An important dimension of villa development, agricultural production, has up until this point remained underexposed in this study. This chapter will therefore attempt to elucidate this economic dimension and explore developments in production as well as the organisation of production. Once more, the settlement is taken as the main level of analysis. How does the agricultural orientation and organisation of Settlements throughout the research region develop over time, also in relation to the organisation of settlement space, building practices and changing social relationships?

Especially from the 1960s onwards, when an increasing number of settlements were excavated on a larger scale, the villa was viewed as a productional unit, functioning within the newly developing Roman market economy. Slofstra even spoke of an economic ‘villa system’, with villas producing in a specific ‘villa mode of production’. This model views the villa as a specific market-oriented farm, based on a form of dependent labour and focusing on the production of a surplus for selling it on the urban market. The thesis of a specific mode of production has played an important part in the understanding of the villa and consequently its conceptual definition. Moreover, it has often been linked to the adoption of effective methods for the increase of productivity, as rationality and efficiency are introduced in production, similar to capitalist production. As has already been emphasised in the previous chapter, the study later moved towards more consumption-oriented approaches, focusing on concepts such as material culture, globalisation and consumerism.

This chapter will once again be focused on developments in rural settlements between the later Iron Age and the late Empire. On this occasion, however, the central theme will consist of production as well as the physical and social organisation of production. Is it possible to shed light on more long-term developments as well as more radical changes in agricultural production, and how should these developments be understood within the context of the developing Roman provinces? In addition, to what degree can the villa be regarded as a productional form, imported from or influenced by Italic forms?

I will initiate these attempts by exploring a number of the significant broader economic developments that took place within the developing Roman provinces and that had a drastic effect on the countryside and its settlements. Subsequently, I will examine productional activities in rural settlements in greater detail, using both archaeobotanical and archaeozoological data. Could productional developments between the pre-Roman period and Roman period in fact be reconstructed and is it possible to distinguish more specific changes to patterns of production within individual settlements and between regions? The focus will then shift onto the analyses of the organisation of production, by looking at both individual buildings – in this case the secondary buildings – as well as the development of a functional working compound, on which part of the agricultural activities will have been carried out. The granary, used for storing crops, will be studied in particular detail, as it is suitable for reconstructing both qualitative and quantitative developments with regard to production, storage and the control over production.

503 Slofstra 1991, 161, 179.
505 Peters 1994, 41.
5.1 The wider context of economic developments in the countryside

Before zooming in on developments in production on the level of the settlement, a number of the significant broader economic developments that took place within the context of the developing Roman provinces need to be assessed. Here, I will predominantly focus on the development of regional markets, monetisation, the army as consumer, the town as consumer, infrastructural developments and increased mobility.

The development of regional markets

One of the basic economic changes within the research region involves the development of a new ‘economic infrastructure’; a market system. In such a system economic agents (individuals or groups) are connected in networks of exchange within which markets can function as central points. With the development of such a network, apart from horizontal ties, complex vertical ties also increasingly develop, as a result of which goods can pass from the countryside to towns, towns to cities, cities to seaports and from seaports into overseas markets. This way, peasants working the land can become involved in a market system with many levels of ever widening scope.

Physical markets are places where economic exchange of goods and money concentrate and where producers, consumers, middlemen, tradesmen and officials can meet to exchange and trade. In an important study on markets in the Roman Empire, Luc de Ligt has studied rural and urban markets in the western Roman provinces, mainly on the basis of toponyms and archaeological sources, as written sources on this topic are lacking. The market functions of quite a number of towns can be deducted from their names. Forum Hadriani and Ulpia Noviomagus are particularly good examples. It is highly likely that both towns in the northernmost part of the research area had regional market functions, possibly already from the earlier Roman period, while it was not until later that they started developing toward urbanised centres. Noviomagus was granted the ius nundinarum (market right) by Emperor Trajan, potentially in order to stimulate the economy. However, the many other large and small centers within the research region will also have had important market functions.

These observations underline that the development of a market system was associated with the development of a network of urban and rural centres from the earliest Roman period onwards. These centres were located at logistically ideal locations and were well-connected by good-quality roads. They seem to have served as important nodes in the economic system that developed during the Roman period, attracting produce from the surrounding countryside, both for their own inhabitants as for further distribution. Such central markets as well as a good-quality infrastructural system are essential for the development of a more complex economic system.

Monetisation and the character of exchange

Intimately related to the development of a new economic infrastructure is the development of new practices of exchange, of which the process of monetisation is an important aspect. This process concerns the development of the use of coins for impersonal exchange. This is not to say, however, that coins could not have been used in other spheres, such as the ritual and religious one. Coins as such are not a Roman-period introduction; they are known and widely used in Late Iron Age societies within the research region as well. However, what becomes apparent is a shift in the use of money highly embedded in social relationships that were personal of character towards the increasing use of money in commodity exchange and market situations, mainly involving impersonal exchanges. In this situation, money as coins has its true economic meaning as portable and standardised means of exchange and payment. This shift in the use of coins is clearly linked to broader changes in production. Traditional communities were mainly self-sufficient and exchange was personal and highly embedded in

506 On markets in peasant societies see Wolf 1966, 40 ff.
507 Wolf 1966, 42.
508 De Ligt 1993, 117.
509 For a discussion on coins and monetisation, see Aarts 2005.
510 Scheidel 2005.
small-scale social structures. The significant changes in the economic reality of the developing provinces with taxation system, large-scale military presence, developing urban centres and markets eventually led to the integration of rural settlements in much wider spheres of exchange, reaching far beyond the local community and existing social and personal relationships. Viewed in this light, it becomes possible to understand the increasing use of money as an economic means of exchange. Once again, however, parallel to this kind of monetised exchange, more socially embedded modes of exchange continued to exist.

Similar patterns are recognised in an anthropological model of exchange created by Bloch and Parry, who defined a short-term and a more long-term sphere of exchange. The short-term sphere relates back to exchange in the domain of the individual, where social relations play a limited part, and where acquisition is paramount. This form of exchange occurs mostly between independent actors and strangers. Conversely, the long-term sphere of exchange is about reproduction of the social and cosmic order. This is the domain of social structure that surpasses the individual. Aarts argues that this model could be used for explaining change in the Roman provinces. He does so by thinking in terms of shifting patterns in the ways these two spheres interacted with one another, rather than the progression from one mode of exchange to another, as is the case in the economic-historic model. As has previously been argued, the short-term sphere of exchange will have gained particular importance during the first centuries AD. It was suggested in the previous chapter that this could also have had a significant effect on the relationships within local communities. The interdependence of members of local communities weakened, as they began participating in commercial cash-based economies, increasing the importance of wealth for the individual at the cost of producing for the continuity of the local community.

Regarding the northern regions, Roymans argues that one of the important stimuli for monetisation and the commercialisation of exchange was actually the Roman army, by means of the commercial transactions made by native groups and payments to local auxiliary troops. This caused a fundamental change in the significance of cattle, as the emphasis came to lie entirely on their subsistence value. Traditional economy, with its traditional values, initially seems to have been predominantly transformed by outsiders from Italy or southern Gaul, as they were not embedded in local values of exchange and were prepared to purchase and supply goods at markets in exchange for cash. In doing so they broke the traditional barriers between the exchange of different categories of objects in the native world, and thus changed patterns of short-term and long-term exchange.

