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Developing a "Small" Resource in an Industrial Network: The Case of Norwegian Goat Milk

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Work-In-Progress

Abstract

Any firm will sooner or later face the problem of resources being used ‘under their potential’, or simply waste. There are more reasons for such a problem, and more solutions. One is to develop the resource. In the paper we start with a principal discussion of resources. We choose to view resources as variables – as a bundle of possible uses. In addition, we regard resources as double-sided; they have both a provision side and a use side, and thus they are relative. Such a perspective is highly relevant for the development of resources. Because resources can be regarded heterogeneous, combinations matter. In an industrial network, combinations stretch across firm boundaries. In the combination, different features of a resource come to use. Resource development can be said to be a question of finding new uses of existing features of a resource and/or giving it new features. To illuminate these points, we present the case of Norwegian goat milk. We tell three development stories related to this resource. In the end we analyse these stories in the light of the theoretical framework presented in the first part of the paper.

Background and Problem Statement

“There ought to be some way in which we can use this resource better”. Such a statement can under certain circumstances be expressed in a specific firm, and can eventually lead to the development of the resource in question; in the form of a novel or improved product, a new means of production, or another way of organising activities. Resource development is certainly not a new phenomenon; it has ‘occurred’ in all history of mankind. Neither is it a new phenomenon to be studied. Why then use resources on one more investigation of the topic?

For the first, the very fact of development changes the context of subsequent developments. What is ‘good development practice’ in one time or space, then, may be less ‘relevant’ in another time or space. Secondly, resources vary in kind and amount. Consequently ways of developing resources may also vary, both within and between categories of resources. The third factor is that firms possessing the same resource in a specific time may face different circumstances, or interpret similar circumstances different, leading one firm to develop the resource, while other firms use the resource “as before”. There is even the possibility that some firms ‘reduce’ or abandon the resource, something that also might be classified under the category resource development. A fourth argument for a new study of resource

development could also be added; there is always a possibility to develop new knowledge when someone sets out to deliberately search for new answers even on 'old' questions.

Relativity of resources

What is the essence of resources for a firm? More answers could be formulated, but one is that resources are needed to carry out activities. But the reverse is also true: activities are necessary to make a resource out of a thing. In other words, there is a reciprocal relation between resources and activities. The observation that resources are dependent on activities, is probably most obvious in the case where the resource 'comes after' the activity in time, that is, when the resource is the *result* of an activity. But resources are also dependent on activities 'coming after' the resource in time. Unless a thing can be used, it is not a resource. Another way to put it is that resources are resources as long as they are or can be a *condition* for an activity. This is perhaps the classical notion of a resource.

This line of argument leads logically to the following statement: No resource is *either* input *or* output. Each and every resource can be viewed from both sides. In the words of Håkansson & Snehota (1995: 132):

> … resources are a result of activities as much as a condition that makes certain activities possible.

The authors term this phenomenon the *double-faced nature of resources*. As a consequence resources are not "absolutes", but "relatives"; they may look different from the use side than from the provision side.[1] As a consequence any resource is exposed to tension, even if it at the outset appears quite unambiguous. This relativity of resources makes it logical to regard them – in principal - as variables and not constants. We stress 'in principal', because resources in practice are not all ways treated as variables. The contrary is very often the case. An actor may want to reduce the variability of a resource that he uses. Take a sawmill as an example. The sawmill does not want to use any kind of timber in its activities, only certain kinds. 'Timber', like most other resources, exhibit a considerable variability (Alderson 1965). Thus, timber as a homogeneous category cannot be taken for granted. Quite the opposite: a lot of

[1] It may be in place to stress that our purpose here is not so much to take part in the (important) discussion of *who* is viewing the resource; the actor dimension. We therefore carefully employ the words provision side and

effort is needed to make the timber homogeneous – constant - so that the sawmill can carry out its production activities smoothly. Generally speaking, 'constant' resources have meaning if the aim is to combine and transform them in a production process into other resource elements (products) (Håkansson & Snehota 1995: 134-135). This is one aspect of resources. It points to the *exploitation* of resources, and highlights resource scarcity, availability and control (op cit.: 135-136) and comprises things like: old certainties, refinement, choice, production, efficiency, selection, implementation and execution (March 1991:71).

But there is also another aspect of resources. Over time, we can observe that new and improved products - goods as well as services - are offered to us in the market place. Firms introduce new methods for producing existing products, and implement new ways of organising activities (Penrose 1995: 85-86). Resources are steadily changed, and new resources emerge. In other words, there is a *development* aspect of resources (Håkansson & Snehota 1995: 135-136). In the formulation of March (1991: 71) this aspect regards 'exploration of new possibilities' and raises questions concerning search, variation, risk taking, experimentation, play, flexibility, discovery and innovation. From the introductory words the reader would have noticed that it is this aspect of resources which we want to investigate in this paper.

Resources and actual and potential use

Penrose (1995: 25) emphasises that:

> …it is never *resources* themselves that are the 'inputs' in the production process, but only the *services* [2] that the resources can render.

This statement helps to clarify the origin of the development aspect of resources, because:

> The services yielded by resources are a function of the way in which they are used – exactly the same resource when used for different purposes or in different ways and in combination with different types or amounts of other resources provides a different service or set of services. (Op cit.: 25)

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use side, and not provider side and user side. As a consequence the argument is independent of whether one assumes one actor on both sides, or different actors on each side.

[2] Penrose (1995:25) states that: "… the very word 'service' implying a function, an activity." The word 'service' could therefore as well be substituted by the word 'use'.

In other words, there are two kinds of uses of a resource, the *actual* use and the *potential* use. This is another way to say that there is an exploitation aspect and a development aspect of resources. According to Penrose (1995: 67), a resource then can be viewed as a *bundle of possible uses*. This consideration, again, is in line with the perspective presented earlier in this paper: regard resources as variables.

Only a few of the possible uses – or the variability - of a resource are 'used' at a certain time in a certain space. Because it very seldom is possible to possess or obtain uses in "pure form", firms must make or purchase "whole resources". Consequently the firm then is in possession of all possible uses, in addition to actual uses. The possible, but unused, and may be unknown, uses, or the mere conviction that possible uses exist, may induce a firm to explore the resource further, in order to exploit it better. Such exploration is a "never-ending story"; one will never reach a 'state of balance' where there are no more 'unused uses' of a resource (Penrose 1995: 68). She lists three causes for this, in principal, endless exploration.

First there is the indivisibility factor. Even small firms need a number and variety of resources to carry out their production. The resources are normally obtainable only in discrete amounts. Consequently if a firm is to use all its resources fully (the perfect state), it must produce an output that corresponds to the least common multiple of the various maximum outputs obtainable from the smallest unit in which each type of resource can be acquired (Penrose 1995: 68). Of different reasons, the possibilities for the firm to expand and reach the perfect state at a given time are restricted. So, there will at any time exist idle resources; some will be only partly used and some used less efficiently than they could have been in the perfect state. But firms will continually make efforts to come nearer the perfect state and avoid idle resources. This is one inducement for finding better use of a resource.

