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Summary

About thirty years of mainly desk research has brought to light the 'forgotten' Roman town of Forum Hadriani at Voorburg near The Hague in the Netherlands. Although already partly excavated during the world's first scientific excavation in 1827-1834, the remains have long been misinterpreted as a military site. This study is the result of reinterpretation of the excavations which have so far unearthed about one quarter of the walled part of the Roman town. A much clearer picture has emerged and shows the development (part I), reconstruction (part II) and importance (part III) of the Roman town in the past and present. The last part was underlined after the text was finished May 2010. A special commission (*Commissie Herziening Voorlopige Lijst Werelderfgoed*) on 12 November 2010 advised the Dutch government to link Forum Hadriani to the Dutch part of the *limes* as World Heritage of the UNESCO, following the related conclusions of this study as forwarded to the commission June 2010.

This study was finished exactly a century after Holwerda started a major excavation in May 1910. Before him, Reuvens had conducted the excavation of 1827-1834, which of itself was enough to contribute to the value of the site as a World Heritage site. Reuvens, the first person to hold a professorship in archaeology in the world, was the Leonardo da Vinci of archaeology. He introduced methods that would not become commonplace until long after his excavation campaign had ended. His profile drawings, detailed excavation plans, journals, technical analysis of wood remains, stratigraphy and much more, have made a reanalysis of the old excavation possible (figs 1.6 – 1.11). His excavation and related documentation has become an object of study in its own right, and a new examination of the old excavation offers new insights into the approach adopted by this archaeological pioneer. To highlight his unique contribution, I have dedicated this study to Reuvens and have labelled the central Roman bath complex the 'Reuvens Baths' (fig. 14.10). Unfortunately, Reuvens died unexpectedly at the young age of 42. The excavation that Holwerda conducted in 1910-1915 provides the other major input for this study. The results of smaller later excavations are included as well. Only preliminary results have been published so far of the last excavation of 2007-2008, which uncovered parts of the harbour. These results already give a good impression of the highlights. Altogether therefore, this study presents a clear picture of our current knowledge regarding Forum Hadriani.

Importance of the 'newly discovered' town of Forum Hadriani

The development and in particular the reconstruction of the town of Forum Hadriani offers an interesting perspective in several respects. It more closely resembles an 'average' Roman town than do famous sites like Pompeii. For example, the number of inhabitants (about 1,000) and the net size of its territory (about 500 km²) are close to estimates for the average Roman town. As early as 1838 the town was called the 'Dutch Pompeii'. At first sight, the town seems to be very unlike Pompeii as no traces above ground level survive. Below this level, however, the high groundwater has conserved organic remains such as quays, wooden wells and cartwheels (fig. 1). In addition, aspects of the town's life have been 'frozen' by marine clay, which acted like the lava at Pompeii. In the harbour, for example, layers of clay show how poles were driven into the soil (fig. 15.10). Other layers reveal how some poles were later gradually pushed aside (figs 15.11 – 15.12). The same clay shows low and high tide levels (fig. 2.11) and organic remains inform us about the marine influence in this inland tidal harbour. It is a very early example of the never-ending fight against the sea in the Dutch lowlands.

More so even than the preserved remains, it is the wealth of available information that makes Forum Hadriani such a fascinating site. The fact that Forum Hadriani was not as rich as for example Pompeii, combined with a relatively short life span of about one and a half centuries, has produced a fairly clear picture of the original town plan. This is of particular interest because the site was one of the first known building projects by Emperor Hadrian, regarded as one of the best strategists of the Roman era. This study shows how the town's design seems to reflect Hadrian's new strategy. The site also offers a rare opportunity to study the town's strategic and economic relevance in relation to its territory and the nearby *limes*. Natural borders clearly define the size of this territory, the *civitas Cananefatium*. A considerable number of rural sites have been excavated here and these are generally well documented. They serve as a basis for analysing the relationship between town and countryside, in connection with the broader strategic perspective of the Roman *limes* along the river Rhine, about 15 km to the north of Forum Hadriani and linked to the town by the Corbulo canal. Some of the relationships are summarized in a macro-economic model, offering a new perspective, amongst others showing how the *limes* was economically connected to such towns. It is concluded that Forum Hadriani, in close connection with the *limes*, should become part of the World Heritage.