The army as a consumer

As has already been pointed out, an important aspect of the rapidly changing economic circumstances was the large-scale presence of the Roman army in the research region, especially in the northernmost parts, where the heavily manned limes developed as a stable frontier from around the middle of the 1st century AD. Already from the earliest Roman period, however, the army will have required the supply of considerable amounts of among other things grain, hides, textiles or wool, wine and pottery for its soldiers. Focusing on grain, the southern loess regions were probably the most important wheat suppliers. The fact that this wheat was actually transported to the Rhine limes is illustrated by the well-preserved ship of Woerden (Woerden ship 1; fig. 5.1), containing part of an original stock of grain. Weeds, found among the grains point at the loess region as the source of this shipload. In all probability, the ship navigated on the Rhine from the direction of Mainz and Cologne or via the Maas for supplying the castella along the limes.

511 Aarts 2005; Bloch/Parry 1989.
512 Aarts 2005, 13.
515 Roymans 1996, 60.
516 For a discussion on the economic impact of the army, see Roymans 1996; Groot et al. 2009; Stallibrass/Thomas 2008.
Fig. 5.1 The Woerden grainship during its excavation in 1978. Although the ship was not completely excavated, it could be established that it had contained a load of grain. After Haalebos 1997, 76.

Another source, shedding some light on the supply of the army with grain are the votive stones mentioning negotiatores frumentarii (grain traders) and nautae (shipmen). A frumentarius was a grain trader who could be either in service of the army or of a private entrepreneur. Carreras Monfort argues that frumentarii were used especially when supplies were extracted from faraway regions. An altar stone from Nijmegen (fig 5.2) mentions a negotiator frumentarius from the civitas of the Nervii, situated in the fertile loess region around Bavay. This frumentarius was likely to have been involved with supplying army camps with grain. Another inscription mentions the nautae from the civitas of the Tungri, of which Tongres was the capital. Possibly, these shipmen also played a role in supplying the army companies with foods from the fertile soils in their region of origins.

Fig. 5.2 Two votive altars. The altar on the left is from Nijmegen, the right one from Vechten. After Willems 1990, 68 and Hessing et al. 1997, 66.

519 Carreras Monfort 2002, 776.
Taking into account that the army was as a substantial consumer, can this need for grain be quantified? A first calculation concerns the average quantity of required grain per soldier per day. Anderson estimates this quantity at between 0.9 and 1.36 kg on a daily basis.\footnote{Anderson 1992, 99.} Estimations based on ancient written sources result in essentially the same quantities. Anderson prefers the use of the lower limit of 0.9 kg per day, as the army companies concerned are stationary, in contrast to expedition companies that would have had a greater need for food. Calculating from 0.9 kg, an auxiliary fort, as found along the Lower Rhine \textit{limes}, would have required a total quantity of grain of around 432 kg per day or 157.7 ton per year. Calculated for the Dutch river area, and presuming twenty auxiliary camps and one legionary camp, a total supply of 14 ton per day or 5124.6 ton per year was required. With regard to the entire Lower Rhine area, Roymans employs the figure of 42000 army men at the time of Tiberius and a grain quota per soldier per year of between 200 and 496.4 kilograms.\footnote{Roymans 1996, 59.} This results in the demand for between 8400 and 21000 tons of grain annually.

It remains important to realise that the above calculation present only a general indication of the military need for grain. In fact, if we were to include the demand for the feeding of livestock -chiefly consisting of horses- and the demand of the civilian people living in or just outside the camps, such as the direct family and perhaps even slaves, we would be dealing with considerably larger numbers. Furthermore, military personnel stationed at smaller posts or travelling around has not been included in these calculations.

Linking these findings to logistical needs, presuming a calculated capacity of between 50 and 70 tons for a ship like that of Woerden,\footnote{Mees/Pferdehirt 2002, 34.} between 73 and 102 ships with complete loads of grain will have been needed each year in order to supply the army in the Dutch part of the \textit{limes}. For the entire Lower Rhine \textit{limes}, a significantly larger quantity of grain and ships would have been required.

\textit{The town as a consumer}

Aside from the army, the growing numbers of non-agrarian civilians living in urban centres also formed a large consumer market. Unfortunately, it is more difficult to obtain insight into the ways in which towns were being supplied. An important part of this supply seems to have been dominated by an urban elite that at least partly consisted of large landowners from the surrounding countryside, controlling production by means of tenancy relationships and/or a directly dependent labour force.\footnote{De Ligt 1993, 211-212.} Furthermore, wealthy grain traders could sometimes play a role in urban supply. However, Roman law tried to oppose the accumulation of large stocks by large landowners and traders.\footnote{De Ligt 1993, 212.} The role of small farmers should not be underestimated either. Literary sources suggest that urban supply could be severely disrupted if these people stayed away from the market for some reason.\footnote{De Ligt 1993, 212.} As these sources originate from the eastern Roman Empire, it is however difficult to assess whether this situation also applied to the research region relevant to this study. Probably, large landowners focused chiefly on large-scale grain production, while smaller farmers supplied towns with products such as eggs, milk and wool.

\textit{The introduction of a system of taxation}

A formal system of direct taxation was introduced in the research region under the reign of Augustus. According to Hopkins, this system stimulated the development of complex interprovincial networks of trade and encouraged agrarian production, resulting in commercialisation and monetisation of various sectors of the native economies. This particularly applied to those controlled by native elites via traditional mechanisms for the centralisation of an agrarian surplus. Hopkins consequently argues that taxation was the key mechanism boosting a market-oriented agrarian production.\footnote{See Roymans 1996; Hopkins 1980.}
Roymans, however, emphasises that Hopkins underestimates the free selling of agrarian surplus at urban and military markets for money. He states that it is this free selling that seems to have formed the financial basis of urban and rural building activities. Furthermore, Roymans argues that in a number of regions, especially the northern ones, taxation took the form of the supply of auxiliary troops. Other regions probably also supplied soldiers, supplemented by grain or pastoral products, dependent on the regional economic orientation. The tribes in the southwest part of Gallia Belgica were primarily taxed in wheat. In conclusion it could be stated that the general impact of the 1st century AD Roman taxation system on the native agrarian economies was not that it generated new regional patterns, but that it strengthened already existing regional differentiations.

5.2 Market orientation and developments in agrarian production

Having explored a number of broader economic developments, I will now focus on agricultural production at the level of the rural settlement. Again, the reconstruction and understanding of development and change are taken as a central objective, while a more long-term approach is once more chosen. In the below, developments in crop and animal spectra will be discussed, exploring both general development trends and more radical transformations. Can general processes of specialisation, intensification, the introduction of new crops and breeds be recognised? Is it possible to elucidate the economic development trajectories of individual settlements?

5.2.1 Regional developments in arable farming and animal husbandry

To a larger extent than architecture, agricultural practice is intimately related to the direct environment of the rural settlement. As a result, one should be cautious to generalise within the extensive and geographically highly diverse research region. For the sake of clarity, however, in the below a general geographical division is maintained between the northern sand and clay soils (covering the Dutch region and Flanders) and the more southerly loess soils.

With regard to pre-Roman agricultural practice, a general picture can be created. On the northern sand and clay soils the crop spectrum was dominated by barley, emmer wheat, oats and millet. Traces of spelt wheat, linseed and gold-of-pleasure could also be documented here, but these seem to have been marginal crops. On the loess soils, emmer wheat and hulled barley dominated, followed by spelt wheat and millet, resulting in a picture relatively similar to the sand and clay regions. Bread wheat was known in this period, but did not develop towards a major crop until the Roman period.