The second factor concerns the specialised use of resources. Even if a resource is not idle, there will always be a potential to use it better, that is, specialise on the qualities of the resource that are most valuable for the firm. To reach such a state will normally require a larger output, which means expansion. The third factor is that during the ordinary operation new uses of resources are continually being discovered, uses that one *did not know existed* or which one *judged as insignificant*. This may regard human resources as well as material resources. This third factor is closely connected to the *heterogeneity* of resources.

The Basis for Resource Development: Heterogeneity and Combination

We have put forward that resources principally can be looked at as variables. In addition we have pointed to their 'double-sidedness'; they have both a provision side and a use side. Both these observations help to illuminate the development aspect of resources. Furthermore, they make it logical to study resources – including the development of resources - as parts of resource *combinations*, rather than as individual entities. A resource has no value, and is ultimately not a resource, in itself. It is only in combinations with other resources that it has value. This is the case irrespective of the resource being 'exploited' or 'developed'. The homogeneous timber that the sawmill uses has one value in that specific combination with social and other technical resources. In a combination with a different sawmill or a plant in another industry (for example a paper mill), this specific timber may have another value. Within any category of resources one can find and eventually employ variability, irrespective of attempts to create homogeneity. The 'answer' is combinations. The phenomenon that the value of resources varies with combination, has been termed the heterogeneity of resources (Håkansson & Snehota 1995: 135):

> Once we accept the heterogeneity in use, resources must be evaluated in different combinations and constellations. The double-faced nature of the resources will then become apparent.

The addition 'in use' is important. As we already have been pointing out, it is strictly speaking not resources as wholes that are used in production processes, but the use that can be made of the resources. This observation is highly relevant for the development aspect of resources, because there are "hidden uses" in every resource. As Penrose (1995: 75-76) emphasises:

> Not only can the personnel of a firm render a heterogeneous variety of unique services, but also the material resources of the firm can be used in different ways, which means that they can provide different kinds of services.

Thus, we are talking about different or new *kinds* of uses, and not more – or less - of existing uses. Here we are at the heart of resource development. Resource development is *one way* of 'using a resource better'. It concerns the qualities – or features - of resources. As we have

shown, the other ways of using a resource better is 1) to employ more of its existing use by a better 'balancing of processes', and 2) reduce some of its existing uses and increase others (specialisation). In both these cases the firm is dealing with amounts of uses of the resource that is already in use. This is hardly resource development, if we with development mean a process that adds or improve features of the resource or change the significance of its existing features.

Ways of Resource Development

To be sure, resources do not develop by themselves. Development presupposes ideas, and ideas presuppose people. But people often get their ideas from confrontations with resources. So there is an interaction between resources and people, resulting in new knowledge, which again changes the use of the resource, giving rise to new ideas and increased knowledge etc. etc. An extensive discussion of different forms of knowledge and various ways of developing knowledge is beyond the scope of this paper. But it can be helpful to think of two ways in which new knowledge of a certain resource can come about. The first is interaction between resource and people in the daily operations, which automatically results in experience (Nelson & Winter 1982). Put simply, experience is mainly a tacit, informal and 'subjective' kind of knowledge (Nonaka & Takeuchi 1995). The second way may be called research. Research may take several forms, but is characterised by that it is a more deliberate and voluntary search for new knowledge (Penrose 1995: 76-78) which results in explicit, formal and 'objective' knowledge (Nonaka & Takeuchi 1995).

Irrespective of type of knowledge, a resource can be developed in two ways. One is to give it new or changed features; the other is to find new ways of combining its known features with those of other resources (Penrose 1995: 77). As we already have stated, new combinations may be combinations of features in order to produce novel products, new means for the making of existing products or changed organisation of activities. But the combinations are not necessarily confined to the individual firm.

Resource Development in a Relational Perspective

So far we have discussed resource development without any explicit consideration of actors and boundaries between them. Building mainly on Penrose (1995) we have developed a comprehension of the basis of resource development in the continuing availability of unused productive uses from heterogeneous resources. But in her system of explanation Penrose

(1995) emphasises the 'unused uses' possessed by individual firms, and how the people internal to firms interact with the firm's resources to make better use of them. Although Penrose (1995) several times stresses the importance of changes in the world external to the firm and the firm's experience and knowledge of these changes, she does not deal with eventual interaction regarding resources *between* firms, be it bilateral or multilateral interaction. Since we are convinced that what goes on between firms is an important factor in resource development, it is appropriate to invoke a perspective presented in the beginning of the paper: the double-faced nature of resources. If we accept this way of looking, it is little reason to believe that resources are developed only from one side, for example the provision side. It is just as reasonable to conceive of a two-sided development, or in the formulation of Håkansson & Snehota (1995: 132):

> Develop[ment of] resources and resource combinations … often originate in relationships with other companies because it is in a relationship that the use of a resource is confronted with how it is produced.

And further (p. 135):

> As … individual firms are collections of heterogeneous resources, a business relationship relates the resources of … two firms and allows their combined effectiveness to be increased. That is achieved as actors learn how to best relate their resources to each other.

In other words, in its development of resources a firm can use its relationships with other firms as a mechanism. A business relationship can have an atmosphere of co-operation as well as conflict (Håkansson & Snehota 1995: 9). In either case, use and 'use ideas' of one or more resources in one firm (resource collection A[3]) can be confronted with use and 'use ideas' of one or more resources in the other firm (resource collection B). Such a confrontation across firm boundaries (Dubois 1998) may bring about development in the form of new features of a resource or new ways of combining its existing features with those of other resources. Consequently it is worthwhile to study the impact of business relationships on resource

[3] Håkansson & Snehota (1995) use the word resource *collection* for the resources owned or controlled by one firm, while the word resource *constellation* refers to a combination of resources which embraces several firms in a business network.

development. Let us see how certain aspects of this impact unfold in a specific empirical context.

Research Problem and Empirical Context for the Study

On the following pages we present a case history. Strictly speaking it is several case histories which all concern the development of a specific resource in what might be called a Norwegian context. The resource is goat milk. The largest user of goat milk in Norway is Tine, a co-operative dairy company owned by approximately 25.000 Norwegian milk farmers, of whom about 750 produces goat milk. So, in terms of volume, goat milk is clearly a minor resource compared to milk in Norway.[4] Given this situation we could hypothesise that goat milk would be a "step child" in the system, a resource that Tine reluctantly took care of. On the other hand, as an organisation, and as all types of resources, we must expect Tine to be a heterogeneous resource. Tine consists of several companies covering different regions in Norway. Within these regional companies again there are more dairies, and for some of these goat milk constitutes the major resource to be manufactured. In one dairy goat milk is even the only resource to be handled. We thus should expect that there is a particular interest in developing this "small resource" in some regions and at some plants. None the less, as goat milk principally can be regarded as a heterogeneous resource, we must expect that Tine "as a whole" also, in one way or another is involved in development of this resource.

