in his price. In both cases the fixed costs are shared across a larger number of companies and a larger acreage, which means that the costs per farm and per hectare can be reduced. The option selected determines to a large extent how the costs of the means of production should be established.

A second point of interest is the cost of machines and buildings that are used for the existing crops. The cultivation of another, new crop may reduce the input of existing machines for the existing crops. This may result in these means of production being used over an increased number of cropping years: the technical useful life in user years increases. However, the economic useful life should also be taken into account, and the development of new technologies plays an important role in this. If the development of new technologies takes place very rapidly, the advantage of the reduced use of the machine may only be of minor significance. Whether or not, and to what extent, the advantage of the reduced use of the machines can be taken into consideration should be looked at on a case-by-case basis.

3.3.3 Valuation of ‘in-house’ resources

The valuation of work put in by the farmer and his own capital cannot be traced back to a market price: it is the price at which the farmer is happy to continue his efforts for the business. This is in general lower than the going market price - the collective labour agreement wage. The question is how much lower. A point of reference for gaining insight into the remuneration for the farmer are the operating results over, for example, the past five years. The choice for the period to be reviewed should be a careful and well-considered one, because farming has its good and bad times. A longer period of time flattens the peaks and troughs and gives a better picture of the average value which the farmer attributes to labour and capital. The major differences per farm type and region should also be taken into account as the yield on labour and capital input by the farmer is closely related to the farm type, the region and the period.

3.4 Examples

In this chapter a number of examples of situations are highlighted which are more complicated than the options discussed in figure 3.1. The options from figure 3.1 are fairly clear: it is either a processor or a farmer who cultivates the desired crop. The examples outlined in this chapter are somewhat more complex, because both links in the chain (the processor and the farmer) have their own role in the production of the new crop. It becomes even more
complicated when one of the two contracts part of the work out to a third party, for example an agricultural contractor. This kind of organization structure can often be found in the case of new crops, new developments and new markets, where one of the links does not want to take all the risks immediately. Consequently, attention is paid to this in this paper.

The examples describe different options. Those shown in figure 3.1. are also referred to briefly. In all of the examples (where relevant) the following three key questions are raised:

1. which cost items should be included and which not? And therefore: which method of cost price calculation is the most suitable?
2. how should labour and capital be dealt with?
3. how should work put in by the farmer be valued?

In doing so as much reference as possible is made to earlier chapters in order to bring the theory described there to life.

Example 1 The processor produces his own raw materials

Processing companies could consider keeping the production of agricultural raw materials in their own hands. In that case they are not dependent on the agricultural farms and do not have to maintain contacts with many growers, who can each ‘only’ provide a small portion of the raw materials required. The production is carried out by the farm's employees, on land which the company buys or rents.

This example describes the first option of figure 3.1.

- In this scenario, a partial cost price calculation whereby the new crop is related to the existing crops is not relevant. The full cost price is a more suitable method for calculating the costs of agricultural products.
- To do this, the costs of labour, capital and land use have to be valued at the going market rates. The production is carried out by employees who receive the collective labour agreement wage, and the funds necessary to finance the production are borrowed on the money market at the going market interest rate.

Example 2 The processor and the grower produce raw materials

There are situations in which the processing company decides to keep the production in its own hands, but calls in the help of a grower and an agricultural contractor. The grower makes his land available and the actual cultivation work is carried out by the agricultural contractor. Such a situation exists, for example, when the market has not yet been sufficiently developed and the market price is not yet good enough for growers to start production.

- The most obvious method in this example involves the full cost price. The processor carries the risks and pays the costs. He will hardly be interested
in the costs of the crop in relation to another crop, which he does not cultivate anyway.

- In this scenario the valuation issue of the labour and capital input also plays a role. If all of the labour and capital is put in by the agricultural contractor, the going market rate should serve as a guideline.