As early as the Late Iron Age, some significant developments with regard to agriculture and the crop spectrum can be pinpointed, including the increase in the number of crops and the growing importance of spelt wheat. Regarding the German Rhineland, a clear increase in agricultural activity can be reconstructed from around 300 BC. The high percentage of narrowleaf plantain in the diagram is an indication for land that has been ploughed frequently. And on the basis of pollen diagrams, changing patterns of land use could be documented. The forest coverage had clearly declined in comparison to earlier periods. Regarding the Late Iron Age, we can reconstruct an almost entirely deforested, open landscape with intensive agriculture and scattered remainders of oak forest. Looking at the crop spectrum, we find that at the settlements of Hambach 382 and Eschweiler-Laurenzberg, dated to the 1st century BC, barley and emmer wheat were still the dominant crops, while millet had lost its importance. Spelt wheat and naked barley were also grown, but were marginal within the spectrum.
Entering into the Roman period, both continuities and significant changes can be documented with regard to arable farming. In the northern sandy regions, change seems little significant. At the settlement of Oss-Westerveld barley, emmer wheat, spelt wheat and millet were grown, as well as flax and turnip.537 At Wijk bij Duurstede and Tiel in the Dutch River area, hulled barley and emmer wheat remained to be the most important crops throughout the Roman period, while at Houten-Tiellandt, threshing waste, dated to the 1st century AD, consisted of a mixture of oats, barley and wheat.538 Van Beurden states that, with regard to arable farming in the MDS-region, a continuous line can be reconstructed. Barley generally remained the dominant crop, and, on the basis of botanical studies, no agricultural intensification was documented.539 A similar conclusion can be drawn for the Menapian region in sandy Flanders. At Bruges-Refuge the crop spectrum has characteristics clearly comparable with the pre-Roman spectrum: emmer wheat, spelt wheat, millet and oats were grown here.540 For this region in general, it could be stated that no indications exist to suggest that arable farming was aimed at the production of a considerable surplus.541

On the loess soils, the story is somewhat different. At Pulheim-Brauweller, during the Early Roman period, spelt wheat had already taken important position within the crop spectrum.542 During this early period, however, crops such as millet and gold-of-pleasure, characteristic to the pre-Roman period, also continued to be part of the spectrum. During the following period, though, their proportions declined significantly. The still dominant position of barley in combination with the small numbers of emmer wheat, millet and gold-of-pleasure indicate a transitional situation, characterised by a crop spectrum that had Late Iron Age characteristics but also showed clear indications for change. This latter observation implies that agricultural developments constituted a gradual rather than radical transformation. In general, spelt wheat was increasingly focussed on during the Roman period, as it was an efficient crop to produce in mass. As the newly introduced grain species were more efficient, millet, oats and rye disappeared.543 This boasts clear signs of the specialisation and intensification of production, especially from the second half of the 1st century AD onwards. This observation is underlined by the Cerealia curve peaking between 50 and 220 AD.544

One of the settlements at which such processes of intensification and specialisation can be reconstructed is that of Voerendaal-Ten Hove. While during the second half of the 1st century AD wheat had already developed to be the predominant crop, further specialisation on spelt wheat can be documented for the 2nd century.545 Regarding this latter period, the presence of a large threshing floor, the construction of a large horreum and clear signs of soil erosion also indicated the intensification of arable farming. Similar specialisation on spelt wheat can also be documented for the settlement of Kerkrade-Holzkuil, not far from Voerendaal.

Still, there are also indications that we should not overestimate the changes in the crop spectrum, especially during the 1st century AD. In Early Roman Tongres, no clear indications exist to suggest change in the Iron Age crop spectrum. Moreover, the same applies to the Aisne valley.546 And in the more southerly Saar-Mosel region, only little new land was taken into agricultural production, suggesting only little significant changes to the crop spectrum and the character of production.547

Aside from arable farming, livestock farming also formed an essential element of the rural economy. I will now explore archaeological data to discuss the character and relative importance of animal husbandry through time and throughout the research region. Unfortunately, sand as well as loess soils - and thus the majority of the research region - are generally unsuitable for the good conservation of bone material, limiting the extent and usability of the dataset.

Both in pre-Roman and Roman period, the most important members of the animal spectrum were cattle, pigs, sheep or goats, horses and dogs. Chickens, donkeys and cats seem to have been introduced during the Roman period. As was the case with arable farming, however, a considerable amount of differentiation existed throughout the research region.

537 Wesselingh 2000, 71-169.
539 Van Beurden 2002, 305.
541 De Clercq/Van Dierendonck 2008, 12.
543 Eck 2004, 427 ff.
544 Bunnik 1995, 337.
547 Wiethold 2000.
During the pre-Roman period, the cattle element was especially dominant in the northern regions. Sheep, goats and pigs had subordinate positions within the animal spectrum here. The predominance of livestock farming within these northern economies is clearly illustrated by the occurrence of byre houses, at which people and animals -being an essential part of their economic basis of subsistence- were living under one and the same roof. In the southerly loess regions, the pattern may have been somewhat different. At the Late Iron Age settlement at Haccourt, sheep predominated, while pigs came second and cattle only took a third place in the spectrum. The significant position of sheep within the spectrum was also suggested with regard to pre-Roman settlements in the French region.

Regarding the Roman period, some developments with regard to livestock farming can be reconstructed. A few of the best archaeozoologically studied settlements are those in the northernmost part of the research region: Tiel, Wijk bij Duurstede, Houten and Geldermalsen. In the clay soils on which these settlements were situated, bone is especially well preserved. During the first half of the 1st century AD, the animal spectrum at Wijk bij Duurstede predominantly consisted of cattle, small percentages of sheep or goats, horses and pigs. From the second half of that century onwards, however, the percentage of horses increased dramatically (up to a third of the animal spectrum), probably indicating specialisation horse breeding. Such specialisation can be associated with the Roman army, which would have required over a thousand replacing horses every year (calculated for the military in Germania Inferior). At Tiel, specialised production could also be recognised, in this case on sheep for wool, dated to the 1st century and first half of the 2nd century AD. Sheep seem to have been held already during pre-Roman times. Probably as a result of the military demand for wool, the settlement specialised in sheep breeding for wool production. After around 150 AD, however, the decline of sheep and the increasing number of horse bones seems to indicate a shift in economic orientation from wool production to horse breeding. Both Wijk bij Duurstede and Tiel could also have produced surplus cattle, although Groot emphasises that no specialised production of beef was needed to meet the demand.

Compared to these northern regions, animal husbandry seems to have had a lower degree of importance in the loess regions. Eck, studying the Cologne hinterland, even stated that animal husbandry did not reach beyond subsistence. In pollen diagrams, relatively little indications are found for the presence of open grassland or meadows. Nevertheless, a number of changes to the animal spectrum can be noted. As early as during the early 1st century AD, cattle became more prominent in the animal spectrum. In the Cologne region, cattle were responsible for up to 90% of meat supply. In another study, King presents figures regarding Gallia Belgica and Germania Inferior, placing the relative importance of cattle on 65% and 60% or more respectively. Furthermore, this development is also visible at a number of individual settlements. At Broekom, comparing the Late Iron Age with the Flavian period, a clear increase in cattle and a decrease in sheep or goats could be documented. And in the more southerly Rhine-Danube region, the importance of cattle also increases during the Roman period. Peters links this increase to the military’s increased need for meat, milk and cowhides. A somewhat different picture emerges from one of the earliest archaeozoologically researched villa settlements, Cologne-Müngersdorf. According to Fremersdorf, pigs and sheep were especially important here. The interpretation of secondary buildings as separate byres for cattle, sheep, pigs and horses underlines the supposed importance of animal husbandry within this settlement. The interpretation of both the archaeozoological data and the buildings should nevertheless at least be critically reassessed.