Some Words about Amount as a Feature

We should be very alert concerning the way we frame the problem here. The formulation "small resource" only refers to the amount in which the resource goat milk is produced, and merely in relation to Norwegian milk. As we already have emphasised, development concerns very much the qualitative sides – the features - of a resource and how these are combined with those of other resources, within as well as across firm boundaries. However, amount can also be regarded as one of the many features of a resource.[5] This feature has a role to play together with other features in the combination a resource is part of. Thus, amount is a relative dimension; it can only be judged and studied in relation to other features and other resources.

[4] In accordance with international conventions, with milk we mean cow milk, unless we explicitly refers to milk of another mammal.

[5] Recall the formulation from Penrose (1995: 25) cited earlier in this paper: "… the same resource when used … in combination with different types or *amounts* of other resources provides a different service or set of services." (Our italics).

Moreover, amount – having the value ‘large’ or ‘small’ – can be a problem as well as a possibility. Diamonds exist in a very small amount in terms of mass in the crust of the earth. Is this a problem or a possibility? A designer of an efficient facility that is going to be used in the extraction and refinement of diamonds, may experience it as a problem. On the other hand, it is an empirical fact that some customers pay huge prices per kg ‘mass’ to obtain a diamond. Of course, we know that the reason for this high price is that diamond has some unique features (i. a. colour, hardness). But it is unlikely that the value of diamond would have been the same, if it had existed in the same large amount as for example granite. One explanation for the high value is undoubtedly scarcity; diamonds are expensive partly because of, and not in spite of, the low amount of them. On the other hand, small amount does not necessarily, in itself, bring high value.

The very essence of this discussion is that it is reasonable to envisage amount as one of the many features of a resource, and that the significance of this feature is relative. Only when taking combinations into consideration is it possible to judge this feature, as well as all other features. Consequently, we cannot leave out the feature amount when we study development of resources. We should realise, then, that, when referring to Norwegian goat milk as a “small” resource, we only take one of its many features into consideration. An investigation of the development of this resource must encompass more, but necessarily not all, of these features.

Purpose

As we recall the theoretical picture we have painted - resource development being dependent on business relations and combination of features across firm boundaries – let us see how the development of Norwegian goat milk has unfolded in a specific industrial network during a particular time period. We want to find out in what ways business relations impact on the resource development.

Research Questions

More precisely we want answers on these specific questions:

1. In what ways is the variability of the resource developed and utilised? Does it have unique features, or is unique features made? Is it the search for new features that matters the most, or new combinations of known and/or used features?

2. Is it possible to identify patterns regarding how “productive interfaces” are discovered, developed and implemented in the network?
3. Do the development follow a preordained deliberate plan to find new features and combinations, or do the findings arise more occasionally and automatically from the daily operations, or is there an interplay between these two forms of gaining new knowledge?

Case: Three Development Stories related to Norwegian Goat Milk

Introduction

From our interviews with people involved in research and development work related to goat milk produced in Norway, and studies of research based literature about goat milk, it is clear that this resource has some distinct features. It may be helpful to present a kind of “objective” list of the features, before we go on to present the case histories:

1. *Taste and smell* is distinct compared to milk of other mammals. The taste is particularly, but not entirely, connected to one of the components in it - fat. Furthermore, the taste may change when goat milk is directly or indirectly combined with certain other resources (microbes, acid, salt, and fodder, heat, humidity, light, type of goat race) or to certain activities (pumping, shaking).
2. It has a distinct pure white *colour*.
3. A certain component in the resource – casein - has the ability to *coagulate* when it is exposed to a certain digestive enzyme – rennet. Furthermore, the texture of this component can thereafter change when it over time is exposed to certain other resources (microbes, air, salt, temperature, humidity). All kinds of milk have this feature, but there are differences regarding the time and extent of coagulation, because of differences in the chemical composition of casein.
4. A certain component in the resource – *lactose* - can be isolated when the milk is heated above a certain temperature.
5. In dried condition, a certain component in the resource – casein – has the ability to *bind water*.
6. It contains *fat* that has specific emulsifying features and distinct tastes.
7. Goat milk has a specific composition of *nutritious matter* which can be liberated and digested in the intestinal tract and ‘used’ by human bodies or other bodies.

8. This nutritious matter can also have healing effect on the *skin*.
9. Some people believe it has specific *health effects,* that is, beyond pure nutritious effects, although this is a contested "truth".
10. It is *fluid*.
11. It contains *water* that the body can take up if the milk gets into the stomach.

This list is not exhaustive, but gives some idea about the variability of the resource in question as well as its homogeneity. Furthermore we very consciously add the notion 'Norwegian' to goat milk, because milk produced by Norwegian goats differ in one or more features from goat milk produced in other countries. In what way and why will to some extent be described in the case stories to follow. We can also note that the stories take place mainly in the 1990'ies.

1990: The Bulk of Goat Milk is used to produce Brown Cheese, and the exploitation of casein is not 'optimal'

Contrary to in many other countries, much of the milk from Norwegian goats is used to make brown cheese. In 1990 the proportion was 68% (Kvam 1999). Tine took at that time care of almost all goat milk in Norway for further processing. Also significant amounts of Norwegian cow milk is used to make brown cheese. Brown cheese is not a real cheese. According to World Health Organisation (WHO) and Food and Agriculture Organisation (FAO) only cheese made of curd (casein), from which whey is separated, can be termed cheese (Aschehoug & Gyldendals Store Norske Leksikon). As such, whey can be looked upon as a waste from cheese making. This 'waste' is the raw material which brown cheese is made of. Norway and some districts in Sweden east of Trøndelag are nearly the only parts of the world, in which there are a significant tradition for producing and consuming whey-based products.

> A lunch packet consisting of loaves of bread with slices of brown cheese is itself the symbol of the everyday and sober life [in Norway]. (Aschehoug & Gyldendals Store Norske Leksikon). (Our translation).

According to FAO and WHO brown cheese is "a caramelised concentrate of whey, where milk and cream is added to the whey". Nearly half of the dried matter in brown cheese is milk sugar (lactose). The brown colour develops when the milk is heated and the lactose is isolated and caramelises. In older times only whey was used to make brown cheese. But by adding

milk and cream one is able to adjust the fat content and increase the content of protein. Both soft and hard cheeses are made from whey. Goat milk is used in two main types of hard cheeses: real goat brown cheese and mixed brown cheese. The first is made of whey from goat milk added goat milk and cream from goat milk (Kielland 1976: 120-121). The latter is produced from whey from (cow) milk added milk, cream from cow milk and at least 10% goat milk. This cheese is called Gudbrandsdalsost ("Gudbrandsdal Cheese"), because it was in this valley one first started to mix milk and cream into the whey when making brown cheese. Around two thirds of all brown cheese produced in Norway is Gudbrandsdalsost.