- The 'costs of land use' occupy a special position in this respect. The grower will refer to the alternative option for 'doing nothing with the land', i.e. setting the land aside (fallow). A realistic fee for making his land available is therefore: the actual costs of the land use (lease or 2.5% of the land price) plus the amount he would receive if he were to leave the land fallow.

Example 3  The grower produces with the help of the agricultural contractor

In the situation in which the cultivation of new crops requires new, adapted machines and/or if the grower only plants a small acreage with the new crop, it is conceivable for the grower to consider hiring an agricultural contractor. The agricultural contractor is able to spread the fixed costs over a larger number of farms and a bigger acreage, and costs per hectare will be lower.

- The method for determining the cost price can be the full cost price or the partial cost price for the long term (II), but also the partial cost price for the short term (I), the profit comparison. In short, all three methods can be used. The question here is what the purpose of the cost price calculation is. If the farmer just wants to consider the attractiveness of the new crop 'for a year or so', the profit comparison is the most suitable method. But if it involves a decision for the longer term the full cost price would be a more obvious method. The grower could then weigh up the advantages and disadvantages of buying his own machines against contracting out activities to the agricultural contractor.

- In this situation, the fixed costs are assigned to the agricultural contractor as far as possible. The input of the farmer's won capital in particular is therefore minimised. As a result of this the question of the valuation of the farmer's own capital does not come into the picture quite so much. In the place of these costs come the 'direct costs', i.e. work carried out by third parties. The labour and capital input by the agricultural contractor are valued at the market value.

Example 4  The grower produces and operates within a cooperative

If the cultivation of new crops requires new, adapted machines and/or different growers only plant a small acreage each, the purchase and the use of the machines in a cooperative may provide the answer.

- The full cost price or a partial cost price in the longer term (II) is the most obvious method, because the machines are bought collectively, which
means that everyone brings in some capital which has to make money over the years.

- The question of the valuation of the labour and capital input is applicable. The growers could consider dividing the labour to be put in among themselves in such a way that no individual grower has labour costs because each one of them puts in just as much labour on behalf of the others as he 'receives'. In that case, there are two kinds of labour: the work put in by the farmer himself, which is put in on the farmer's own holding as well as in his colleagues' holdings, and the possible difference between 'the hours of work received and carried out'. This first kind of labour can, depending on the alternative possibilities in the region, be valued at anything between nil and the collective labour agreement wage (see section 3.1). This is less conceivable for the second kind: then the collective labour agreement wage would be more reasonable. A similar approach can be used for the capital.

Example 5  The grower produces and tries a new crop for a year

Suppose the farmer has a piece of land 'left over' or that the farmer wishes to gain experience in growing new crops on a modest scale, to 'just try it out', without making any major investments. He wishes to capitalise on the optimistic price projections presented by the representatives of companies developing new initiatives who go out and try to get people interested in their ideas and find out just how interested people are on the basis of attractive price projections. The farmer then sees if he likes the new crop. He will then first of all look for crops that most closely resemble the crops he already has. He is not really interested in major changes in his farming system. This example describes the last two options given in figure 3.1.

- In this scenario the profit comparison is the most obvious method. It is a try-out, an initial introduction to a new crop, in which case the farmer wants to limit the risks as much as possible. Major differences in fixed costs are not a relevant issue and a profit comparison is sufficient.

Example 6  The grower produces perennial crops

Perennial crops do not fit into the usual, traditional agricultural production pattern. Traditionally, a crop rotation-scheme. By definition, a perennial crop does not fit into such a plan. If the farmer has a tight cropping plan which allows little room for keeping a plot outside the cropping plan, the farmer may consider expanding his farm's acreage. This means that extra land will have to be purchased.

- For perennial crops the full cost price is the most suitable method. The positioning in relation to a single crop is after all not, or hardly, applicable because the crop has to compete against all of the crops in the crop-
ping plan. Only if the farm exclusively grows wheat, for example, could positioning in relation to a single crop be an option.