Content

Following an introduction outlining the study's approach, structure and scientific relevance, there are three parts to the study. The first describes the development of the settlement. The introduction to this part starts with the history of the excavations, including old interpretations. The next chapter describes the geological situation as a basis for further analysis. The following six chapters outline the settlement's development, from the first early Roman settlement until the few remains of activities in the late Roman period. The medieval remains fall outside the scope of the study and I mention them only very briefly. Part II provides a reconstruction of the Roman town of Forum Hadriani, with a focus on the 2nd century and early 3rd century. In the next eight chapters, I provide a reconstruction of several parts of the town buildings. Finally, Part III focuses on both the past and future significance of Forum Hadriani. With respect to the past, the strategic and economic relationship of Forum Hadriani and its environment, and the *civitas Cananefatium* and nearby *limes* in particular, is outlined in the next seven chapters. I apply several economic models to this period for the first time. More so than Parts I and II, Part III is explorative in nature, developing several hypotheses to be tested in future research. A macro-economic model forms part of the syntheses. Finally, I describe the future significance of the town, including heritage management and heritage development, in the last chapter. The brief epilogue offers some final comments on the extent to which such a town may be called Roman. The attachments elaborate on some specific items such as a reconstruction of coin hoards and comments on old maps (figs L1 – L3).

Main findings

Because of space constraints, I will only briefly describe some of the main findings of each chapter, focusing on those that may have a broader significance than for Forum Hadriani alone.

The introduction on the importance of Forum Hadriani firstly describes the research dimension. Because the study is based on very early excavations, I make a distinction between 'secondary archaeology' and 'primary archaeology'. 'Secondary' means that the analysis is primarily based on excavations conducted by others. As the main excavators of Forum Hadriani are now dead and cannot be consulted for cross-checking, the study is an example of 'antiquarian archaeology', a subbranch of secondary archaeology. This raises some special questions and demands a specific approach. Secondary archaeology will become increasingly important in the future as the archaeological archive diminishes at a great rate. The oldest, very well-documented excavation is of particular importance to antiquarian archaeology. This study also combines knowledge from Roman provincial archaeology with expertise from Mediterranean archaeology. It shows the extent to which better preserved towns in the south are representative of towns on the periphery of the Roman Empire.

A special feature of the study is the transformation of the economic relationship between town and countryside into a macro-economic model, building upon a reconstructed price list for the 2nd century (table 21.1). This has enabled me to convert all kinds of transactions to a financial value, including the size of the local economy and its different parts including the *limes*. The analysis is also linked to the money supply. A distance and travel timetable has been reconstructed for Forum Hadriani and connected towns. The timetable allows us to calculate the economic reach of several products. I have also introduced various other economic and business models. One example is the 7S model, which describes other elements of the Cananefatian economy such as shared values. Finally, I propose the development of a 3D computer reconstruction of the reconstructed parts of the town. This can be used as a handheld virtual reality device for onsite tours, a new technique. The reconstructions in Part II are very detailed in order to support such a tool.

A new 8I model is introduced to illustrate the current social importance of archaeological and historical studies in general, and Forum Hadriani in particular. The potential practical application of historical knowledge is divided into eight groups, based on a review of the development of historical thinking since ancient times. To make these groupings easier to remember, each one is summed up in a key word starting with the letter 'i', referring to the practical insight that is offered. The eight groups are: Introspection, Instability, Integration, Identity, Inspiration, Imagination, Inheritance and Interest. I then describe the impact on heritage, illustrating in some cases the importance of quantification. In chapter 6, for example, I point out that the ratio of name graffiti to stamps ('stamp-graffiti ratio') is only 1:13 in

Forum Hadriani, a little less than the 1:10 in the cemetery of the Roman town at Nijmegen, and much less than the 1:4 to 1:8 in the nearby *castella*. The name graffiti at Voorburg do not therefore provide evidence of the presence of soldiers or veterans in the town, as has been suggested by others.

In the final part of the introduction, I describe the approach I have adopted and the structure of the study. An example is the 'uni-diverse' approach. My aim is to avoid the pitfall of a single perspective when comparing Forum Hadriani with other sites. While it is recognized that some items were fairly universal across large parts of the Roman empire (as illustrated, for example, by the similarity of some of the house plans in Forum Hadriani and Herculaneum), there was considerable room for local adaptation (as illustrated by the much more open and spacious town plan of Forum Hadriani compared to Pompeii and Herculaneum). The orientation of the street grid in Forum Hadriani is another example of local adaptation.