In 1990 38% of the goat milk received by Tine was used to make pure goat brown cheese, and 30% was used in the production of Gudbrandsdalsost (Kvam 1999). Especially the latter cheese represents a very good utilisation of goat milk because here all the components in goat milk are used. Production of pure goat brown cheese results in casein as by-product.

Even if over the years there has been some change in the basic technology, the manufacture of brown cheese is rather straightforward. The lactose in cow milk and goat milk is supposed to be quite similar, thus there is little need for specific knowledge and competence related to the making of goat milk based brown cheese. Contrary to white (real) cheese, brown cheese is a 'dead' product that does not change taste and consistency on storage. Consequently one cannot mature a brown cheese and in this way develop different tastes and consistencies after it is produced. The only change related to Norwegian brown cheese over the years has been that the main types are produced in different fat variants (low, medium, high), colour variants (light, dark), form and – from 1972 - adding of iron (10 mg per 100 grams of cheese) (Kielland 1976: 120). But the main types – pure goat brown cheese, mixed brown cheese and pure cow brown cheese – have remained the same for decades. Seen from the side of the raw material, for long *little work was done to improve the quality of the goat milk, since most of it was used to make a rather "unproblematic" brown cheese*.

Thus, one can say that little development has been carried out regarding the use of lactose as raw material, both concerning goat milk and cow milk. On the provision side, much work has been done to improve cow milk, because this raw material is used to produce a wide range of products, of which brown cheese represents only a minor part. This is not the case for Norwegian goat milk. A major part of it is used to produce brown cheese, in fact to such a degree that in everyday language in Norway goat cheese is almost synonymous with brown goat cheese.

But not all the goat milk was in 1990 used to produce the volume product, brown cheese. Around 1970 Tine had developed a real, white, hard goat cheese, called Rosendal. Tine Syvde[6] in Sunnmøre produced this cheese until 1999. Tine Storsteinnes in Troms produced a mixed white cheese – Balsfjord – made of milk and goat milk. Both cheeses were partly exported, partly distributed by Norwegian retailers. However, the sale of the cheeses was far less than the sale of brown goat cheese, and the sale was decreasing. In 1990 5% of Norwegian goat milk was used to produce these two cheeses. Another critical factor at that time was that 27% of the goat milk was regarded as surplus milk. Since goat farmers, as members, have the right to deliver the milk which they produce to Tine, Tine had to 'make the best' out of this surplus goat milk. In 1990 it was used to produce rather low value products.

For the first, casein, an unavoidable result of the production of pure brown goat cheese, was mixed with cow milk casein and dried. Tine sold this product at rather low prices to Norwegian and foreign food companies, which used it as a water-binding agent in among other things meat stuffing and fish stuffing. For the other, surplus milk – by Tine's definition milk that is not used to produce food products - was partly processed to dried milk, partly sold to animal farmers as feed, also at low prices. Thus, the problem regarding the exploitation of goat milk in Norway around 1990 can be summed up as follows:

1. Around 33% of the milk was used to produce pure goat brown cheese. All the casein in this milk turned out as by-product, of which were made products of rather low value.
2. 5 % of the milk was used to produce two white cheeses, of which the sale was decreasing.
3. 27% of the milk was categorised as surplus, of which different non-food products were produced and sold at rather low prices.

In other words, nearly 2/3 of the Norwegian goat milk was in one way or another 'problematic' around 1990. In the following years, Tine, in co-operation with different partners, did efforts to find better uses of 'surplus' goat milk and goat milk casein. Let us look at five efforts. The first three are related to the exploitation of casein, while the last two deals with 'the whole milk'.

[6] Regional dairy companies forms the organisation Tine Norwegian Dairies. In 2001 there are ten regional companies in Tine. All Tine dairies are owned by a regional Tine company, but Tine Norwegian Dairies decides on matters like what is going to be produced on each dairy and does most of the development and marketing. In order to simplify, we term each dairy 'Tine' followed by the name of the place where it is located, without mentioning the name of the regional Tine company which owns the dairy.

Request from Greek restaurants in Oslo – producing goat feta

During the 1970'ies and 1980'ies a lot of immigrants settled in Norway, not at least in the Oslo area. In the late 1980'ies, Greek immigrants, who had established restaurants in Oslo, asked if Tine could start to produce a feta cheese. Tine was positive to the request. It was decided that Tine's R&D Centre in Voll in Rogaland[7], in co-operation with the goat milk dairy Tine Haukelid in Telemark, should develop a feta. The Greek restaurants also participated in the development. Feta is originally a Greek cheese, produced of sheep milk, goat milk or a mix of the two. However, a court decision in EU has stated that the Greeks have no copyright on this recipe. Thus, Danish dairies for example produce large volumes of feta based purely on cow milk. But all the recipes have in common that the cheese is a real cheese (made of casein) cut in cubes and pickled in a spiced, vegetable oil with olive.

The Greek restaurants wanted an original feta. Since there was – and still is - no sheep milk production in Norway, the only original feta Tine could produce, was a feta made of goat milk. To choose Tine Haukelid as the dairy to produce the new cheese was not a coincidence. This dairy was one of the few dairies in Tine that processed only goat milk. Most other Tine dairies process milk.[8] The rest process both milk and goat milk. Consequently, the latter group of dairies can produce products based on a combination of milk and goat milk as well as pure goat milk products. For example they can use a mix of milk and goat milk as raw material and produce mixed brown cheese (like Gudbrandsdalsost and Misværost), mixed hard white cheese (like Balsfjord) and mixed soft white cheese (like Snøfrisk). Tine Haukelid had no possibility to produce mixed products in this way.[9] In 1989 this dairy produced only pure goat brown cheese. This gave casein as a by-product. This casein was transported to another Tine dairy many hundred km away for drying. With a feta production at Tine Haukelid, one could avoid the long transportation of the goat milk casein, and also get a more valuable product out of it.

Tine's R&D centre, Tine Haukelid and the Greek restaurants managed to develop the feta, and Tine Haukelid started to produce it in 1989. In addition to the Greek restaurants, the new feta was also sold to consumers via some retailers. The volume was quite low, 30-35 tons

[7] Tine has split its R&D Department into two centres. The centre dealing mainly with processes and technology is purposely located next to Tine's dairy at Kalbakken in Oslo, "Fellesmeieriet". The other centre, dealing mainly with product development, is located at Voll in Rogaland, in the south-west of Norway.

[8] Only cow milk can officially be termed milk. Milk from other animals must be named with the name of the actual animal as a prefix before the word milk, for example goat milk, buffalo milk.