548 Lauwerier 1988; Laarman 1996. Roymans mentions a relative figure of between 50% and 90% for cattle within the animal spectrum (Roymans 1996, 51).
549 Even clearer specialisation on animal husbandry can be found in the Dutch peat areas. In the other cases, settlement had mixed economies, combining agriculture and animal husbandry. (Van Wijngaarden-Bakker/Brinkkemper 2005, 507 ff.). For a discussion on the importance of livestock and cattle in particular, see Roymans 1996.
551 Malrain/Matterne/Ménier 2002, 112.
554 Groot 2007, 190.
555 Groot 2007, 91.
556 Eck 2004, 431.
557 Becker 2007, 137.
558 King 2001.
559 Vanvinckenroye 1988, 37-42.
561 Fremersdorf 1933, 122 ff.
Horses did generally not constitute a frequently documented species in the settlements of the loess region. Eck argues, however, that horses could have been bred in larger numbers in the Eifel region. 562 Furthermore, the position of pigs within the animal spectrum remains stable, although they were slaughtered at a younger age, which may indicate that they were increasingly being held for meat. It is remarkable that at Voerendaal, Maasbracht, Kerkrade and Broekom the proportion of pig exceeded that of sheep and goats (although cattle always remains dominant). 563 Perhaps this could be related to changing food tastes, as pork is the meat of choice in the Roman world. High percentages of pork were also associated with rich houses in the urban centre of Tongres. 564 With regard to the importance of sheep, it is interesting that these seem to have been the dominant species in the most southerly part of the research region. Probably, this situation can be explained in the light of the important textile industry that characterised the region. 565

Detailed bone studies also demonstrate that animals themselves changed over time. While indigenous cattle had a height of around 100-115 cm, from the Early Roman period onwards, cattle up to a height of 140 cm were found. 566 Over the 1st century AD, the number of larger cattle increased considerably and, by the 2nd century, larger species had almost completely replaced their smaller counterparts. 567 In the Lower Rhine region, however, this process was somewhat less far-reaching with the percentage of larger species not exceeding 50%. 568 The fact that not only cattle, but also sheep, goats and pigs increased in size during the Roman period has been demonstrated with regards to northern France by Lepetz. 569

5.2.2 Economic development trajectories of individual settlements

With regard to a number of settlements, it is possible to reconstruct specific economic development trajectories. The settlements situated at Tiel-Passewaaij and Wijk bij Duurstede-De Horden have already been mentioned. The former specialised in sheep breeding for wool production during the 1st and first half of the 2nd century AD, subsequently shifting its focus towards horse breeding. The settlement at Wijk bij Duurstede focused on horse breeding from as early as the 1st century AD onwards. Economic reorientation could also be suggested with regard to the settlement of Hambach 512. During the earliest settlement phase, the presence of two or three byres, probably byre houses combining residential with byre functions, indicated an important role of livestock farming. In the second settlement phase, however, the number of byres decreased and the size of the granary increased, indicating a reorientation from stock farming to arable farming, according to the author. At the same time, the settlement compound became smaller, as fewer animals were held. 570

At Voerendaal-Ten Hove an all-round style of farming existed before the end of the 1st century AD. 571 From the early 2nd century onwards, however, and increasing emphasis on arable farming becomes apparent, especially focusing on the growing of spelt wheat. Apart from this specialisation, intensification is indicated by the increased erosion, the construction of a large horreum and a threshing floor.

Concerning the settlement of Champion-Le Emptinne, a focus on the production of beef (cattle breeding) was reconstructed for the period up until the second half of the 2nd century. From the late 2nd century onwards, however, this emphasis seems to have shifted towards sheep breeding and consequently towards wool production. 572 Unfortunately, little is known about arable farming for this settlement, so the relative importance of stock farming remains unclear. The relatively large number of byre houses could however be indicative. In this light it is interesting that similar types of house were also found in a number of villa settlements near Champion: Hamois-Le Hody and Vezin. Did stock farming also play a relatively important role in these settlements? If so, this relative importance of stock farming could possibly have been characteristic of the Condroz region in which these settlements were situated. Compared to the loess plains, the stronger relief and less fertile soils would have favoured a more mixed production, increasing the importance of stock farming at the cost of arable farming.

562 In this context, he discusses a veterinarian from Blankenheim (Eck 2004, 430).
565 See Agache 1978, 358-359.
567 See Hegewisch (2007, 138-139) for an oversight of this process in the German Rhineland; Eck 2004, 427 ff.
568 Becker 2007,133-143.
569 Lepetz 1996.
571 Koosstra 1996, 182.
5.2.3 Quantifying production: estimates of surplus size

After having identified developments on a qualitative level, is it possible to quantify changes in production and shed some light on the potential production of surpluses? Laura Kooistra has constructed quantitative models for production with regard to a number of villa settlements in the Dutch and German loess region. Examining the size of byres and granaries, she concluded that byres in German villa settlements could hold an average of 24 pieces of cattle. In addition, granaries (with an average surface of 56 m2) could store 15400 kilos of spelt wheat, 12208 kilos of emmer wheat or 17472 kilos of barley (produced on 50 hectares of land). This capacity exceeded the settlements’ own need over five times. The 36 m2 granary at the axially organised settlement of Champion has been calculated to have had capacity of 10 tons. With regard to the villas in the Dutch loess region, Kooistra states that the seven villa settlements in the Heerlen valley had the productional capacity to feed between 700 and 2800 people.

From another perspective, the yield ratio of the land is an important factor: how much sowing yields how much grain? Kooistra presents an example of Canadian pioneers who used 200 kilos of grain for sowing 1 hectare of land, yielding 1000 kilos of grain, resulting in a yield ratio of 5. Eck states that, dependant on the quality of the soil, the yield ratio could be between 4 and 15. This figure implies a yield of between 0.4 and 3.6 tons of grains per hectare. The annual production potential of the Cologne territory, with a land surface of around 400000 hectare, around half of which will probably not have been used for grain production, will consequently have constituted between 80000 and 720000 tons of grain. Considering the demand side of things, employing figures of 1 kilogram of grain per person per day and a number of 150000 people for the Cologne territory, including the army, it becomes clear that the production will certainly have exceeded the regional subsistence level considerably. Despite the uncertainties associated with such calculations, we may conclude that this region may very well have been able to produce considerable surpluses for export. The fact that grain production actually took place on a large scale is underlined by the already mentioned Cerealia curve, peaking between 50 and 220 AD; precisely the blossoming period of the colonia at Cologne.

5.3 Exploring the spatial-architectural and social dimensions of production

After having focused on rural production as such, the theme of production within the context of the settlement will subsequently be studied. This section will attempt to shed light on the organisation of production, both on a spatial-architectural and on a social level. Here, the category of secondary buildings, which has up until this point remained relatively underexposed, will be a focus of study. Besides the houses explored in the previous, these buildings formed integral and essential parts of rural settlements. In order to obtain better insight into the functioning of rural settlements, it is consequently essential to explore this category as well.

First of all, we will attempt to shed some light on this elusive category of secondary buildings with economic functions, as well as on the development of an ‘economic compound’. Secondly, the specific group of storage buildings generally referred to as granaries or horrea will be discussed. Contrary to the general category of secondary buildings, these storage buildings are relatively well recognisable and able to elucidate both developments in production and the organisation of production. In this section, again, the development perspective is taken as a central approach. How are new production strategies, new objectives and techniques developed and integrated within the settlement by developing new structures of production (involving both the reorganisation of settlement space and the creation of new buildings)?