Part I: Development of the Roman settlement

The introduction describes the geographic and geological context of the site (Ch. 2). The *civitas Cananefatium* covers the area between the mouths of the Old Rhine and Meuse rivers (fig. 17.3). After the mid-1st century AD the Old Rhine functioned as a border (*limes*), thereby marking the northern boundary of the *civitas*. In the west, the North Sea was a clear barrier. In the east, a large inhabitable peat area formed a natural divider between the *civitas Cananefatium* and the *civitas Batavorum*. The river Meuse and its large estuary (Helinium) probably formed the southern border of the *civitas*. This study follows the borders as reconstructed by Bloemers in 1978. The *civitas Cananefatium* probably covered an area of 1500 km², of which about 500 km² was habitable (table 18.3). This habitable area is about average for many Roman towns.

The Roman settlement at Voorburg was situated on a dune ridge that once ran roughly between the Rhine and Meuse rivers (fig. 2.1). The ridge still exists near Voorburg but is particularly eroded along the Meuse. To the south runs the Corbulo canal, an approximately 30 km waterway connecting the Rhine and Meuse. When Corbulo dug the canal in the mid-1st century, he made use of partly existing natural waters. The reconstruction shows how several layers of clay were distributed via these waters. It is suggested that this marine impact continued during the early Roman period, producing three new 'Roman' layers of clay which are labelled Arentsburg Ia – Ic (table 2.1). Because Forum Hadriani had a tidal harbour, tide levels have been reconstructed to gain a better understanding of how the harbour operated. This is also connected to the Roman groundwater table.

Part I then describes the development of the Roman settlement (table 8.3). The excavations have yielded most information for the period of Forum Hadriani, founded soon after 120 AD, but there are a few traces and finds from earlier phases (Ch. 3). In the beginning of the 1st century, the site seems to have been a native settlement with some imported material, which indicates above average wealth (figs 3.1 – 3.2). The area was possibly still part of the larger *civitas* of the Batavians. There may already have been a secondary local centre as the administrative centre of a Cananefatian *pagus* of the Batavian *civitas*. Such a centre may have numbered no more than a few hundred inhabitants. Even a small local centre of this size has so far not been discovered at Voorburg. For that reason, it is suggested that such an early centre, if any, may have existed at Lugdunum near the mouth of the river Rhine at Katwijk. If such a centre had existed at Katwijk, which could explain the presence of the double-sized *castellum* Brittenburg nearby, it was probably destroyed during the Batavian revolt of 69-70 AD. After the revolt, the site of Voorburg probably developed as the area's centre, but this may have occurred gradually, given the pattern of coins and terra sigillata (fig. 3.4). Remains are scarce and, in the light of military tiles from the Legio X, may include a military post. The Cananefatian territory probably became less dependent on the neighbouring Batavians, but may have started as a kind of military territory in preparation for *civitas* status.

In around 85-90 AD the province of Germania was divided into Germania Inferior and Germania Superior and became a civil entity. Around this time the settlement at Voorburg clearly functioned as the *civitas* capital. Holwerda excavated strip houses along the main road, which are comparable to houses in the contemporary *civitas* capital at Nijmegen (fig. 3.5). A rectangular street grid is most likely for this stage, although remains are very fragmented (fig. 3.3). Post-Roman fields in the west with the same orientation may partly reflect a Roman land division related to this 'Domitian' *civitas* capital (fig. 2.10). The presence of the Corbulo canal makes the presence of a harbour very likely. A natural creek

was probably used for small ships, but was then flooded and filled with clay. As in Nijmegen, we may expect building activities during the reign of Trajan, but so far no clear traces have been found.