[9] Of course, Tine Haukelid had still the possibility to combine milk and cow milk in the product by assembling a milk based cheese (maturated or unmaturated) and a goat milk based cheese (maturated or unmaturated). Then Tine Haukelid could have bought the component that it could not produce itself - milk based cheese - from another Tine dairy or another firm.

a year. However, it was not the low volume that led Tine to terminate the production in 1991, but strong taste in cheese made of summer milk. And the longer the storing, the stronger the taste. At last the Greek restaurants did not want to purchase Tine's feta cheese anymore.

Tine did no systematic attempt to detect the causes of the taste problem. One reason was that the import of cheap Danish feta made of cow milk increased considerably in the following years. The other may be that Tine felt that the name and reputation of their feta was destroyed. Tine Haukelid continued to produce pure goat brown cheese as before 1989. Four years later Tine got a request from an American customer that needed more supplies of frozen goat milk curd.

Inquiry from California – Frozen Curd

Laura Chennel runs a goat farm and a goat milk dairy in the 'wine district' around 200 km north-east of San Francisco, California. There is a rather large production of goat milk in California. Unlike in Norway, the goats are held within fences and fed with hey, straw and concentrated fodder all the year round. In addition to her own goat milk production, in 1995, Laura Chennel purchased goat milk from 12 other goat farmers in the district. Of most of the milk, Chennel made unmaturated frozen curd. Under the name Frozen Curd, Chennel had marketed this product as a health product in USA since 1977. Frozen Curd is sold mainly to industrial customers and is used as cold cuts and flavouring in among other things pizza. It is produced in a pure version (Naturell) and a spiced version (Tine Meieriet Sør 2001).

From its American subsidiary, Norseland Inc., Tine was in 1994 informed that Chennel needed more frozen goat milk curd for resale to industrial customers[10]. Regarding Norseland Inc., this company does sales and marketing within the speciality cheese and related food and food service industry in USA. The company's main task is to market Jarlsberg in USA. Jarlsberg is a white semi-hard Tine cheese made of cow milk.

Tine decided to start production of Frozen Curd and localise it to Tine Haukelid in 1995. One of the reasons for choosing Tine Haukelid was that the suppliers to this dairy for many years had delivered milk with good and stable microbial and hygienic quality. And the suppliers were very enthusiastic about the new product. In addition it was not a new, but an existing product that was going to be produced. All in all, the chances for a successful production seemed good.

[10] Tine Meieriet Sør. [http://tms.tine.no/drift/haukelid.htm]

The production started early in 1995. In the beginning, Chennel was very satisfied with the quality of the product. But in the summer the same year, she complained that the taste of the curd had become too strong. She made it clear that she could not purchase more of the product until the taste had become milder. This time, as opposed to in the case of Feta, Tine put much effort in solving the problem. Because she produced Frozen Curd herself, Chennel knew the product and the production of it very well. She sent one of her dairymen to assist Tine Haukelid in improving the process in the dairy.

However, it was discovered that the main problem was not connected to processes in the dairy. It seemed more likely that the problem had to do with the raw material. Since Frozen Curd was a 100% goat milk based product, it was not possible to solve the taste problem by adding or subtracting components in the raw material. Hence the problem had to be localised and solved in the production of the raw material and in the transportation and storing of it before it reached the dairy. Tine now asked the Departments of Food Science and Animal Science at the Norwegian Agricultural University for help. In addition, personnel at Tine's own departments for Organisation and Research & Development took part in the efforts to find the causes of the problem and solve it. Tine's department for Organisation deals with questions related to animal health, breeding, feeding and milking operations, while the R&D department deals with product development and technological solutions. A project group with participants from the organisations mentioned above was set up. The project went on from 1995 to 1999. The group identified three problem areas: feeding, breeding and transportation and storage.

Taste problems and change of feeding

The Departments for Food Science (DFS) and Animal Science (DAS) co-operated to research the connection between taste and feeding. Anne was one of the main participants from DFS, while Clara was one of the leading persons from DAS. Chennel had complained about strong taste. Since Tine and the various panels of taste referees set up to evaluate taste traditionally had perceived strong taste as a positive quality of goat milk, the very notion of taste had to be re-evaluated. Earlier it had been usual to operate with a scale from 1 to 5 when characterising taste in goat milk. 1 represented 'weak taste' while 5 meant 'strong taste'. Instead, Anne and Clara proposed to divide the taste into three components, goat taste, rancid taste and harsh taste. Milk with goat taste has a distinct, hazelnutty, taste that is easy to distinguish from the taste of cow milk, but is neither rancid nor harsh. Strong taste is entirely tied to the two latter

elements and these are negative features of goat milk, they claimed. Consequently, the causes to rancid and harsh taste in the milk that Tine Haukelid purchased had to be found and fought.

Anne and Clara now carried out some experiments at a small number of goat farms. From the experiments they learned that goat milk produced on pastureland, especially late in summer, tended to have a stronger taste than goat milk produced during other seasons. The main finding from their research was that strong taste mainly was related to the *amount of free fatty acids* in the milk. At the outset, the fat in milk is contained in globules enclosed by a membrane. Free fatty acids are produced when the membrane is broken. Then the fat molecules are attacked by an enzyme – lipase – and split into free fatty acids. This is a process called *lipolysis.*

Anne and Clara were able to show that *lipolysis was related to feeding*. Clara and her colleagues found that an energy deficit was the main cause of lipolysis and thus strong taste in goat milk (Eide 1999). An energy deficit means that the goats mobilise energy resources from their own bodies in addition to exploiting the fodder they eat. Energy deficit occurs especially late in the grazing season when there is less and poorer graze, the animals have to make more and longer grazing trips, and their body weight is higher. It is important to avoid that the top of the lactation curve coincides with the late grazing period. In addition, versatile feeding is advantageous. Thus, to allot additional feed in the late grazing season can prevent energy imbalances. To investigate the significance of high quality fodder, Clara and her colleagues carried out an experiment. 24 milking goats in-door were given as much hey as they could eat (appetite feeding) in 48 hours and 24 other goats grazed out doors in 48 hours on a pasture. Only 10% of the goats in the first group produced strong milk, while 90% of the goats in the last group produced strong milk. In direct co-operation with the project, Felleskjøpet – a farmers' co-operative supplying means of agricultural production – has developed and started to produce a special feed concentrate for milking goats (FORMEL) (Felleskjøpet Øst Vest 2001). This feed supplements grass fodder, prevents energy deficit and thus reduces the occurrence of strong taste in goat milk.

The director at Tine Haukelid reports that the situation has improved considerably. Already in 1995, when they first experienced taste problems, Tine Haukelid started weekly evaluations of the taste of each producer's goat milk (on the farm). The practice until then had been to measure taste of whole carloads when they arrived at the dairy. Carloads consist of a mix of milk from many farms. Since then Tine Haukelid have purchased goat milk only from farmers that can document that they produce a satisfactory raw material. In 1998 – the first

year with full round-the-year production of Frozen Curd - 65% of the milk had to be rejected because of too strong a taste. In 2000, the figure had declined to 15%.