576 Eck 2004, 428.
577 Bunnik 1995, 337.
5.3.1 Secondary buildings and the economic compound

Within villa studies, the creation of a simple dichotomy between the main house and the secondary buildings is common practice. These secondary buildings are assumed to have been important elements in the rural settlements as an agricultural unit. As has already been established in the third chapter, however, interpretational problems are paramount, rendering the reconstruction of the purposes of individual buildings and settlements as a whole a difficult task. In many cases, buildings that could (hypothetically) be interpreted as houses are also included in the broad category of secondary buildings. It seems likely that some buildings will have had both residential and productional functions. Here, we will focus on secondary buildings with productional purposes.

Rural settlements were locations of production. Lands were worked, sown and harvested outside the settlement compound, while the processing and storing of crops was predominantly situated within the compound. Animals could be held in byres, kept loose on the compound or herded out in the fields or on the fallow lands. It is likely that milk, meat and dung were processed on the compound as well. Furthermore, artisan production, such as the production and reparation of tools, also took place within the settlement. Is it possible to identify these activities within settlements as reflected in the structure of an ‘economic compound’? In addition, how did this economic compound develop in relation to the developments previously reconstructed?

During the later Iron Age and earliest Roman period, generally, settlements seem to have been organised on the level of the individual farmstead in particular. These farmsteads consisted of a house and a number of secondary constructions. As has already been mentioned a number of times, byres in the northern regions tended to be integrated into the house. Often, outside the house, quite a number of small four- or six-post constructions could also be found. These are generally referred to as granaries (spiekers (Dutch) or speichers (German)), and assumed to have been used for the storage of crops. It is nevertheless possible that morphologically similar structures could have served a variety of purposes. They might in fact even have been multifunctional. The somewhat larger post-built constructions are even more problematic with regard to their interpretation. For example, should two buildings at Frimmersdorf 129, displaying floor surfaces of 24 and 35 m2 respectively (see fig 5.3), be interpreted as byres, sheds, large granaries or even simple residences? Pion has argued that the only credible functional division with regard to such buildings is that between small constructions consisting of between 4 and 9 posts, and the larger constructions with more posts and considerably more varied plans.

Regarding the pre- and Early Roman period, buildings with economic functions thus were simple, small and probably at least partly multi-functional. Throughout the research region crops were stored in small granaries situated in proximity of each house. Economic practice thus seems to have been small-scale, predominantly based on the level of the individual farmstead and the individual family. Each family seems to have kept livestock and grown and harvested crops that they stored in their own small storage constructions.

From the 1st century AD onwards, however, both the organisation of settlement space and house building changed considerably. In the previous chapter, these developments were linked to significant changes in the social relationships between people within the household, local community and broader society. Now focusing on production and secondary buildings, how did both these buildings and the ‘economic compound’ develop over time?

The excavation of secondary buildings within villa settlements is a relatively recent phenomenon. An exception regards the excavation at Cologne-Münnersdorf, where a complete settlement compound was uncovered already in the 1920s. Other, highly monumental complexes, such as that at Anthée and Blankenheim had also been integrally excavated, but economic interpretations were lacking here.
functional interpretations are made altogether. Here, I would like to present a short overview of the variety of secondary buildings and their possible functions. This by no means serves as an exhaustive overview. Its key goal is to gain some insight into the general developments with regard to secondary buildings.

Fig. 5.3 A selection of secondary buildings from rural settlement throughout the research region. The wooden buildings in the top row can be dated to the 1st century AD. The others can be dated to the 2nd century AD.

A useful overview of secondary buildings (‘Wirtschaftsgebäude’) between Rhine and Meuse was created by Heimberg. Although the author aimed to focus on buildings with economic functions, a number of secondary houses with at least partially domestic functions were also included (such as those at Hambach 512). Within the typological overview, a distinction is made between wood-built constructions, wood-built constructions with partly stone foundations, stone-built constructions and granaries. Within the category of wood-built constructions, small 4, 6 and 9-post structures and a category of larger rectangular buildings, partly with internal posts (often around 20 m in length or even beyond), were included. More likely in some cases than in others, this latter category could be interpreted as (byre) houses. Belonging to another category, the plans of buildings with partial stone foundations could generally not be reconstructed in detail. Heimberg suggests a function as byre for such buildings. Alternatively, in a number of cases, it could be argued that the sections on stone foundations may be reconstructed as residences and the post-built sections as byres, but this remains highly hypothetical. The secondary buildings on stone foundations were generally rectangular or squarish, while their degree of internal segregation varied substantially. One special category is that of long-rectangular buildings (around

20 m or even larger) on stone foundations that had buttresses protruding from it.\textsuperscript{584} The precise location of these buttresses varies between exclusively on the inside of the wall, exclusively on the outside and on both the in- and outside. It remains unclear, however, whether this phenomenon could be associated with the building’s function. Although for many of these buildings, a storage function has been suggested, other functions were documented as well. At Voerendaal, a rectangular building with buttresses was associated with iron working and in some other cases byre functions have been suggested. Furthermore, buttresses can also be found in houses, such as at Cologne-Braunsfeld, Jüchen-Neuholz, Hambach 23 and Rijswijk-De Bult. And when a development trajectory could be reconstructed, it appears that buttresses were situated at the spots where supporting posts stood when the building was still constructed with posts set in postholes (see fig. 5.4). It thus seems that these buildings in fact represented a translation of a traditional type of building into a new technique.\textsuperscript{585} The opposing pairs of supporting posts were no longer set in postholes; instead they were set on stone buttresses, connected by a low foundations wall. Viewed from this perspective, the use of buttresses seems a more general building technique, applied in a range of buildings with probably different functions rather than being related to a specific building function.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{fig5.4.png}
\caption{Fig. 5.4 Two phases of one of the secondary buildings at Champion-Le Emptinne. The building on stone foundations is a literal translation of the wooden construction, whereby the exact dimensions were preserved. Contrary to the two-aisled post-built construction, the building on stone foundations is single-aisled.}
\end{figure}

Another, rather varied category of buildings is interpreted as byres by their excavators. Relatively comparable buildings were found at Voerendaal (building A) and Wesseling (building 3; see fig. 5.3), characterised by a long narrow space fronting a larger rectangular room. Also quite similar is the building at Kerkrade-Spekholzerheide, for which no function was reconstructed. For two other, consecutive buildings from Voerendaal (buildings C-I (1\textsuperscript{st} century) and C (2\textsuperscript{nd} century); see fig. 5.3) a byre function was suggested as well. With the rebuilding of the post-built construction, the dimensions were preserved in the stone foundations with buttresses (quite parallel to what was documented for one of the buildings at Champion-Le Emptinne; see fig. 5.4). Two different, remarkably long, rectangular and narrow buildings, documented at Cologne-Müngersdorf and Hamois-Le Hody, have been identified as sheep byres. Possibly, the comparable building at Lez-Roux-Les Fosses could also be interpreted as such.

Although typological studies like that of Heimberg are useful, they ignore the factor of time and the theme of development. Reconstructing the development of secondary buildings may shed more light on the variety of secondary buildings as well as the developments in production and the organisation of production. Unfortunately, compared to the houses explored in the third chapter, less detailed data on developments are available with regard to these secondary buildings. Still, in a number of cases we can shed some light on their development.