The big change came when Hadrian probably visited the site during his first major journey as emperor (Ch. 4). The site, whose former name is not known, was given the new name Forum Hadriani. The most striking feature is the town's new orientation, not a very practical solution for an existing *civitas* capital. As there are no signs of mass destruction, this new design is rather special and seems to have been political in nature. At the beginning of his reign, Hadrian made the historically important decision to consolidate the ever-expanding empire and to maximize leverage of the local population. While the nearby city of Xanten, founded by his predecessor Trajan, still retained the independent design of a Roman camp, Forum Hadriani was much more closely aligned to the local topography. The street grid was aligned with native houses in the surrounding countryside, but the west border continued the old orientation of the Domitian town, which related to the local land division along the principal road across the dune ridge. Another local adaptation was the town's southern boundary, aligned with the Corbulo canal. As a result, the first town plan was less regular than typical Trajan settlements like Xanten and Timgad, and probably also Nijmegen. The foundation of Forum Hadrian is one of the first archaeologically documented major activities of the new emperor and may symbolize his new strategy for the Roman Empire. Rare mortar stamps from Bonn (fig. 19.1) may indicate that Hadrian, a former commander of the Legio I Minerva, settled veterans of that legion in Forum Hadriani. A graffito 'veterani' (fig. 18.3) could illustrate the presence of veterans, although as stated earlier name graffiti are certainly no proof.

As already mentioned, the site offers interesting insights into Roman town planning (Ch. 5). Unfortunately, the eastern boundary of Forum Hadriani has not been established with absolute certainty. However, a few remains of the later defences suggest that the original new 'Market of Hadrian' (Forum Hadriani) was quite small – about 11 hectares. It was probably surrounded by a single ditch reused in later defences, perhaps with a symbolic earthen wall behind (fig. 5.1). In view of the style of the wall paintings, the building of the central baths ('Reuvens baths') probably started during the reign of Hadrian. The forum has not yet been excavated, but a likely location is adjacent to the harbour. Most interesting are the many town houses that show similarities with Mediterranean houses in for example Herculaneum. It is also interesting to note that a new land allotment was started in the countryside, in the south of Forum Hadriani (fig. 5.25). The *insula* grid of Forum Hadriani has been reconstructed, but it is partly hypothetical, especially in the east where little excavation has occurred (fig. 4.2).

I suggest that Forum Hadriani was not granted municipal status until the reign of Antoninus Pius and not Hadrian as traditionally assumed (Ch. 6). The new name is only known as the abbreviation M.A.C. and would have been Municipium Aelium Cananefat(i)um, a title applicable to both Hadrian and Antoninus Pius (both Aelii). This hypothesis has wider implications as more *municipia* may have been wrongly attributed to Hadrian. The case of Gightis (Tunisia), known from an inscription, shows that although he never left Italy, Antoninus Pius did elevate towns on the borders of the empire to municipal status. In the case of Forum Hadriani, building activities in the middle of the 2nd century may indicate the time of elevation to such status. Building work includes a possible monumental arch at the western entrance to the city (fig. 6.1). The *municipium* title is mentioned for the first time on a milestone of Antoninus Pius found in situ four Roman miles from the west gate of Forum Hadriani (fig. 17.2 sub A). The date of 150-151 AD may fit the period when municipal rights were granted. This may also have been the case with other *municipia* in the region, such as Nijmegen and Tongres. The town also acquired a wooden palisade, probably a symbolic town defence (figs 6.3 – 6.6). A stone town defence appeared later, most probably in the period 175-190 (figs 9.2 – 9.13) and perhaps the work of Didius Julian, who was governor during part of this period. The defences would have erected in response to local unrest. The town of Nijmegen was given defences at around the same time. There may even be a link to defences at Aardenburg, built in the same period. The building of stone defences was probably the reason for making minor modifications to the southern boundary, affecting the local street grid in the southwest corner of the town (fig. 6.16). At some time in the 2nd century the town may have acquired an amphitheatre. A possible location in the northeast is suggested, based on possible curved traces in post-Roman land division (fig. 6.17).

At a subsequent stage, the town was probably extended to the east (Ch. 7). Unfortunately, the traces of this expansion are minor as this part of town has remained largely unexcavated (figs 7.6 – 7.8). The expansion is hypothetical, based on some small-scale excavations and the shape of medieval land