Taste problems – changing the breeding goals[11]

Contrary to feeding, breeding is a much more long term undertaking. In 1997 Anne and Clara investigated 50 milking goats on farms that delivered to Tine Haukelid, and found that 5 animals produced milk with a strong (rancid and harsh) taste. In 1998 they investigated 60 goats and got a similar result. Since Anne and Clara in these investigations obtained data from animals representing more generations, they were able to conclude that the property to produce strong milk was due to heredity. Consequently systematic work to identify individual animals producing strong milk in individual herds is a way to go.

However, breeding organised above the farm level is also important. The Norwegian Association for Sheep- and Goat Breeding (Norsk Sau- og Geitalslag - NSG) have worked to develop what they term 'the Norwegian goat race' for many years. NSG is a member organisation for sheep farmers and goat farmers in Norway. The National Goat Breeding Board (Landsrådet for geiteavl) manages the goat breeding on the national level. This board is subjugated NSG and is represented by different spheres and organisations. Two goat farmers, of whom one heads the board, represent NSG. There is one member from Tine and one from Department for Animal Science in the board. The Ministry of Agriculture is represented by the animal consultant (Fylkesagronom i husdyrbruk) at one of the County Governor Offices. NGS alone has not the expertise to carry out the organised system of goat breeding. In addition breeding scientists at the Department of Animal Science and regional consultants in Tine contribute in specific ways.

One main task of the board is to shape the goat breeding goals. In general, animals with good milk, efficient exploitation of natural resources, and good health and fertility are chosen for further breeding. Regarding the feature 'milk', high yield was the primary goal until 1996. Then the board changed the goal and introduced a new formulation: "Develop a goat that produces milk with good and distinct taste". High yield was not a goal in it self any more. However, obtaining a reliable and valid measure of the taste of the milk from every milking goat in the country is a too complicated undertaking. But it is known that milk with a high relative portion of dry matter has a more mild taste. Therefore the breeding board doubled the weight that was put on the parameter 'relative portion of dry matter in the milk'

[11] Much of this chapter draws upon information provided by Norsk Sau- og Geitalslag (2001) on their web page and via one of their consultants.

when crossing within the population of Norwegian goats. In addition genes from the Swiss race Saanen has been used. Saanen goats are recognised as the best milking goats in the world (Haenlein & Ace 1984), and they produce milk with a mild taste.

That this change in the goals occurred in 1996 was not a coincidence. It was a direct result of the problems of strong taste in Frozen Curd that Tine experienced in 1995. As a participant in the breeding board, Tine could directly influence the actors that was responsible for and carried out goat breeding.

Taste problems and storage and transport facilities

Feed and genetics are two – of more - resources affecting goat milk. Transportation and storage facilities are a third group. Since, in the case of Frozen Curd, the processing of the milk was organised in order to take care of the milk from many farms; the milk had to be transported from the farms to the dairy. This demanded specific transport facilities and storage facilities. That is, one could not take for granted that fresh milk on the farm had the same taste as the milk that arrived at the gate of the dairy.

Tine's department for Research & Development work to improve the transport and storage facilities so that the taste of the goat milk remains mild along the way from the farms to the dairy. In the case of Tine Haukelid, milk is transported to the dairy from farms that are situated up to 350 km away. Tine has chosen to collect milk every third day, which has the consequence that milk has to be stored on the farms for up to three days. On the farm the normal practice is, immediately after milking with milking machine, to pump the milk into a pipe leading to a cooling tank. In the cooling tank there is an agitator. Agitation implies that all the milk is mixed, that the fat does not fleet to the top, and that all the milk at no time gets warmer than +4°C. So far the tank solution with the agitator has been the same for cow milk and goat milk. Since cow milk is produced in far larger volumes than goat milk, the design of the agitator has been done on the basis of requirements for cow milk. The standard agitator is not very suitable for goat milk. The agitation is so fast that too many free fatty acids are produced. Furthermore, the need to agitate to hinder the cream to fleet up is less important for goat milk because the fat molecules in this type of milk are smaller and more dispersed (emulsified) than in cow milk. David, one of the consultants at Tine R&D, has developed a programmable agitator where the rotating speed can be altered. He has found that slower agitation resulted in a lower level of free fatty acids in the goat milk and thus milder taste.

Another improvement which David and his colleagues are working with is based on the observation that *lipases are inactivated at high temperatures* (above 60-70°C). Some farmers take part in this work by letting David use their milk handling facilities in his experiments. David imagines two technical solutions. One is to plug in a *heater* on the milk pipe between the milking machine and the cooling tank. In addition a small water cooler has to be plugged in after the heater to bring the temperature in the milk down to the level it had before it entered the heater. This solution will be quite expensive and is considered only for livestocks where so-called spontaneous lipolysis is a serious problem. Spontaneous lipolysis is lipolysis that starts immediately after milking. David carried out a small-scale experiment in the summer of 2000 in a setting where the goats grazed on a mountain pasture. He experienced what he terms ‘dramatic effects’. Milk that was heated was almost without exception classified as having ‘mild taste’, ‘1. class’ and ‘low content of free fatty acids’. Contrary to this, untreated milk generally obtained the classification ‘harsh and rancid taste’, ‘2. or 3 class’ and ‘high contents of free fatty acids’. In 2001 David plans to carry out the ‘inactivation experiment’ on a larger scale.

A cheaper solution is to heat up the milk after it has been pumped from the tank on the farm to the tank lorry that transports the milk to the dairy. In this case, the lorry must be equipped with two tanks. First the milk must be pumped in to a small tank where it is warmed up, then to a large tank where the milk is cooled off and mixed with milk from other farms. So far, David and his colleagues have not constructed such a ‘rolling dairy’, but have serious plans to do so.

Half versus full tank during transportation to the dairy also makes a difference. One of David’s colleagues carried out an experiment and found that if the tank was full, the milk had fewer free fatty acids after the transportation than when the tank was half full. The explanation is that in the former case the milk do not ‘splash’ so much. Splashing may destroy the membrane around the fat globules and release free fatty acids. Clara has made experiments and found that goat milk that was 72 hours old had a significantly stronger taste than milk that was 4 hours old. Full tanks and higher frequency of collection, especially in the critical late grazing period, may therefore contribute to a more mild tasting end product. Clara points to France where it is common to make cheese the same day as the milk is milked, because the quality of the raw material is regarded as being better then.

Developing a new goat cheese aimed at German customers - Snøfrisk

In 1993 Tine decided to develop a new goat milk casein based cheese. Already from the start it was clear that the main market for the new product should be foreign. The development process started with an English Company carrying out market research in England and Germany on the behalf of Tine. The main findings from this research were that Germany was the most interesting market for a new goat cheese produced in Norway. Such a cheese should have an image of 'clean and pure nature'. In addition it should be soft, since German consumers, more than most other consumers, prefer soft cheeses. Based on these premises, Tine started the development.

