

# Ten rules of thumb in contract design: lessons from Danish agriculture

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## Summary

Real contracts balance a number of conflicting objectives that characterise the contracting situation. Contract theory provides useful insights but the formal models used in theoretical analysis tend to focus on a few effects in stylised environments. The risk of a partial approach is that while improving one aspect of a contract, new and more serious problems may arise in other respects. Practical, theory-based contract design can therefore benefit from a more holistic, systemic approach. In this paper, we offer a checklist that can support such an approach. The checklist combines theory with experiences from Danish agricultural contracts.

**Keywords:** contract design, contract theory, agricultural producer, food processor, Denmark

**JEL classification:** L14, Q13

## 1. Introduction

Contract design is a complex task. Contract theory identifies numerous issues of potential importance. Typically, however, individual papers in contract theory focus on just one or a few problems. This is natural from a scientific point of view, but as a means of practical guidance, such a partial approach is not satisfactory. The risk is that while solving one issue in a contract, one may end up creating new problems. In practice, it is necessary to consider all aspects of a contract simultaneously.

Contracts have played an important role in Danish agriculture for many years. This suggests that firms and farmers have acquired valuable knowledge about the design and management of contracts. We have tried to extract and synthesise some of this knowledge in a research project.<sup>1</sup> This paper summarises a number of our findings in a rule-of-thumb format.

We have collected a broad spectrum of production contracts used in Danish agriculture as well as information about the specific characteristics of the various sub-sectors. To understand the possible rationales of the contracts, we have interviewed processors and producers. Also, we have developed a theoretical framework for contract analysis based on the concepts of co-ordination, motivation, and transaction costs. We have used the theoretical

1 The Norma and Frode S. Jacobsen Trust supported the research project 'Economic Analysis of Contracts in Danish Agriculture'.

framework to analyse the contracts with the aim of understanding and if possible improving specific contracts. This work has been documented in papers with detailed analysis of specific contracts and a number of fact sheets providing basic information about the contracts.<sup>2</sup>

We have found that actual contracts can be just as advanced as recent progress in contract theory. From this perspective, the primary role of research is to understand and rationalise existing practice. On the other hand, we have also found considerable variation in ingenuity between contracts. In particular, it seems that contracts undergo numerous improvements over time. This suggests that a theory-based approach can help to improve actual contracts, and that systematic information dissemination between agricultural sectors can be valuable.

In this paper, we distil the main lessons of this research project and present them as ten rules of thumb. We also give numerous examples of how these rules apply to Danish agricultural contracts. The resulting guidelines hereby offer a systematic, practice-oriented review of contract theory.

The outline of the paper is as follows. We first discuss a comprehensive yet focused view on contract design in Section 2, and in Section 3 briefly summarise the contracts studied. The ten rules are then developed and illustrated in Section 4. Section 5 concludes the paper.

## 2. Contract design

Handling the complexity of real-world contracting requires a systematic approach. In this paper we develop such an approach and present it as a checklist or guideline for contract design. A good guideline has three properties. To be relevant, the guideline must be comprehensive and cover the main issues (objectives) involved. To be useful, it must link the main objectives with specific means for attaining them. To be applicable, the guideline must show how to balance the various objectives and means.

To guarantee a *comprehensive* coverage, it is helpful to step back and recall the general design issues identified in the economic literature.<sup>3</sup> All economic systems—except simple Robinson Crusoe systems—involve several agents with conflicting interests, private information and private options for action. From the point of view of specialisation, one can even argue that the decentralisation of information and decision-making among several agents is what gives a system the potential to operate more efficiently than a single individual. Specialisation, however, comes at a cost. Information must be shared and actions must be co-ordinated. There are three aspects of this:

- (i) co-ordination: to ensure that the right products are produced at the right time and place (rules 1–3 on the checklist);

<sup>2</sup> See Olesen (2001).

<sup>3</sup> See Milgrom and Roberts (1992).

- (ii) motivation: to ensure that the parties have individual incentives to make co-ordinated decisions (rules 4–8);
- (iii) transaction costs: to ensure that co-ordination and motivation are provided at the lowest possible cost (rules 9 and 10).

To give a *useful* list, we will link general objectives with the more specific means and instruments in the contract designer's toolbox. We cover primary co-ordination tools such as instructions, prices, allocation of decision rights and risk-sharing. We also discuss alternative motivation tools such as incentive schemes, contract menus, repeated contracts and renegotiation mechanisms. Finally, we discuss ways of reducing transaction costs via low information requirements, infrequent negotiations, arbitration and reputation building, as well as the use of simple and transparent contracts.

The various objectives in contract design may conflict, and the various means may have both desirable and non-desirable effects. Objectives must therefore be *balanced*. The checklist clarifies the necessary trade-offs. In some cases, co-ordination is the primary concern, where product perishability requires fine synchronisation of harvesting and processing. In other cases, the motivational issues are at the forefront, because of potential lock-in effects with resulting under-investment. In general, we cannot say which trade-offs are the optimal ones. It depends on the context, including the technology, the preferences of the parties involved and the distribution of information. For specific problems, we can describe the context in detail and then discuss the relevant trade-offs. We have done so for specific sectors<sup>4</sup> but by and large it requires a full paper for every sector. It is therefore not an approach we can pursue in any detail here.