division that seems to be organized around the remains of the latest Roman town defences. I suggest that part of the interior of the existing town also changed during this stage, such as a possible shift of the *forum* and the introduction of a stone Capitolium in the *insula* next to the *forum*. The evidence is meagre, however, and conclusions remain preliminary (figs 15.3 – 15.4). The adjusted *insula* grid has been reconstructed, but remains partly hypothetical (fig. 7.1). The date of the assumed extension is uncertain, but a date shortly after 210 AD is most likely. There may be a relationship to building activities in the harbour and roadworks, probably dating to 213 AD based on the in situ discovery of a milestone four Roman miles to the west of the town. It is even suggested that a personal visit by Caracalla around this time may have played a role. The conclusion to Part I describes how investments in Forum Hadriani continued on a smaller scale up until the second quarter of the 3rd century. A crisis clearly began in the mid-3rd century and by the end of the 3rd quarter activity had strongly diminished. The old find of a skeleton in the centre of town may, given the date of the associated fibulae, be a reminder of the violence of that time (figs 1.11 – 1.12 and 8.2 – 8.3). The settlement may have lost its role as the local centre, as was the case with some other *civitas* capitals in the coastal region. Finds such as coins suggest that some activities continued in the 4th century in a smaller nucleus. Finally, the ruins may have housed people in early medieval times, as coin finds suggest. Unlike many other Roman towns, however, there was no real continuity. The site remained rural until the early 20th century and was partly transformed into urban green zones, which has meant that the remains are fairly well preserved.

Part II: reconstruction of Forum Hadriani

Part II describes the reconstruction of the Roman town of Forum Hadriani. As the detailed nature of the reconstruction makes it difficult to summarize, I will confine myself to only a few items with a broader significance. Regarding the town defences (Ch. 9), I suggest an interesting rule of thumb for the height of curtain walls. In the case of walls backed by an earthen wall, the height in well-preserved examples seems to be close to the wall thickness plus ten Roman feet, the earthen wall itself having a minimum base of 20 feet. In the case of Forum Hadriani, for a wall of about 0.75 m in thickness, a parapet walk at about 3.75 m has been reconstructed (figs 9.9 – 9.10). This offers important input for the reconstruction of the Helinium Gate, the largest excavated gate. The special ground plan makes it very likely that the gate consisted of a large gate chamber across the entire building, covered by a crenulated top as in well-preserved town gates in Rome (figs 9.13 – 9.18). There were also smaller towers with a single gate (figs 9.19 – 9.23).

The next chapters (Ch.10-11) describe the ordinary town houses, including a reconstruction of the very well-preserved *insula* II (figs 10.6 – 10.7). These row houses with an average width of 20 feet show interesting similarities to houses in Herculaneum. I suggest a construction with a shared porticus and enclosed atrium, based on archaeological findings and architectural knowledge. The detailed reconstruction takes into account such aspects as the relationship between the ground area and window area of Roman buildings (approx. 6:1) and checks the height of reconstructions against the calculated ground pressure and maximum pressure allowed in Voorburg. The somewhat more luxurious houses in *insula* VIII have been reconstructed in a similar fashion (Ch. 12). These are about 30 feet wide and show similarities with, for example, houses in Xanten (figs 12.3 and 12.10). They include some stone cellars. Because of the special conditions in Voorburg (the high groundwater level), the cellars look more like souterrains, with their ceilings probably above ground level (figs 12.4 – 12.6). A large urban villa and some neighbouring houses in *insula* VII are discussed separately (Ch. 13). The urban villa featured a separate bath suite, most probably connected directly to the water tank of the neighbouring public baths (fig. 13.4). Only the back of this large town house has been excavated, with next to the bath suite at the back a large room with a hypocaust as part of a wing surrounding a small courtyard (fig. 13.2). These kinds of heated room were used for dining and feasting.

As for public buildings, the public baths in the centre have been reconstructed (Ch. 14). They are quite similar to, for example, a bath at Zülpich (figs 14.1 – 14.12). Next to the bathing wing was a large hall with beautiful wall paintings of the same type as in an urban villa in Cologne. Connected to this is a public latrine and large water tank (figs 14.4 – 14.5), probably supplied by a pumping system as the flat landscape around Forum Hadriani offered no space for aqueducts. Based on the reconstruction, I have estimated how much water, heating material etc. was needed to operate the public baths, and the costs involved. The next chapter describes other public buildings such as temples (figs 15.5 – 15.8), including a possible Capitolium (figs 15.3 – 15.4). Of special interest here are the simple four-cornered buildings with unequal corners that are known from other temple sites as well (fig. 15.8 sub I-