Already from the start, it was clear that the production of the new cheese should be located at Tine Ørsta. This dairy is situated in Sunnmøre, a region with relatively many goat farmers. It was personnel at Tine Ørsta who had taken the initiative to develop the new cheese. They were also very active during the development process. Tine Ørsta already produced a soft cheese from cow milk, and thus had equipment and competence to produce a soft cheese based on goat milk as well. As casein from goat milk forms a looser coagel, it was regarded easier to make a soft than a hard goat milk based white cheese. On the other side it is more demanding to distribute a soft cheese, since it is more perishable. But Tine regarded that they were relatively competent in distribution of cheese and could take on the extra challenges of handling a more perishable product.

Tine was aware that German consumers, like consumers in many other European countries, were accustomed to goat cheese with a mild taste. Tine experienced that Norwegian goat milk – also goat milk from Sunnmøre – had a tendency to get a strong taste in summer. However, contrary to Frozen Curd, Snøfrisk ("Snow Fresh") as the new cheese was named, had not to be a pure goat milk product. It was only necessary that the casein be from goat milk, in order to market the new product as a goat milk product. The component that gave the strong taste, fat, did not have to be from goat milk. This opportunity has so far been used to secure a mild taste in Snøfrisk. Instead of changing the delivered raw material, goat milk, the fat component in it is substituted with the fat component in cow milk. Fat from Norwegian cow milk has, of different reasons, not the same tendency as fat from Norwegian goat milk to get a harsh and rancid (strong) taste. Tine Ørsta already purchased cow milk for the production of other products, so this substitution was quite unproblematic.

But the raw material had to be changed in other dimensions. It was crucial that Tine was able to deliver Snøfrisk all the year round. But the customers did not accept that two deliveries in a row had the same date of production stamped on it. That is, producing extra for

the store to meet demands in the future was not an actual solution. On most Norwegian goat farms the goats give birth in February, and thus goat milk production goes on from February to November. Then the goats have to rest for 2-3 months. In co-operation with Tine, goat farmers who supplies milk to Snøfrisk has managed to shift the time of birth, so that Tine Ørsta get supplies more evenly during the year.

Another question is that in 2001 – after several years with research and development regarding taste in goat milk, mainly a result of Frozen Curd, goat milk delivered to Tine Ørsta also has got a milder taste. As a consequence, Tine plans to produce a variant of Snøfrisk that is based purely of goat milk.

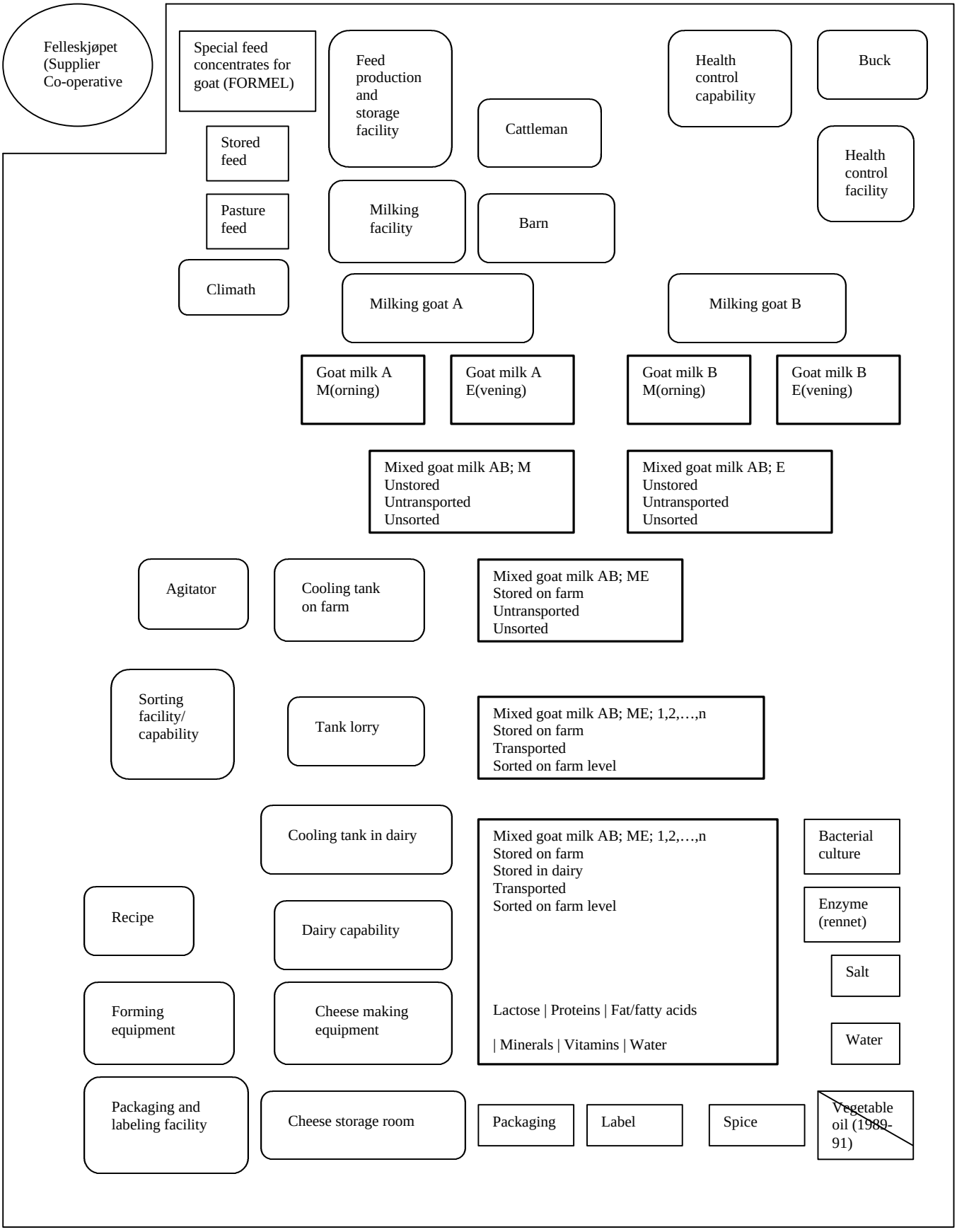
Ordinary production of Snøfrisk started in 1994, the same year as The Winter Olympic Games were arranged in Lillehammer, and Norwegian culture and products were heavily marketed abroad. Thus Snøfrisk got an extra effort when it was launched. It is produced in four variants: Natural (without admixtures), with mushrooms, juniper berries and dill. The cheese is packaged in a three cornered, white box. With this form the box has rather narrow corners, which gives associations to Norwegian mountains. It was the English marketing company that had the idea to this solution.