Our basic methodological approach is to consider contract design as a multi-criterion decision problem. We identify the set of relevant objectives and the spectrum of alternatives, i.e. the various means. We suggest that this approach, and in particular when coupled with context-specific information about the relative importance of the objectives, will lead to superior contract design.<sup>5</sup> We have used such multi-criterion decision-making approaches to design agricultural contracts as well as payment plans in other sectors. What we have done in this paper is to group the means and ends into 10 perspectives based on what we have found to be particularly useful in understanding and improving actual contracts. By working with the broader classes or perspectives, we avoid the informational overload resulting from attempts to cover all tools in the contract designer's toolbox. Just knowing the general groups of tools and jobs allows the user to ask relevant questions, to guide the search for additional information, and to support the use of common sense.

4 See Olesen (2001).

5 See, for example, Bogetoft and Pruzan (1997) and Bogetoft and Olesen (2000).

### 3. The contracts

We have studied contracts covering a broad spectrum of the agricultural sectors in Denmark. The contracts involve investor-owned as well as co-operatively owned processors. Table 1 summarises the contracts, the key

**Table 1.** Survey of eight contracts

Contract	Key issues	Co-ordination	Motivation	Transaction costs
Peas <sup>a</sup> (Danisco Foods)	Synchronise harvest Investor-owned	Centralised decision-making Minimum payment	Tournaments	Producer association Advising Inspections
Special pigs <sup>b</sup> (Danish Crown)	Reduce transport cost Traceability Adjust supply Co-operative	Geographical restrictions	Market-determined bonus Quality bonus	Limit information Advising
Eggs <sup>c</sup> (Danæg)	Disease control Adjust supply Traceability Co-operative	Production schedules Mandatory reduction of flocks	Quality bonus	Regular testing
Broilers (Rose <sup>d</sup> Poultry)	Synchronise slaughtering Disease control	Processor determines production schedule	Quality bonus	No monitoring
Fruit <sup>e</sup> (Vallo Saft)	Synchronise harvest Use local information on ripeness Investor-owned	Decentralised decision-making Processor can delay harvest Forecast on harvest	Quality bonus	Advising
Grass and clover <sup>f</sup> (DLF-Trifolium, Hunsballe and Wiboltt)	Ensure quality Control supply 1 Co-operative 2 Investor-owned	Total area limited by the contracts	Quality bonus	Advising No pooling of income
Sugar beet <sup>g</sup> (Danisco Sugar)	EC sugar regulation Investor-owned	Non-tradable production rights No side-trading	Quality bonuses Penalties outside delivery tolerance	Producer association
Potatoes (AKV Langholt) <sup>h</sup>	EC quota Ensure quality Co-operative	Tradable production rights Side-trading allowed	Quality bonus Penalties outside delivery tolerance	No monitoring Advising

<sup>a</sup>In 2000 Danisco Foods was sold to the Belgian company Ardo. This paper refers to the situation before Danisco Foods was sold. The contract is described in Danisco Foods (1998), Grower Association (1998), and Sørensen (1998). Olesen (2001) gives an in-depth analysis of the contract.

<sup>b</sup>Villadsen and Andersen (1999) and Danish Crown (2000a, 2000b).

<sup>c</sup>Danæg (2000).

<sup>d</sup>Danish Competition Council (2000) and Rose Poultry (2000).

<sup>e</sup>Bjerregaard *et al.* (1999) and Vallo Saft (1999).

<sup>f</sup>Hunsballe (1996), DLF-Trifolium (1998), Kisselhegn (1999), Nissen and Sørensen (1999), and Wiboltt (2000).

<sup>g</sup>Danisco Sugar (1996).

<sup>h</sup>AKV Langholt (1991, 2000) and Bjerrum (2001).

issues in the context they are designed for, and some of the main co-ordination, motivation and transaction costs tools they apply.

#### 4. Ten rules of thumb

This section defines the ten rules of thumb for contract design. We also provide examples that illustrate how the rules have been implemented in real contracts. The ten rules of thumb are listed in Table 2.

**Table 2.** Ten rules

Co-ordination	1 Co-ordinate production
	2 Balance the pros and cons of decentralisation
	3 Minimise the costs of risk and uncertainty
Motivation	4 Reduce the costs of post-contractual opportunism
	5 Reduce the costs of pre-contractual opportunism
	6 Do not kill co-operation
	7 Motivate long-term concerns
Transaction costs	8 Balance the pros and cons of renegotiation
	9 Reduce direct costs of contracting
	10 Use transparent contracts

Table 2 groups the rules into three categories corresponding to the overall objectives of co-ordination, motivation, and minimisation of transaction costs. This categorisation is not unique. The grouping simply reflects the primary intention of the (class of) tools considered. We emphasise that all tools have implications for all objectives. That is, when a given tool is applied, it will almost always have (adverse) effects on the other objectives. An incentive scheme to improve motivation may, for example, at the same time be costly from the point of view of co-ordination and transaction costs, as it may lead to sub-optimal risk-sharing as well as costs of writing and administering the contract. We will emphasise the trade-offs when discussing the 10 rules.