\textsuperscript{584} In fig. 5.3 examples from Hambach 132 and Voerendaal are presented, but similar buildings were also documented at quite a number of sties, among which Hambach 133, Selin, Cologne-Müngersdorf, Kerkrade-Holzküll, Saint-Gerard-Try Hailot, Nivelles, Jüchen-Neuholz and Champion-Le Emptinne.

\textsuperscript{585} See also the developments of the house at Rijswijk-De Bult (see paragraph 3.3.1) and the building at Bocholtz (Hiddink/De Boer 2003).
In the two well-excavated settlements of Jüchen-Neuholz and Pulheim-Brauweiler, small four- and six-post constructions functioned as secondary buildings with economic functions during the pre- and Early Roman period. When an enclosed compound was created at Jüchen, around the middle of the 1st century AD, these types of secondary constructions were still being built. Then, when in the second half of the 1st century, two larger rectangular buildings were constructed, it remains unclear whether one of these can be interpreted as a secondary building with economic functions or that we should regard both as multi-functional or domestic constructions. In the larger 2nd century compound settlement, apart from the main house, two larger rectangular buildings are constructed, one of the well-known type with stone foundations and buttresses, the other post-built. For the latter a function as shed is suggested. At Pulheim, at least two larger secondary buildings were constructed when the settlement was reorganised as a compound settlement in the early 2nd century. One of these buildings could possibly be interpreted as a shed or garage for a cart. For some settlements, it could be established that the development of post-built secondary buildings into constructions on stone foundations took place in a phase after the initial monumentalisation of the main house. At Voerendaal-Ten Hove, for example, the main house was built in stone around the middle of the 1st century AD, while the secondary buildings were rebuilt with stone foundations during the large-scale reorganisation of the complex in the early 2nd century. And at Kerkrade-Holzkuil, it was not until the late 2nd or early 3rd century that the secondary buildings were rebuilt on stone foundations.

Examining the dataset, a considerable variation regarding the secondary buildings of rural settlements becomes apparent. The secondary buildings of some settlements developed into relatively complex and monumental structures, while those of others remained fairly basic and traditional. This variation can potentially be related to the degree of specialisation and intensification of production of these settlements. While at Champion-Le Emptinne, Hamois-Le Hody and many smaller German compound settlements the secondary buildings remained simple, at settlements such as Voerendaal and Blankenheim they were rebuilt as more complex and new types of buildings on stone foundations.

Apart from this variation, however, a general trend towards the differentiation and specialisation in activities stands out. The variety in secondary buildings increased significantly and activities that probably were carried out in or around the house in earlier times, now were housed in special buildings. Animals that were kept outside during earlier periods were now more often held in byres it seems. And if the interpretation is correct, specialised byres for cattle, horse, pig and sheep were built. At Tiel-Passewaaij and Wijk bij Duurstede-De Horden, a number of buildings that represented new types, were interpreted as horse byres. And at Hoogeloon, a wooden corral for keeping cattle or horses could probably be associated with the monumental house. These developments can probably be related to the breeding of animals for the market in more coordinated and specialised ways. Furthermore, some other constructions can probably be associated with the storage of the increased number of agricultural tools and even carts.

Another point concerns centralisation. Organised compound settlements seem to have constituted coherent economic units. Production was organised at the level of the compound that potentially contained several houses and secondary buildings. The large storage buildings and specialised byres found in these settlements did not connect to separate farms but were part of a single economic compound, controlled by the dominant family living in the often monumental residence. In the northern regions, the situation tended to be somewhat different. Generally, production still does seem to have been organised on the level of the farmstead here. In fact, no real coherent compound settlements developed within this particular area.

5.3.2 Developments in storage facilities as indicator for economic change

One category of secondary buildings that offers particularly good possibilities for study is that of storage constructions. These can be quite directly linked to arable production, as they contained the harvested crops. This section will focus on these buildings and their development and position within rural settlements in particular.

586 Andrikopoulou-Strack et al. 1999, 156.
587 Andrikopoulou-Strack et al. 2000, 431-432.
588 A number of simple post-built granaries and a 10 meter long two-aisled building interpreted as a shed (building 5; see Tichelman 2005, 114-6).
Especially grain needs to be stored in dry, airy and cool (under 15 degrees celcius) places, clear of any vermin. As has already been described, traditional granaries tended to be the small four- or six-post constructions, reconstructed by archaeologists as supporting a raised platform with walls and roof, found in almost all pre- and early Roman rural settlements. The often relatively large number of granaries documented near farms indicates that it is likely that they were rebuilt on a frequent basis.

Besides the already explored developments in settlement organisation and house building, it becomes apparent that storage constructions were often subject to considerable change as well. This may be associated with changing production strategies, changing storage practices and evolving socio-economic relationships within the settlements. Figures 5.5 a and b present a selection of storage constructions within the research region. Regarding a number of sites, it was possible to reconstruct a development trajectory. In general, pre-Roman and Early Roman period settlements boasted simple four- or six-post granaries. This is the case not only at northern settlements like Tiel-Passewaaij, Oss-Westerveld and Rijswijk-De Bult, but also at for instance Verneuil and Seclin, settlements situated in the southern regions that would later on develop towards larger, highly organised complexes. Throughout the research area, new types of storage buildings were constructed from around the middle of the 1st century AD onwards. In the northern sand and clay region, new types of wooden storage buildings developed. These consisted of a core of posts, set in either post-holes or ditches, with an ambulatory of posts around it. Such constructions can be found at for example Oss-Westerveld, Houten-Tiellandt and Tiel-Passewaaij (see fig. 5.5a). With regard to the development of this new type of granaries, some scholars have suggested a military influence. A somewhat different type of storage building developed on one of the farmsteads within the settlement of Rijswijk-De Bult (fig. 5.5a). During the 1st and early 2nd century AD, a traditional type of granary existed, consisting of two rows of posts (four and five posts respectively). Then during the following development phases, larger and sturdier buildings were subsequently constructed. A first one consisted of three parallel ditches in which posts were set. Then, an even larger one was constructed, the now four parallel ditches being filled with stone material, potentially for supporting horizontal construction beams. The youngest construction, consisting of a core construction and an ambulatory of posts, was originally interpreted as a temple by the author. However, its similarities to other granaries have led others to suggest it served as a granary instead.

Regarding settlements in the loess region, the monumentalisation of storage buildings reached even further. At Hambach 512, a granary with parallel foundation ditches, in which, according to the reconstruction, horizontal foundations beams were placed, was dated to the first half of the 2nd century. Then, in the second half of the 2nd century, a multi-roomed storage building on stone foundations was constructed on the same location (fig. 5.5a). This building had a surface four times larger than the post-built structure. Relatively similar multi-roomed storage buildings on stone foundations were also documented at Hamois-Le Hody and Hambach 132. The one at Hamois has not been dated, while that at Hambach 132 was imprecisely dated between the late 1st and early 3rd century AD. Even outside the research region, notably in France and Switzerland, this specific type of building can also be found.

Another type of storage buildings one stone foundations regards the ones with rectangular plans, such as those documented at Hambach 127, Jülich-Kirchberg, Voerendaal-Ten Hove and Verneuil-en-Halatte (fig. 5.5a and b). In the first three cases, internal supports were documented that carried the raised floor, needed for protecting the stored crops from moist and vermin. The building at Jülich was divided into two identical rooms. In the other cases, the buildings had one large and one or two smaller rooms. Regarding Verneuil, a development trajectory could be reconstructed (see fig. 5.5b). In the earliest, Augustan-Tiberian phases of the settlement, granaries were small and post-built. Then, in the Claudian period, a considerably large post-built storage building was constructed on the working compound. Subsequently, during the Flavian period, the long-rectangular building on stone foundations was constructed at the same location.