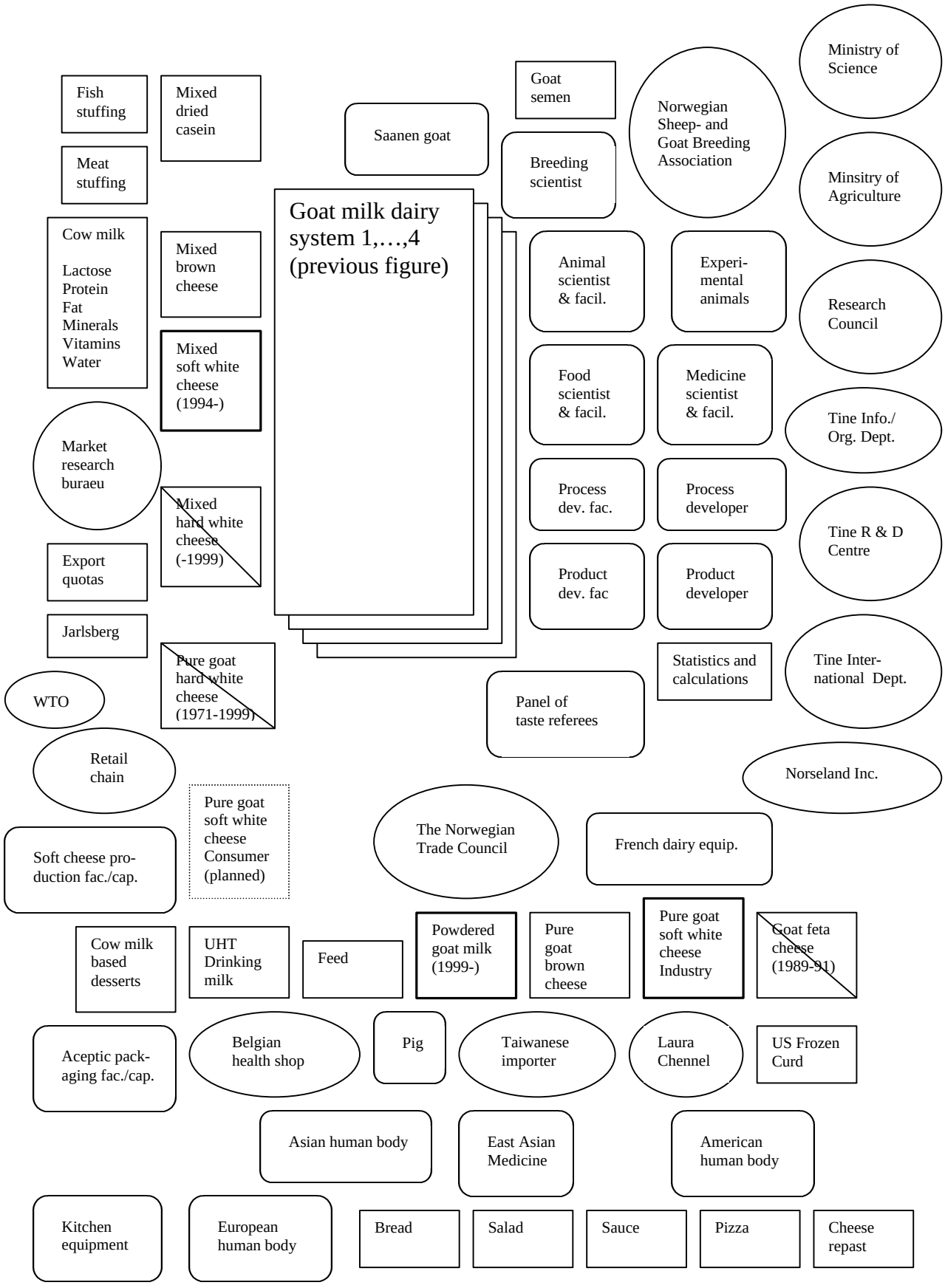
Analysis

A certain category of resources, a product, is in focus in the stories told above. The product is goat milk. From the stories, we realise that the development of any resource has to take into consideration features of the resource and how these features are or can be related to those of other resources. Furthermore, what we thought was the relevant resource in the stories changed somehow during the reading. In this case the focal resource could be divided into ‘smaller’ components. Some of them (casein) turned out to be a problem, and consequently the actors dealt with the features of a specific component of the resource, and not the resource as a whole. It turned out that in the first history one did not investigate the sources of the problem, because the marketing of a substitute of the product (milk feta) was started. In the second story the problems of the raw material are taken very seriously. An investigation is started, lasting many years and involving many actors. The investigation bears fruit. But in none of these cases does the inducement for taking up the production of new products based on goat milk come from those producing goat milk or the actor refining it. It is customers who start the development process. In the last case the initiative comes mainly from the dairy that refines goat milk, and not so much from Tine’s central staff.

In order to understand these development stories better, it can be fruitful to map the resource interfaces more systematically, and analyse them. This presupposes that we identify the relevant resources. In the figure below, most of the relevant resources in all the stories are drawn. Furthermore, resources that we consider are near each other in ‘real life’, are placed close to each other in the figure. (It should be mentioned that the figure also contains resources that are part of two case stories that are not included in this paper).

How can we make sense of the figure? For the first, none of the three development stories that we have presented uses all of the resources in the figure, only some. But the point is that in every case the relevant resource combination and the respective interfaces stretch across more firms, that is, a resource constellation. So the figure could be divided into more resource constellations.


Felleskjøpet (Supplier Co-operative
Special feed concentrates for goat (FORMEL)
Feed production and storage facility
Health control capability
Buck
Stored feed
Cattleman
Health control facility
Pasture feed
Milking facility
Barn
Climath
Milking goat A
Milking goat B
Goat milk A M(orning)
Goat milk A E(vening)
Goat milk B M(orning)
Goat milk B E(vening)
Mixed goat milk AB; M Unstored Untransported Unsorted
Mixed goat milk AB; E Unstored Untransported Unsorted
Agitator
Cooling tank on farm
Mixed goat milk AB; ME Stored on farm Untransported Unsorted
Sorting facility/ capability
Tank lorry
Mixed goat milk AB; ME; 1,2,…,n Stored on farm Transported Sorted on farm level
Cooling tank in dairy
Mixed goat milk AB; ME; 1,2,…,n Stored on farm Stored in dairy Transported Sorted on farm level
Lactose | Proteins | Fat/fatty acids
| Minerals | Vitamins | Water
Bacterial culture
Enzyme (rennet)
Salt
Water
Recipe
Dairy capability
Forming equipment
Cheese making equipment
Packaging and labeling facility
Cheese storage room
Packaging
Label
Spice
Vegetable oil (1989-91)



Legend

Product

Facility

Organisation

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