##### 4.1. Co-ordinate production

Perhaps the most important role of contracts is to co-ordinate the actions of independent decision-makers. After all, the reason for co-operation is to create values through joint actions.

Co-ordination must ensure that production is optimised throughout the entire production chain. Lack of co-ordination leads to sub-optimisation where decision-makers ‘optimise’ their own decisions without considering all the consequences for other decision-makers in the production chain.<sup>6</sup>

6 See Milgrom and Roberts (1992) for detailed discussion of the co-ordination aspect in contracts.

An important aspect of co-ordination is the minimisation of production costs. Producers with lower marginal costs should be allocated a larger share of the production. The allocation can be handled through a market approach, where producers compete for the right to produce through auctions. Another approach is centralised decision-making, where the processor chooses the producers and their production levels.

Co-ordination can generally be achieved either using instructions or price signals, or some combination of the two. It is often attractive to co-ordinate qualitative aspects as well as matching and synchronising problems via instructions, and quantitative aspects via prices.

#### *4.1.1. Examples*

The contracts studied here have various approaches to quantity control. Biological uncertainty makes it impossible to control agricultural production completely. Therefore, the contracts allow for some flexibility in the quantities delivered. For instance, the contracts for special pigs allow for the deliveries during a 5-week period to vary by  $\pm 30$  per cent. The contracts for fruit, grass and clover, and peas control only the area used for production. On the other hand, the contracts for potatoes specify a fixed quantity, which the producer must deliver. The processor can buy any shortfall at the producer's expense and the producer can use any excess production for other purposes.

Harvesting perishable products creates a problem of synchronisation. The products must be processed soon after harvest and will spoil if harvesting is not co-ordinated with the processor's capacity. Often synchronisation is more important than choosing the best time for harvesting when considered in isolation, i.e. when the products have the highest yields, the best ripeness, etc. Therefore, the harvesting of perishable products is often co-ordinated through instructions. For example, the harvesting of peas, fruit, and broilers are all co-ordinated via instructions. On the other hand, the harvesting of storable products, such as potatoes, sugar beet, and grass and clover seed, does not require synchronisation and is not co-ordinated in the respective contracts.

The problem of allocating production efficiently among producers is solved in several ways. The production rights on potatoes are tradable, i.e. the market mechanism ensures efficient allocation. On the other hand, the production rights on sugar beet are non-tradable and efficient allocation is probably not ensured. The production of special pigs is restricted geographically. Only producers close to the slaughterhouse handling a particular special pig can produce them. This rule limits transport costs, which are paid by the slaughterhouse, but it also means that the special pigs are not necessarily produced by the lowest-cost farmers. However, the problem of minimising transport costs is probably more important than the issue of allocating production between farmers efficiently.

## 4.2. Balance the pros and cons of decentralisation

The allocation of decision rights is a key aspect of a contract. A contract is decentralised if producers have authority to make most of the decisions and centralised if the processor is in charge of most decisions. When designing a contract the parties should aim to have decisions made by the most informed party.

There are two immediate benefits of decentralised decision-making. It reduces both the risk of important information being neglected and the need for costly communication. On the other hand, a decentralised contract may increase the risk of unco-ordinated decision-making and may create problems of matching and synchronisation.<sup>7</sup>

The information requirement is an important criterion when determining the degree of centralisation in a contract. It is costly to collect and process information. Therefore, a good contract minimises the information requirement.

Decentralising decision-making may create motivation problems.<sup>8</sup> If a contract delegates decision rights to producers, the contract design must include incentives for alleviating the moral hazard problem. On the other hand, centralised decision-making can promote opportunistic behaviour by the processor, such as hold-up problems. The allocation of decision rights can be used to reduce problems of pre-contractual opportunism. If the processor determines the levels and characteristics of some inputs (e.g. by supplying the inputs), a producer is less able to mimic other producer types.<sup>9</sup>

The costs and benefits of decentralised farm decisions are summarised in Table 3. A plus (+) in this table indicates that the choice (decentralisation or centralisation) has a positive impact on the problems listed in the first column.

**Table 3.** Pros and cons of decentralisation

Problem	Decentralisation	Centralisation
Use all important information	+	
Reduce costly communication	+	
Co-ordination		+
Information requirement	+	+
Moral hazard		+
Hold-up	+	
Reduce information rents		+

7 Milgrom and Roberts (1992) discuss the pros and cons of decentralisation.

8 The motivation problems referred to here are further expanded upon in Sections 4.4, 4.5 and 4.7.

9 Goodhue (1999) applies this idea to agricultural contracts in the USA.

#### 4.2.1. Examples

Fruit producers have more information than the processor about the ripeness of the fruit because producers can inspect their fields directly. Therefore, the contract delegates the right to decide the harvesting time to producers. However, the harvesting must be co-ordinated to avoid capacity problems at the factory, because the fruit perish unless they are processed or frozen within a few days of harvesting. Hence, complete decentralisation of harvesting decisions may lead to co-ordination problems. The contract solves this issue in a simple and very effective way. Producers must use boxes supplied by the processor for harvesting. This allows the processor to control the harvest in case of capacity problems at the factory by adjusting deliveries of boxes to the producers.