591 Such a construction can probably also be identified at Hoogeloon. This structure was originally interpreted as part of a house, but clearly resembles storage constructions like that of Houten and Oss. 592 Heeren 2009, 237. 593 Derks 1998, Heeren 2009. 594 Kaszab-Olschewski 2006, 35. 595 For the settlement phasing of the Hambach 132 settlement see Brüggler 2009, 280 ff. 596 Although, with regard to many cases, a function as granary can be presumed, these buildings also seem to have been used as houses in some cases, for example at the axial complex of Port-sur-Saone (see Gaston 2008). The distribution of these buildings over a considerable geographical region has led Gaston (2008) to suggest standardisation.
At Kerkrade-Holzkuil, a number of smaller post-built constructions dated to the earlier settlement phases can be interpreted as granaries. Respecting the later phase, a large rectangular single-aisled building (building 1), constructed on square stone material footings may possibly be identified as a granary.597

At Seclin, a large post-built construction is identified as a storage building for no clear reason.598 During a later phase, two larger buildings on stone foundations with buttresses are constructed. These buildings together provide a remarkably larger storage capacity that cannot be explained in relation to the character and size of the settlement. Possibly, we should be cautious with interpreting both these buildings as granaries.

Some of the mentioned storage buildings had buttresses protruding from their walls. As mentioned previously, buttresses have often been associated with storage functions. One possibility is that buttresses were used for supporting an overhanging roof that kept the walls of the building dry and thus guaranteed dry storage conditions for crops.599 Another interpretation, regarding the buttresses as reinforcements, needed for handling the horizontal pressure created by stored crops, also suggests a potential storage function for these buildings.600 And thirdly, internal buttresses could even have facilitated the construction of a raised floor, as these buildings generally lacked internal supports.

597 Tichelman 2005, 100-103.
600 Gentry (1976, 15, 62ff) stated that in Britain, buttresses can be found at many storage buildings, which triggers the conclusion that these buttresses served to create a sturdy construction that was fit to handle the large horizontal pressure.
**Storage structures development trajectories**

<table>
<thead>
<tr>
<th>Time</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>

- Hambach 512
- Hambach 127
- Jülich-Kirchberg (WW 112)
- Voerendaal-Ten Hove
- Oss-Westerveld
- Houten-Tiellandt
- Tiel-Passewaaij
- Rijswijk-De Bult

Fig. 5.5a Examples of storage buildings development trajectories within the research region.
Fig. 5.5b Examples of storage buildings development trajectories within the research region.
Table 5.1 Overview of the surface in square metres of storage structures and their dating.

<table>
<thead>
<tr>
<th>Site</th>
<th>Surface in M2 (dating)</th>
<th>Surface in M2 (dating)</th>
<th>Surface in M2 (dating)</th>
<th>Surface in M2 (dating)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiel-Passewaai</td>
<td>5-15 (1)</td>
<td>80 (1d-2A)</td>
<td>64 (3A)</td>
<td></td>
</tr>
<tr>
<td>Houten-Tiellandt</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Rijswijk-De Bult</td>
<td>13 (1d-2a)</td>
<td>29 (2b)</td>
<td>123 and 93 (2d-3a)</td>
<td>119 and 64 (3)</td>
</tr>
<tr>
<td>Hambach 512</td>
<td>44 (2A)</td>
<td>160 (2B)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verneui-en-Halatte</td>
<td>9–25 (1a)</td>
<td>240 (1b)</td>
<td>250 (1B-2)</td>
<td></td>
</tr>
<tr>
<td>Seclin</td>
<td>9 m2 (LIA)</td>
<td>182 (1)</td>
<td>650 and 370 (1-2)</td>
<td>600 and 625 (2-3)</td>
</tr>
<tr>
<td>Voerendaal-Ten Hove</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jülich-Kirchberg</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Examining some of the development trajectories discussed in the above, it becomes clear that storage buildings considerably increased in size and capacity over time. Table 5.1 offers an overview of the development of storage building surface. With regard to some settlements, the earliest granaries dated back to the earlier 1st century or even Late Iron Age. These simple four- or six-post constructions only had a limited surface and thus limited storage capacity. Subsequently, generally in the second half of the 1st or first half of the 2nd century AD, considerably larger granaries were built, in most cases multiplying the storage capacity several times. Some more general observations have been made regarding a number of regions and settlements. Around the Dutch town of Oss, Iron Age granaries had a floor surface of between 2 and 18 m2, with an average around 6.5 m2. During the Roman period, this average increased substantially towards 28 m2, the largest being over 80 m2. This suggests either an increase in the amount of grain grown and stored or a change in storage strategies, whereby storage was concentrated in fewer granaries.601 During the first half of the 1st century AD, every household at Tiel and Wijk bij Duurstede-De Horden had several small granaries. In the second half of the 1st century, the average surface area of the Wijk bij Duurstede settlement was 17 m2, while Tiel's was 9.9 m2. At this latter site, however, a large granary offered storage capacity for more than one household. During the first half of the 2nd century, each house still had several associated granaries. At the same time, several larger granaries were built as well. At Tiel, the average surface of the storage constructions increased at the cost of the number of constructions. One of the larger granaries was a new type. This granary had a storage capacity of 45.6 m2, exceeding the local needs by almost 100%. Compared to some of the granaries on stone foundations, found in the more southerly loess regions, these post-built examples are nevertheless relatively limited in size. The granaries at Voerendaal-Ten Hove and Jülich-Kirchberg were both around 400 m2 in surface and the very large buildings at Seclin, if correctly interpreted as storage buildings, even measured around 600 m2.

With regard to the chronology of the development of storage buildings, the available data are unfortunately limited. From some dated cases, it is nevertheless possible to obtain a general impression. The relatively late development of larger storage buildings on stone foundations is particularly remarkable. At both Voerendaal and Hambach 512, such larger buildings are not constructed until the 2nd century, well after the main house had been rebuilt on stone foundations. This phenomenon may be linked to the increasing specialisation of these settlements’ production. As previously described, the settlement at Voerendaal developed from mixed, more or less all-round type of production during the 1st century AD, into much more specialised and intensive production during the 2nd century.602 Furthermore, control over production also may have increased, symbolised by these large storage buildings that could even been actively used to create and communicate positions of control. This particular theme will subsequently be discussed.

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602 See Kooistra 1996.
5.3.3 Granaries and the social control over production

Granaries do not only reflect developments in storage practice and production, they also shed light on changes in the organisation of production and thus on changing socio-economic relationships within settlements. As Given states: ‘Assuming proper identification, changes in social and economic relationships can be charted by means of changing storage patterns’. In order to be able to study these storage patterns, granaries are to be placed in their settlement context. How does the position and character of storage buildings within the settlements reflect socio-economic relationships? Moreover, how could they have been actively used to construct new socio-economic relationships, new patterns of control over production?

Control over production and storage is essential when wanting to acquire social power in a complex society. According to Purcell, storage control was even one of the principal ingredients of the very formation and maintenance of elites in Mediterranean history. Containing the agricultural wealth that was essential to the survival of the community, storage buildings were functionally as well as symbolically important, communicating control over surplus, storage and exchange. Consequently, they could be employed in the creation and maintenance of the socio-economic relationships. After all, in the Roman tradition, storage buildings were intended to impress.