M). Also of interest is the wooden foundation of the central road (figs 5.8 – 5.12). The internal harbour that was excavated in 2007-2008 by the Amsterdam Archaeological Centre (AAC) is unique. Final results will probably be published by AAC in 2011, but preliminary results are already very promising. In advance of that, this study analyses the old excavations in order to gain a better understanding of the harbour, including the parts that were not excavated in 2007-2008. This has yielded interesting information about the harbour's natural shape, water levels and capacity in terms of number of ships, and it places some old observations in a new perspective (figs 2.5 – 2.7 and 15.10 – 15.17). It provides interesting background information on the new discovery that will in particular tell us more about aspects like construction details of the well-preserved wooden part of the harbour. Also addressed is the water supply, which in Forum Hadriani was heavily dependent on wells (figs 12.16, 13.9 and 15.19), and the associated sewer system. Although unexcavated or barely excavated, the possible site and size of cemeteries and possible *forum* and amphitheatre are discussed as well.

The concluding chapter in Part II describes the reconstruction of the town as a whole (Ch. 16.). It focuses in particular on the use of public space compared to other towns. For example, Forum Hadriani seems to have been a relatively open, green town. The proportion of public space (roughly half of the total area) is quite high compared to towns like Pompeii and August, which had less than 40% (fig. 16.2). And only 45% of private ground was occupied by houses in Forum Hadriani, compared with 88% in Pompeii (fig. 16.3). The orientation of parcels towards main streets is also analysed, showing how they point like compass needles to the main traffic flows; this is also supported by other evidence (fig. 16.4). The distribution of wealthier houses across the town is analysed (fig. 16.5), revealing a preference for the centre and western parts of the *insulae*. However, there is no evidence of true areas for the rich or poor, comparable to the situation in other well-researched Roman towns.

Part III: Significance of Forum Hadriani

Part III discusses the significance of Forum Hadriani. The first chapter (Ch. 17) focuses on the town's market role. This involves a reconstruction of the road network as a basis for a table showing both the distances and travel time needed to reach other towns in the region (table 17.4). I then discuss the role of Forum Hadriani as a local, regional and interregional market, taking into account the effect of travel distances. I develop a hypothetical market circle model as a basis for future research (fig. 17.4). Finally, I explain the role of money in market exchange.

The next chapter addresses the strategic role of Forum Hadriani (Ch. 18). I use system theory to show interdependencies. First I describe the natural system, including climate. I then introduce the human factor, for example, by estimating the carrying capacity in terms of maximum population that can be fed. I introduce a demographic model and reconstruct a model life table for the population of the *civitas*, based in part on demographic patterns in local graves (table. 18.6). A fairly new element is the quantification of the number of veterans and recruitment pressure. Finally, I present an analysis of population growth.

The second part of chapter 18 describes the social system. An innovation here is the 7S model. Although normally used to describe companies, it can also be applied to countries and regions like the *civitas Cananefatium* (fig. 18.4 and table 18.7). The seven interrelated components of the social system are Strategy, Shared Values, Skills, Systems, Structure, Style and Staff (Social demography). Special attention is given to the shared values measured along several axes in accordance with a study by Hofstede (fig. 18.6). In this chapter I show how the understanding of shared values, closely related to identity, was already a potential aspect of strategy in the Roman period, as Hadrian paid special attention to the leverage of local habits and identity.

Chapter 19 focuses on Forum Hadriani itself by developing a population model for the town. After suggestions concerning population size, age distribution and growth, I use a sample of 24 house plans to reconstruct the distribution of wealth among the inhabitants (figs 19.2 – 19.4 and table 19.4). I then compare the results with houses in Herculaneum and Pompeii, and distribution patterns elsewhere in the Roman empire. The Gini index, a measure of inequality, is calculated at 0.34. A rough picture emerges in which about one-tenth of the population lives in high-wealth households and three-tenths in medium-wealth households. The majority (six-tenths) show a low-wealth pattern. Based on patterns such as lack of modifications to houses and changes in house type, I suggest that perhaps about half of the houses were rented, a similar number to what we know for the cities around Vesuvius. Social security and social mobility are discussed as well. Finally, I present a rough reconstruction of the kind

of labour available in the city and its main components, based among other things on an estimate of the number of shops and the size of the city council (30 people, equivalent to the estimate for the earlier *Cananefatium* tribal council). Although these estimates are hard to substantiate, they offer us a better understanding of the possible economics within the city.