The contracts for fruit production lead to the optimal allocation of decision rights both with and without capacity problems at the factory. When there is no capacity problem, the most important issue is to utilise local knowledge about the ripeness of the fruit without costly communication. Therefore, the decisions on harvesting are decentralised when there is no capacity problem. On the other hand, when there are capacity problems the most important task is to co-ordinate the harvest to avoid oversupply. Therefore, decision-making on harvesting is centralised when there are capacity problems.

The production of peas is another example where co-ordination is the most important issue. Peas must be harvested within a 24-hour window. If the peas are harvested too soon, the yield will be too low. If the peas are harvested too late, the taste will be ruined because the peas will be too ripe. Once harvested, the peas must be frozen within 4 hours to remain fresh. To ensure the necessary precise co-ordination, most of the decisions are centralised. The processor chooses the producers and the timing of both sowing and harvesting.

Centralised decision-making reduces the moral hazard problem in the contract for eggs. Producers must buy their chicks and their feed from suppliers approved by the processor. This eliminates the possibility for producers to use cheaper inputs with lower food safety standards.

#### 4.3. Minimise the costs of risk and uncertainty

Agricultural production and marketing are subject to different types of risk, including biological risk, price risk and institutional risk. In addition, there is behavioural uncertainty, because one party (e.g. the processor) does not know what actions the other parties (e.g. producers) are taking.

Normally an uncertain payment is considered less valuable than a certain payment with the same expected value. The parties can reduce the cost of risk and uncertainty in two ways. They can minimise the risk or they can share the risk between them.

One way of minimising risk and uncertainty is to choose a robust contract that leads to reasonable outcomes even if the initial assumptions do not hold true. Information collection (monitoring) is another way.<sup>10</sup> The parties can

<sup>10</sup> Milgrom and Roberts (1992) discuss how monitoring can reduce the risk. Information collection and monitoring is discussed in more detail in Section 4.9.

reduce the measurement errors through the sampling design, e.g. by using multiple spot checks.

Risk-sharing depends on the context and interacts with incentives. If the producers are risk-averse and the processor is risk-neutral, the efficient way to share risk is to place all the risk on the processor so that the producers receive fixed salaries. However, to motivate the producers to take unobservable actions, the payment must depend on the output (see also Section 4.4). An efficient contract balances the costs of risk bearing against the incentive gains.<sup>11</sup>

There is no trade-off between risk-sharing and incentives for common risks affecting all producers equally. By using relative performance evaluations rather than absolute ones, one can eliminate common risk from the payment to producers.<sup>12</sup> Similarly, it may be possible to remove price risk from the producers' payments without affecting their incentives.

In a producer co-operative, the risk cannot be shared between producers and processors because they are the same people. However, some risk-sharing is still possible. First, most co-operatives process several products and the co-operative can share risks between the producers of these products (producer groups). Second, the equity in the co-operative can be used as a buffer to absorb temporary fluctuations in profits.<sup>13</sup>

#### 4.3.1. Examples

The fruit contract uses relative performance evaluation. For each percentage point by which the content of dry matter is above (or below) the average, the price to the producer is increased (or reduced) by 0.5 per cent. The total payment to the producers is unaffected by the average quality of the Danish harvest. Hence, the processor bears the general risk of the quality of the fruit.

The contract for production of peas also uses relative performance evaluation. The producers are divided into groups based on the time of sowing, so that all producers in one group have the same weather conditions and use the same variety. The average payment per hectare is the same for all groups. Hence, the expected payment to a grower is independent of the time of sowing. Within the group, the payment is distributed in proportion to the quantity produced, i.e. through relative performance evaluation.

Co-operatives choose different approaches to risk-sharing. DLF-Trifolium keeps the profits from the various species of seed separate. There is no risk-sharing between the various producer groups, e.g. between producers of red clover seed and producers of blue Kentucky grass seed. By contrast, Danish Crown pays a fixed bonus to the producers of pigs destined for the UK market. The bonus is independent of the sale of special pigs. Hence, the producers of UK pigs may be subsidising the ordinary producers, when

11 See Holmström (1979) and Milgrom and Roberts (1992).

12 See Holmström (1982) and Schleifer (1985).

13 Hansmann (1996) and Bogetoft and Olesen (2000) discuss the possibilities for risk-sharing in co-operatives.

the demand on the UK market is high, and vice versa when the demand on the UK market is low. This provides risk-sharing between the producers of UK pigs and the producers of ordinary pigs.