Example 7 The grower produces on fallow land

The set-a-side scheme involves taking agricultural land out of production. However, the system does allow the farmer to grow certain produce for non-food purposes. It often involves land that is covered by this scheme for several years and that cannot rotate in the cropping plan. The grower receives a set-aside scheme allowance in addition to the profits on his products for the non-food application.

This scenario requires a full cost price, in which the set-aside scheme allowance has to be explicitly mentioned. The clearest way to present this is to state the cost price including and excluding the set-aside scheme allowance. In this way the effect of the set-aside scheme allowance becomes clear and the risk of a possible reduction in, or the abolition of, the set-aside scheme can be taken into account.

Example 8 A supply curve

Figure 3.5 shows various supply curves. The graphs show that the price that has to be paid to the grower has to increase as production increases. The most important reason for this is that more expensive land, which yields more profit per hectare, will have to be used in order to produce greater quantities of the product.
Figure 3.5 shows three curves. Curve 1 is a supply curve for a region in which the same amount of A is offered at a (lower) price $p_1$ in comparison with curve 2, where the same amount of A is offered at a (higher) price $p_2$. The reason for this may, for example, be the difference in the costs of labour, land and capital, which may vary from region to region. Curve 3 is a supply curve where the need to cultivate more expensive land arises sooner in comparison to curve 2. This results in a higher price having to be paid at an earlier stage in order to be able to achieve a greater supply. The angle of curve 3 ($\alpha_3$) is therefore steeper than in curve 2 ($\alpha_2$).
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APPENDIX
Appendix 1 The ETSU method

In 1996, a standard method was developed with which it is possible to calculate the price for energy derived from biomass. This method was developed by six institutes in the European Union within the context of a Concerted Action (AIR3-CT93-1671), with ETSU in the United Kingdom acting as the coordinator. The other participants were: CRES (Greece), NOVEM/LEI-DLO (the Netherlands), IER (Germany), Hyperion (Ireland) and CCE/CBE (Portugal). The aim of this method was to arrive at a standard method which can be used to determine the price of energy derived from biomass.

This method takes all costs over the whole chain into consideration: production and conversion. Furthermore, this method takes account of the fact that all links individually have to earn something from the cultivation or processing. And the method offers room for including perennial crops in the calculation easily and quickly, taking the Cash Value issue into account. The method has been developed in such a way that the variables can easily be changed and the influence of these quickly becomes transparent. As a result of this, the method has important practical value.

The method comprises the cost price of the agricultural raw materials as one of the components and has been developed in such a way that this cost price can be seen as a combination of full cost price and partial cost price. It is built up as follows.

- Direct costs:
  - costs of sowing seed/planting material;
  - costs of fertilizers;
  - costs of crop protection agents;
  - other directly attributable costs (insurance, levies, certification costs, etc.);
  - interest on circulating assets;
  - costs of work carried out by third parties.

- Costs of harvesting
- Costs of storage
- Costs of land use (lease or interest, water and sewerage charges) and
- General expenses

- Profit

Figure A1.1 Composition of the cost price according to the 'ETSU' method

These cost items can be interpreted and detailed in various ways. The costs of harvesting can, for example, be calculated with or without labour; the same applies to the costs of plants, fertilizing, crop protection, etc. Similarly, this method does not explicitly stipulate whether and if so, how the fixed costs should be included. This leaves the purpose for which the method is used undefined. This is not necessarily known from the outset. The concrete figures (with or without labour, with or without fixed costs) ultimately determines which cost price 'comes out of the method'. This does therefore not guarantee 100% that results of calculations made according to 'the' standard ETSU method will be comparable.

In short, the ETSU method has important advantages, that simplify cost price calculations. Most certainly in the case of perennial crops. The approach which the
methodology prescribes is clear, simple and comprehensive. However, the choices available for the figures used in the calculation ensures that the results obtained with the method are not necessarily comparable.