Chapters 20-23 develop an economic model of Forum Hadriani in relation to its territory and wider environment, including the nearby *limes*. A special feature of chapters 21-23 is the quantitative model that is unique for analysing a society in the Roman period. Chapter 20 is a non-quantitative introduction describing some economic mechanisms, starting with the pressure from Roman authorities to increase production in order to pay taxes and guarantee the existence of the city Forum Hadriani with its approximately 1,000 non-agricultural producers in the mainly agricultural economy of the *civitas Cananefatium*. The total population is roughly estimated at 20,000 for the *civitas* in the 2nd century, including 3,000 soldiers and 2,000 inhabitants of the related military *vici* (table 21.3). The chapter shows how specialization increases production, with Von Thünen's model describing the regional impact of specialization. I discuss the related traces in the archaeological record and then address the question of how a town like Forum Hadriani could contribute to production increase, which is partly related to risk reduction.

Chapter 21 estimates the financial value of the production capacity in the *civitas Cananefatium* in the 2nd century at 41.5 million *denarii*, or 57 million *denarii* if you include the strategic value of locations (table 21.2). Based on an average return of 6%, this translates to a yearly production value of 3.4 million *denarii* (6% of 57 million *denarii*). It is estimated that this was made up of 2.1 million *denarii* agrarian production, 1 million *denarii* military production (including the value of safety) and 0.3 million *denarii* production in the town of Forum Hadriani. These values fit quite well with estimates of the value of the consumption of these segments.

With a total population (including military) of about 20,000 people, this makes an annual per capita number of 170 *denarii*, or the value of 900 kg wheat or 49 g gold. Excluding military production, this amounts to 140 *denarii*, 750 kg wheat or 40.3 gram gold per capita. The yearly subsistence level is calculated at 100 *denarii*. A production and consumption level at 1.4 to 1.7 times subsistence level is quite normal for this kind of agricultural society. The total ancient production in the area of the current Netherlands is estimated at 32 million *denarii* (128 *denarii* per capita) a year, 85% of which is agricultural production. Extrapolated to the Roman Empire as a whole, assuming a total population of 60 million, total yearly production would amount to roughly 8 billion *denarii* (135 *denarii* per capita). Based on Purchase Power Parity, a subsistence level of 100 *denarii* compares to \$365 a year in 1993. On that basis, the productivity in the *civitas Cananefatium* may be compared to about \$600 per capita (1993 level), or about \$500, excluding the military (table 23.5). This compares for example to \$493 in Lesotho and \$561 in Sri Lanka, and \$22,157 in the Netherlands (all 1993 levels, table 21.7). The Human Development Index is estimated at 0.23, even lower than the current lowest score (0.33 for Sierra Leone).

Chapter 22 reconstructs the physical and monetary flows between the economic segments in the *civitas Cananefatium*. In the situation of a Roman presence, the agricultural population had to produce to a value of 2.1 million *denarii* per year compared to only 1.7 million *denarii* a year in the theoretical situation without a Roman presence. The surplus of 0.4 million *denarii* would be needed to pay taxes and rent and to support the people of Forum Hadriani who could not contribute to agricultural production. The higher production is partly translated into a benefit for the rural population, for example through higher safety and some risk reduction in case of famine due to increased access to long-distance food markets. Excavations show that luxury items were imported. Under normal circumstances, the rural population would need to export a large part of its surplus in order to earn the money needed to pay taxes and rent and to buy goods on the market. The presence of the army would be an advantage here because the rural population could largely focus surplus production on supplying the nearby army instead of long-distance markets. A flow model describes how transactions may have occurred between the segments, including the market of Forum Hadriani as intermediary (figs 22.1 – 22.3). A simple formula is used at micro-level to calculate the maximum economic reach of products as part of the trade flows. For river transport, for example, the maximum reach of cheap wood is calculated at 16 km and of wheat at 300 km. This explains both the use of local firewood and the import of grain from the loess region about 300 km south of Voorburg.