The contracts also illustrate various ways of minimising risk and uncertainty. In a number of contracts the producers can require a second spot check to be analysed by a neutral third-party, if they question the first test result. The double testing reduces measurement errors. The option of double testing also reduces the behavioral uncertainty of the processor cheating via the test results. Multiple testing is used in the grass and clover industry, in contracts for sugar beet, and in contracts for potatoes.

#### **4.4. Reduce the costs of post-contractual opportunism**

Opportunistic producers do not automatically take the actions called for in the contract, i.e. moral hazard problems occur. The contracts should motivate the producers to take the right actions, even if they are unobservable.<sup>14</sup>

To provide incentives for unobservable actions, compensation to producers must be based on outcome. However, usually there is a stochastic relationship between the actions and the resulting output. This implies that output-based incentives will expose the producers to risk, because the output depends on factors outside the producers' control, e.g. the weather. When the producers are risk-averse, this risk carries a risk premium. Hence, there is a trade-off between providing incentives and minimising the cost of risk (see Section 4.3).

If the processor can obtain better information about the producers' effort, he or she can expose the producers to less risk—and still induce the producers to take the same actions. According to the informativeness principle, any performance measure that reduces the error in estimating a producer's actions should be used in the contract.<sup>15</sup> This implies that the payment to a producer should depend on information about the performances of other producers if this gives a more precise estimate of the effort provided by the producer in question (e.g. as a result of common risk).

The optimal strength of the incentives depends primarily on three factors.<sup>16</sup> First, the incentives should be strong if the additional effort has a high value, i.e. increases the integrated profit considerably. Second, the incentives should be strong if incentives have a strong effect on producers' behaviour. Third, the trade-off between providing incentives and reducing the cost of risk means that the incentives should be weak if the producer is very risk-averse or if the processor has only very imprecise information about the producer's behaviour.

Often producers undertake various tasks simultaneously. In such situations a rational producer will tend to ignore less well-paid tasks and focus on the more generously rewarded ones. To avoid this problem, the incentives must

14 The contracts must respect the incentive compatibility constraint, which states that a producer chooses the actions that maximise his or her own utility.

15 See Holmström (1979).

16 See Holmström (1979).

be balanced. Let us consider a producer who has to allocate his time to two tasks. The producer's disutility per time unit is the same for both tasks. The equal compensation principle<sup>17</sup> states that if the allocation of time between two activities cannot be measured, either the marginal rate of return must be equal for both tasks, or the activity with the lower marginal rate of return receives no time.

#### 4.4.1. Examples

If the processor only has imprecise information about the size of production, a producer may be tempted to sell part of his production elsewhere if he can receive a better price. This problem actually occurred for Vallø Saft. The firm used to offer contracts with minimum prices to producers. When the market price was below the minimum price, deliveries from the producers in a minimum price contract were very high whereas deliveries from producers receiving the lower market price were very low. This is the problem of side-trading. When market prices were low the producers receiving the market price sold their fruit to the producers receiving the minimum price. Vallø Saft no longer offers minimum price contracts.

The production of special pigs involves a number of moral hazard problems. It is costly for the slaughterhouse to monitor whether the producers follow all the rules. Therefore, monitoring is based on spot checks. This means that producers may be able to cheat without being caught (e.g. by not using the right feed). Producers are motivated to take the right unobservable actions because of the risk of losing the bonuses they have already received and their right to produce special pigs if a spot check reveals cheating.

The production of pigs also illustrates a classic multi-task problem, where the slaughterhouse wants to motivate the production of both quantity and quality. The producers can affect the meat quality in a number of ways: feeding, breeding, pigsty systems, etc. It would be very costly for the slaughterhouse to monitor producers' behaviour, so the incentives are based on output measures. Danish Crown uses two parameters to measure quality: meat percentage and slaughter weight. These parameters are positively correlated with other quality parameters such as taste and consistency. Thus, the slaughterhouse motivates producers to supply high-quality pigs (right taste, colour, consistency, etc.) by encouraging the production of pigs with the right slaughter weight and a high meat percentage.

### 4.5. Reduce the costs of pre-contractual opportunism

A producer signs a contract only if it gives him an expected profit at least equal to his reservation value, i.e. the profit from his best alternative option. This is the individual rationality constraint. To maximise his own profit, the processor tries to design contracts so that each producer receives exactly his reservation value. If a producer has private information about

17 See Holmström and Milgrom (1991) and Milgrom and Roberts (1992).

his skills, cost structure, etc. before the contract is signed, the producer may be able to obtain a contract giving an expected profit above his reservation value (i.e. the producer earns information rent). This is the problem of pre-contractual opportunism or adverse selection.<sup>18</sup>

The literature on contract theory points to four ways of reducing the adverse selection problem. First, the processor can collect information before the contract is signed. In this way the processor reduces the producer's informational advantage. Second, producers can use signalling to reveal their true type through their behaviour before the contract is signed. Third, the processor can use rationing and offer a contract that is acceptable only to some ('good') producer types. This reduces the producer's ability to extract rents by mimicking 'less good' types. Hence, rationing leads to fewer but better contracts. The fourth approach is screening, where the processor offers the producers a menu of contracts. The contracts must be designed so that the producers reveal their true type through their selection of contract.