In a study on the control over surplus in colonial situations, Given found that, particularly when surplus was required for tax payment, a situation developed in which the ability to produce and control agricultural surplus became essential. Dependency relationships were often economically shaped by the extraction of a proportion of people’s grain or dairy produce by others. They were literally made dependent by partly removing self-subsistence and autonomy; they no longer controlled their own risk buffering. Storage was instrumental in this process. As Given states, ‘Stored food is a concrete expression of people’s role in society. It can embody a head of households’ prudence and care, or the power of an elite over its subjects, or the proud memory of a family’s hard work during the harvest.’

Having said that, how can these processes be identified within our dataset? First of all, the increasing storage capacity of granaries could be related to the centralisation of storage and thus the centralisation of control over production and surplus. Instead of every farmstead and household having its own small granaries, storage was now centrally organised and controlled. Such processes were recognised at several settlements described above. In a number of cases, a development could be documented from several small four- or six-post granaries towards a single large storage buildings, often constructed on stone foundations. Such larger storage buildings were found in many settlements. The other houses on the compound do not seem to have had their own granaries. Parallel processes were also recognised in the northern regions. At Tiel-Passewaaij, the average surface of the storage constructions increased at the cost of their number and at several other rural settlements new, relatively large storage buildings developed. These larger storage buildings clearly exceeded the personal needs of the household.

Secondly, the specific spatial relationship between the large storage building and the main house was significant. Examining the dataset, the close association of the main house with a large granary is a well-documented phenomenon. Control over production and surplus were spatially symbolised in this way. At Hamois, the storage building was situated directly in front of the main house (fig. 5.6). A similar situation was documented at Eschweiler-Laurensberg, At, among other places, Cologne-Müngersdorf, Hambach 132, Le Roux-Iez-Fosse, Hambach 512, Rheinbach-Flerzheim and Rijswijk-De Bult, storage buildings were situated directly next to the main house (see fig. 5.6 for some examples). At Voerendaal-Ten Hove, the granary was even connected to the main house by means of a portico. In addition, the storage buildings at the axially organised complexes of Verneuil-en-Halatte and Champion-Le Empinnee were situated on the working compound, but, remarkably, at a location closest to the residential compound. A somewhat different situation is found at Bruges-Refuge and Neerharen-Rekem. In both settlements, an Alphen-Ekeren type house was directly associated with a cluster of seemingly contemporary granaries. At Bruges, the house in question has the most prominent position within the settlement and at Neerharen-Rekem, the house was replaced by a multi-roomed house on stone foundations during the late 1st century

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603 Given 2004, 36.
604 Purcell 1995, 169.
605 Purcell 1995, 169.
607 Given 2004, 36.
609 Bloemers interpreted this non-residential structure as a temple, but Derks (1998, 152, note 96) and Heeren (2009, 217) have argued that it should be re-interpreted as a large horreum.
AD. We could consequently suspect that the inhabitants of these houses had a prominent position within the settlement communities and that their apparent control over production was symbolised and communicated through the construction of several granaries in direct association with their residence. The houses themselves still being non-monumental traditional buildings, this was a clear way of symbolising control, wealth and power. Apparently, changes in patterns of control were not necessarily related to the construction of new and larger types of storage buildings.

A third factor concerns the monumentalisation of storage buildings, resulting in their increased durability and representativeness. As described, many storage buildings developed from relatively small and inconspicuous constructions into relatively large, and more or less monumental buildings, potentially furnished with white-washed walls and red-tiled roofs, comparable to monumental houses. This monumentalisation might have played a role in the creation, communications and fixation of new socio-economic relationships. As conspicuous and durable structures they were now ultimately suitable for symbolising the lasting prominent position of the dominant family, within the settlement and possibly even in wider society.
All in all, storage buildings were actively used in the creation, communication and fixation of new socio-economic relationships, as well as in new patterns of control over production. As large, durable and conspicuous constructions, containing surpluses extracted from dependent workers and being spatially associated with the main house, they symbolised the control and lasting prominence of a single family. Constructing such buildings helped constructing and maintaining dependency relationships.

Still, the situation in the northernmost region might be somewhat different. As discussed earlier on, recent studies have elucidated changing economic relationships within settlements in this region. In an interesting paper, Groot has looked at economic differentiation on a household level and discovered that interesting patterns could in fact be identified. While some households specialised their production, others maintained traditional patterns of production. Groot demonstrates that the farmsteads of these specialised households were often characterised by prominent houses (relatively large houses or portico-houses (sometimes termed ‘veteran houses’)), special material culture (militaria, keys, seal-boxes), specialised horse stables and relatively large granaries. At other settlements, similar patterns have been documented as well. At Den Haag-Wateringe Veld, for example, the house with a long fronting portico was also associated with militaria.

It is likely that these phenomena can be associated with veterans returning to their settlements. With their knowledge of the army and its needs, their contacts and their financial position, they would have been able to specialise their production, probably aimed at the military market. In addition, veterans may have had a prominent social status within the communities to which they returned. The involvement of returning veterans may be suspected in more settlements in these northern regions. At Oss-Westerveld, the inhabitant of the portico-house on the separate compound could well have been a veteran, specialising his production and acquiring wealth and status. The same could be held for the inhabitant of the monumental house at Hoogeloon, where the find of a military diploma underlines such an interpretation further. In this latter case, the corral associated with the house could be seen as an indication of the importance of livestock and, at the same time, as a symbol for the prominent economic position of the family in question.

At these northern settlements, production seemingly continued to be organised at farmstead level, without being centralised through the creation of relationships of dependency within the local community. It seems that socially and economically prominent persons within these communities, such as veterans, were able to specialise and intensify production without directly controlling other families in asymmetrical dependency relationships. According Groot, these other families appear to have continued producing in traditional ways. This lack of direct dependency relationships is also reflected in the layout of these settlements, which was spatially and architecturally hierarchised to a lesser degree in comparison to its southern counterparts.

5.4 Regional differentiation: recognizing a villa mode of production?

One of the prominent elements in the definition of ‘the villa’ has been its economic function as a production unit. Slofstra even defined a specific ‘villa mode of production’. From this perspective, the villa is regarded as the centre of a landholding exploited by controlling the workforce of others. Production was intensive, aimed at producing surpluses for the market and using asymmetrical social relationships to control production. Studied from a broader, less essentialist approach, as aimed in this study, this economic interpretation of ‘the villa’ also needs to be reassessed. Especially in relation to the new insights into the economic developments of settlements in the northern regions, it could be argued how typical this ‘villa mode of production’ actually was. The production of a surplus and the increased control over production and workforce were mentioned as important aspects. However, it seems that

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610 On Tiel-Passewaaij and Wijk bij Duurstede-De Horden, see Heeren 2009 and Vos 2009. An economic analysis of these settlements was carried out in Groot et al. 2009 and Groot in press.
611 Groot in press.
612 See Vos 2009.
613 Examples are house 20 at Geldermalsen-Hondsgemert and House 3 at Tiel-Passewaaij.
617 Slofstra 1991, 161, 179.
regarding several northern settlements, generally characterised as non-villa ‘indigenous’, such processes could also be recognised. Here, we also find changing orientation and specialisation in production, changing relationships of production and the changing physical dimension of production (buildings with economic functions and their location). These processes are at least partly comparable to those found in the southern regions, albeit in a somewhat different form.

I would consequently like to argue in favour a broader approach to developments related to production. Once more, it becomes apparent that the definition of ‘villa’ should not be considered in excessively essentialist ways. Processes of change, also with regard to agricultural production, can be recognised throughout the research region, albeit with regional accents.