Monetary flows are reconstructed in the second part of chapter 22. Based on reconstructions for the empire as a whole, the money supply in the *civitas Cananefatum* is calculated at 1.4 million *denarii* in value. Of this, generally about 60% was gold, 32% silver and 8% copper. The implied velocity of money (3.4 million production/1.4 million money = 2.4) of about 2.5 is credible in historical terms. Based on different annual wear rates for gold, silver and copper coins, it is estimated that a coin velocity of 2.5 is equivalent to an average of about 1.5 for gold, 3 for silver and close to 9 for copper (table 22.2). As coin loss is strongly correlated to velocity, this explains why copper coins have a much larger share in the archaeological record than money supply would suggest (table 22.3). After this correction, the coin record offers a good reflection of the reconstructed composition of money supply. The model also shows that the small number of coins in rural sites reflects the small population and lower coin loss of silver and gold coins used for major agricultural transactions. The coin loss per m² can also be estimated for a town like Forum Hadriani. It is calculated that about 400 *denarii* may originally have been lost in the area excavated by BAAC in 2006. Only about one-fifth of this amount has been excavated, at first glance a low 'survival rate'. However, after some correction, the survival rate for brick material shows a similar pattern. As the site excavated by BAAC was already built over in the past, it is quite possible that four-fifths of the Roman remains were already lost before excavation started, especially as layers were disturbed below the Roman ground level. Certainly in the case of large numbers, this kind of analysis can contribute to our understanding of find complexes.

The final economic chapter (Ch. 23) introduces dynamic aspects into the model, taking into account changes over time. The reconstruction shows that about three-quarters of income was used for direct consumption (fig. 23.1), with the rest spent on taxes, rents and investments for future consumption. A formula for savings is reconstructed and illustrated by means of the coin pattern of a gold hoard from Utrecht. These kinds of economic 'functions' are part of a model describing economic effects over time. It is shown how a stimulus of consumption can impact the economy for many years, depending on how saving and consumption patterns transfer activities to the future. For example, we see how an initial investment of 20,000 *denarii* can increase the value of production by 60,000 *denarii* in the long term. This means that founding Forum Hadriani may to some extent have had a positive 'multiplier' effect on the local economy. The chapter closes with a discussion of the extent to which the production increase of 0.2 million *denarii* did increase the wealth of the population. Forum Hadriani required a total additional production of 0.3 million *denarii* on a yearly basis, but about one-third was produced by the town population itself. In that respect, Forum Hadriani was one-third a producer city and two-thirds a consumer city. But the remaining additional 0.2 million *denarii* also brought some advantages to the local population, such as access to new products and better risk diversification. The inhabitants of Forum Hadriani 'within the town wall' were not all winners. Clearly the wealthiest 10% accumulated a level of wealth that they could not match in the native settlements, even as local leaders, as the luxurious town villa illustrates. For the approximately 30% at medium-wealth level, the picture is on average also still positive. The average house area of 200 m² is much larger than in native settlements, even if we subtract an average of 70 m² for working areas. Food was more varied and people had access to services like public baths and amphitheatre. The lowest wealth group however, at 60% the largest segment, must have consisted of a considerable number of 'losers'. Slaves were probably much more common in the cities than in the countryside. And the really poor in the cities probably had less access to food in times of crisis than people at the countryside. Overall, this leaves a mixed picture of the impact of Forum Hadriani on local wealth.

Chapter 24 describes the future of Forum Hadriani. It summarizes the city's possible social significance and describes the potential for further development as a World Heritage site, closely related to the nearby *limes*. A map shows the areas of special attention regarding the protection of remains (fig. 24.1), with a particular focus on remains outside the city walls such as cemeteries, harbours, fortifications, roads and remains of the ancient land division. I suggest that this land division may actually be a very rare example of the typical Dutch landscape going back to Roman times. For that reason, the remains could be an integral part of the potential World Heritage site. In order to sustain and develop the old heritage, I propose a step-by-step development of a green archaeological park that will increasingly reflect the old Roman town (e.g. by showing the old street grid). Also proposed is the introduction of handheld virtual reality technology to make reconstructions visible on site. Other suggestions include allocating Forum Hadriani a role in the National Historical Museum that is currently being developed. Regarding future research, items are suggested for a research agenda (table 24.1).

Finally, the brief epilogue (Ch. 25) looks at the extent to which a Roman town may be called Roman. It is tempting to compare Forum Hadriani, with its fairly complete ground plan, with other famous towns like Pompeii or nearby Xanten or Cologne. The easiest conclusion would be that Forum Hadriani is no more than a marginal, almost non-Roman town. But as stated in the introduction, Forum Hadriani may turn out to be closer to the average Roman town than for example Pompeii, which was rare in terms of its size and wealth. In this respect, Forum Hadriani offers a counterbalance in our knowledge. To conclude, Forum Hadriani is a fascinating 'forgotten' Roman town that should become part of the World Heritage.