#### *4.5.1. Examples*

One example of pre-contractual opportunism occurs in the case of fruit production. Previously, the contract did not reward (or penalise) producers of high- (or low-) quality fruit. As a consequence, producers used to sign contracts even though their fields were not suited to high-quality production. Later, the contract was changed so that producers with high-quality fruit received a higher price (see Section 4.3). Now, producers with fields not suitable for fruit production no longer sign the contract. Hence, Vallø Saft has used rationing and signs fewer but better contracts.

Contracts for fruit also illustrate the use of screening. As mentioned, Vallø Saft used to offer a contract with minimum prices. Risk-averse producers chose minimum-price contracts (with lower expected payment), whereas risk-neutral producers chose to trade at market prices. In this way, producers revealed their risk attitude and Vallø Saft could improve risk-sharing. However, offering minimum prices created a moral hazard problem as a result of side-trading as discussed in Section 4.4. Vallø Saft's experiences illustrate the important point that solving one problem in a contract can create other and more severe problems.

The contract for pea production also illustrates pre-contractual opportunism created by restrictions in the use of information. The pea producers prevent Danisco Foods from using information about their soil quality and field size in the contract. This means that Danisco Foods must raise the payment to all producers if Danisco Foods wants to attract producers with high reservation values (e.g. as a result of good soil quality). This enables the pea producers to obtain compensation above their reservation values (see Olesen, 2001).

<sup>18</sup> See Akerlof (1970), Milgrom and Roberts (1992), or Salanié (1997) for detailed analysis of pre-contractual opportunism.

#### 4.6. Do not kill co-operation

The parties can only achieve the full economic benefit from their production if they co-operate. Producers can help each other by sharing know-how, exchanging favours, etc. Flexibility from both producers and processors may enable the parties to adjust to events not accounted for in the contract. Hence, it pays for the parties to work in a co-operative spirit where changes can be made without costly negotiations or conflict resolution.

Relative performance evaluation<sup>19</sup> may have a negative impact on co-operation between producers.<sup>20</sup> Using strong incentives can complicate co-operation between the processor and the producer, because the payment will be very sensitive to the decisions taken by the other party. For instance, a producer in a high-powered quality contract may protest when the processor changes the delivery time to ensure an appropriate flow at the factory, if this adversely affects the producer's payment.

Often producers have better information about other producers' behaviour than the processor. Where the total payment to a group depends on the performance of the entire group, group incentives motivate the producers to monitor one another and perhaps to impose some kind of social penalty (e.g. a bad reputation in the neighbourhood).<sup>21</sup> Producer co-operatives are extreme examples of group incentives.

Co-operating can give rise to influence costs. Influence costs arise from activities designed to influence the decisions of others for self-interested purposes. Limiting communication or limiting the number of decisions can reduce influence costs.<sup>22</sup>

To exploit the synergies in co-operatives, the contract must ensure that no producer group has an incentive to break away from the co-operative to form their own co-operative instead (e.g. a co-operative for organic producers).<sup>23</sup> This means that the profit that a producer group earns within the co-operative must be larger than or equal to the profit the producer group can earn outside the co-operative.

##### 4.6.1. Examples

The contracts studied use various mechanisms to share know-how between producers. Most of the companies provide consultancy for the producers. The consultants pass on experiences to other producers. Some companies facilitate dispersion of know-how through newsletters and producer meetings.

The co-operative, DLF-Trifolium, can order producers to plough up their fields to reduce the total supply of seed. The contracts for production of grass and clover seed for the two private companies, Hunsballe and Wiboltt, do not

19 See Section 4.3.

20 See Lazear (1989).

21 See Milgrom and Roberts (1992).

22 For a comprehensive discussion of influence cost, see Milgrom and Roberts (1990) and Hansmann (1996).

23 See Bogetoft and Olesen (2000) for a detailed analysis of the problem.

have this option. This illustrates that the higher the goal-congruence between the producers and the processor, the easier it is for the parties to co-operate. The reason is that the risk of DLF-Trifolium misusing its authority to order reploughing is small because the producers control the co-operative, whereas the risk of private companies misusing the same authority is higher.<sup>24</sup> This illustrates how the context, here the ownership structure, influences the importance of objectives, here the misuse of authority and the need to incentivise the parties, and how this in turn affects the ability to co-ordinate and co-operate, here reploughing.

The producers cannot obtain precise information about Danish Crown's profit on special pigs. Similarly, only the processor has information about the earnings on the various types of seed in the grass and clover industry. This illustrates how limiting communication can reduce influence costs, because the producer groups do not have the information required for serious discussions of the distribution of payments to different producer groups. A drawback of this information-sparse approach is, of course, that individual producer groups may lose trust in the organisation. This does not seem to be the problem in the Danish Crown case but certainly can be observed in other firms.

#### **4.7. Motivate long-term concerns**

The contract should induce the parties to take the long-term effects of their actions into consideration. It is important that the contract encourages the right investments. Often production and processing require specific investments, i.e. assets with a lower value in their best alternative use. A party who has invested in specific assets is vulnerable to termination of the contract. This leaves the party with specific assets in a weak bargaining position in negotiations once the investment has been made. Of course, the parties foresee this and are reluctant to make specific investments. This is the hold-up problem, which can work both ways, i.e. both the processor and the producers can hold up the other party. However, the hold-up problem is usually more significant when the processor holds up producers.

The hold-up problem can be reduced in various ways. First, long-term contracts reduce the hold-up problem because the terms are settled before one of the parties makes specific investments. In practice, however, it is impossible for the parties to make complete contracts that cover all possible events. This makes hold-up possible even in long-term contracts. Second, if both parties make specific investments the balance in the bargaining positions can remain unchanged. Third, a party (e.g. the processor) with a good reputation may be reluctant to devalue this reputation by holding up a contract partner, because this may ruin his chance of making contracts with other agents.<sup>25</sup>

24 See Hansmann (1996) for a more complete discussion of a similar finding.

25 See Hart (1995) for a comprehensive analysis of the hold-up problem.

Long-term contracts can also alleviate ratchet effects, i.e. the tendency to underperform in early contracts to avoid tough contracts later on, and facilitate the development of know-how through planned experiments.

#### 4.7.1. Examples

In most of the contracts in our study hold-up problems have been dealt with. In many cases, producers can sell their products through alternative channels. This reduces asset specificity.

Broiler contracts usually have a two-year notice of termination and do not specify how the base payment is determined, i.e. the processor is free to change the price paid to the producers. This could enable the processor to hold up the producers for a two-year period. However, the importance of the processor's reputation prevents such behaviour. The contracts for the production of peas for Danisco Foods facilitate experiments. Danisco Foods can order a producer to try out a new variety on a part of his field.

### 4.8. Balance pros and cons of renegotiation

Renegotiation facilitates flexible contracts and enables the parties to adjust the contract to changes in the environment. Hence, the parties can remove *ex post* inefficiencies through renegotiation. However, renegotiation also reduces commitment and may lead to strategic behaviour.<sup>26</sup>

If the parties know that the contract will be renegotiated, the parties do not act according to the incentives in the initial contract but according to the incentives they expect to receive in the renegotiated contract. Hence, renegotiation can lead to *ex ante* inefficiencies.<sup>27</sup> Often, powerful incentives rely on harsh penalties that are costly for both parties to implement, i.e. both parties can be better off *ex post* if the penalty is removed. If the parties foresee this as the result of renegotiation, the incentives will be weakened. The trade-off between risk-sharing and incentives discussed in Section 4.3 demonstrates this. If the parties renegotiate after the effort has been provided, the parties can improve the *ex post* efficiency by shifting the risk from risk-averse producers to a risk-neutral processor. However, the incentives vanish if the producers expect this to happen.

#### 4.8.1. Examples

The contracts for peas illustrate some strategic problems of renegotiation. Previously, producers were divided into groups after harvest. Danisco Foods took account of production results when dividing the groups, such that producers with high yields tended to end up in one group and the producers with low yields in another. This meant that all producers received a payment close to the average. We do not know the rationale for this division principle but one possibility is that it helped reduce risk *ex post*. The incentives, however, almost disappeared. For this reason the contract has

<sup>26</sup> See Milgrom and Roberts (1992), Hart (1995) and Williamson (1996) for further analysis of the pros and cons of renegotiation.

<sup>27</sup> Williamson (1996) refers to this as the problem of forgiveness.

been changed so that grouping takes place immediately after sowing (i.e. before any indication of yield). This illustrates that output information before renegotiation can weaken incentives. It may also illustrate how the trade-off between risk-sharing and incentives has developed over time in this contract.

#### **4.9. Reduce the direct costs of contracting**

The direct costs of contracting are the time and money spent on collecting information, monitoring, bargaining and conflict resolution, i.e. the costs of running the contract. These costs should be kept down because they do not directly generate a surplus. On the other hand, they are important activities as they provide the information required for well co-ordinated decisions.<sup>28</sup>

The contract design affects the information requirement. Some contracts are very specific about the actions required from the producer, whereas other contracts leave a wide range of choices to the producer (see the discussion of decentralisation, Section 4.2). Changes in the contract often shift information requirements from the processor to the producers and vice versa, without actually reducing the information requirement.

##### *4.9.1. Examples*

The producers of special pigs receive either a fixed bonus or a market-determined bonus. The fixed bonus is independent of the actual demand for the special pig in question. The market-determined bonus depends on how large a share of special pig production is actually sold as special pigs (rather than as standard pigs). With market-determined bonuses, the information requirement is lower for the slaughterhouse, as producers automatically adjust their production according to the price signal. However, with market-determined bonuses the information requirement is higher for producers because, if a producer is to choose the right output level, he must be able to predict the market-determined bonus, and therefore the supply and demand of special pigs. Thus, shifting the information requirement does not solve the information problem.

Most contracts involve some monitoring of the producer. However, the degree of monitoring varies from contract to contract. In some of the contracts (e.g. for the production of grass and clover seed), monitoring is combined with advice.

The contracts in our study point to several practical ways of reducing the cost of contract negotiation. One solution is to avoid individual terms in the contracts. Most of the contracts are offered to the producers on a take-it-or-leave-it basis, where producers cannot negotiate individual terms. One exception is contract production of broilers, where the growers receive different negotiable bonuses, e.g. bonuses for new buildings.<sup>29</sup> Another

<sup>28</sup> Coase (1937), Milgrom and Roberts (1992), Hansmann (1996), and Williamson (1996) analyse the direct cost of contracting.

<sup>29</sup> Danish Competition Council (2000) and Rose Poultry (2000).

solution is to negotiate infrequently. The grass and clover industry uses the same contract for several years and so limits the number of negotiations.

The contracts also point to various means of conflict resolution. One approach is to use an arbitrator. All contracts in our study specify how one party can require a conflict to be solved by an arbitration institution. Another approach is to delegate authority to the processor, so the processor can determine most of the questions on which the contract is silent. For this to work, producers must trust the processor. This trust is created in various ways. First, the reputation of the processor plays an important role. In the contract production of peas and sugar beet, producer associations play an active role in conflict resolution. Hence, the reputation of a processor will be damaged severely if one producer is treated unfairly. Second, most of the contracts are based on a long-term relationship.<sup>30</sup> Thus, the threat of losing profitable trade in the future prevents the processor from abusing his authority.

#### 4.10. Use transparent contracts

The contracts must take account of the parties' bounded rationality.<sup>31</sup> The parties act according to perceived incentives, which may differ from the true incentives. Therefore, it is important to use simple contracts, so that the parties can easily relate their choice of action to the compensation scheme set out in the contract. However, simple contracts may also mean less complete contracts where more questions are left unanswered in the contract. To affect the behaviour of the parties, the incentives should be articulated *ex ante*. There is no motivational effect from an unexpected bonus.

##### 4.10.1. Examples

The contracts for the production of peas and sugar beet, respectively, are negotiated between a producers' association and the processors. Acceptance of the contract by the producers' association acts as a stamp of approval for the contract. This means that individual producers do not have to understand the contract in detail, because they trust their representatives to accept only fair contracts. Thus, producers' associations can reduce the costs of studying and understanding contracts.

Consulting may help the producers to understand how the incentives in the contract should affect their production decisions. Most of the processors in our study provide advice to their producers. This reduces the cost of transferring output-based incentives into specific production decisions.

In the pea production contract, the marginal payment for peas depends on the group size. Olesen (2001) shows that the marginal payment for peas varies from around Dkr0.50 to 1.00 per kg depending on the group division. A producer cannot calculate his marginal payment for peas, because he does not know to which group he belongs. Hence, producers do not know their actual incentives. This reduces the motivational effect of payments.

30 These solutions correspond to what Williamson (1996) suggests.

31 See Hart (1995) for a discussion of bounded rationality and the implications for contract design.

## 5. Conclusion

This paper combines contract theory with experience from actual contracts. Based on the study of contract theory and an examination of eight contracts between producers and processors in Danish agriculture, we have developed a checklist containing ten rules of thumb for contract design. These rules cover what we consider to be the most important aspects in the understanding and improvement of agricultural contracts between producers and processors.

We have illustrated the rules by referring to various features of the eight contracts. We emphasise, however, that the details of the contracts, and in particular the trade-offs that they make between objectives, depend on much context-specific detail that we have not been able to cover here.

In the project underlying this paper, we have worked with both the practice and the theory of contracting. We close by indicating some of the implications for future applied and theoretical work on contracts that can be derived from this combination.

We have observed that actual contracts can be just as advanced as recent progress in contract theory. From this perspective, the primary role of research is to understand and rationalise existing practice. Also, we have observed that there are considerable variations in the ingenuity of the contracts. In particular, contracts seem to undergo numerous improvements over time. New contracts are often rather naive and do not take account of some very important problems. They therefore undergo modification over the first 5–10 years. Lastly, we have observed that practitioners often design contracts without using contract theory. Instead, the design of a contract is based on experience and a process of trial-and-error. This has advantages, but it is often an unsystematic, costly and uncertain approach that can be improved by more interaction with theory. Based on these observations, we conclude that a theory-based approach to reality and systematic dissemination of information between agricultural sectors can be a valuable supplement to existing practice.

Despite recent advances in contract theories, we believe that they are still insufficient and that attempts to apply them in practice reveal several aspects that require further development. The theories stress motivation and develop advanced tools to cope with dishonesty (cheating and lying). Unfortunately, co-ordination aspects ensuring that the right people are doing the right things at the right time and place are largely ignored. In practice, co-ordination is just as important, and a more balanced theory offering a combination of motivation and co-ordination tools would be much more valuable. We suggest that contracts are analysed from a holistic perspective where the multiple effects are considered and where the trade-offs are made explicitly rather than implicitly.

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