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8. The fruits of better roads and waterways: facilitating fertiliser improvement through transport innovations

To get the off-farm fertilisers from the urban depots, middens and cesspits to the fields of the farmers and peasants, transportation was of key importance. Depending on the size of cities and the distance to the rural outlets, a smaller or greater number of intermediary tradesmen and transporters were involved in the manure trade.¹ Apart from the people organising the manure transport, the quality of the waterways and the roads on which the dung boats and carts were moving forward, might have impacted considerably on the diffusion of the off-farm fertilisers. The obstructive characteristics of inadequate transport, and hence high transport costs, during the *ancien régime* have been stressed in different studies.² Rick Szostak hypothesised that market access for farmers relied heavily ‘on the availability of low-cost transport, by road or water’, because agricultural produce was basically characterised by a low value/bulk ratio.³ A high share of charges for transporting agricultural products to markets would make cultivators turn to urban markets nearby and would by consequence hinder market integration.⁴

The connection between adequate transport and market access and market integration guided scholarly attention towards the 18th-century improvements to water and road transport (often labelled as a ‘transport revolution’). However, the scene was already set in the 17th-century Dutch Republic, as an integrated transportation network based on so-called *trekvaarten* (or canals) marked the blossoming economy of the Dutch Golden Age.⁵ Following the Dutch example, both England and the Austrian Netherlands were taking the lead in the 18th-century by improving existing waterways, constructing new canals and setting up a road building program resulting in a dense network of turnpike roads.⁶ Considering the construction of new paved roads, some authors question their favourable impact, because levying tolls at intermittent barriers alongside these roads would offset advantages such as the ability to carry

¹ For the Low Countries: Parmentier, ‘Résidus’, 410-411; Daru, *De kwestie der faecaliën*, 27. Cf. chapter 7XXX.

² A.o. Szostak, *The role of transportation*, 236-237; Bagwell, *The transport revolution*, 35-41; Blondé, ‘Feeding cities’, 130; idem, ‘At the cradle’, 106; Kaplan, *Provisioning Paris*, 596.

³ Szostak, *The role of transportation*, 236; see also Gerhold, ‘Productivity change in road transport’, 511-512.

⁴ Blondé, ‘Feeding cities’, 127-128; Blondé, however, recognised that transportation costs were only part of the decision-making process of farmers turning to urban markets. The size of the market was next to distance from the market centre an important aspect that was taken into consideration.

⁵ Studying the relation between economic growth and the improved passenger transportation on the *trekvaarten* in the Dutch Republic: de Vries, *Barges and capitalism*.

⁶ On England: e.g. Gerhold, ‘Productivity change in road transport’, 491-515; Bogart, ‘Turnpike trusts’, 479-508; Szostak, *The role of transportation*; Bagwell, *The transport revolution*; Hindle, *Roads and tracks*, 91-118; Hindley, *A history of roads*, 61-63; on the Austrian Netherlands: a.o. Blondé, ‘At the cradle’, 89-111; idem, *Een economie met verschillende snelheden*, chapter 4; Dejongh, *Tussen immobiliteit en revolutie*, 15.

heavier freights over longer distances with fewer horses in less time.⁷ Yet, in his study of English turnpike trusts, Dan Bogart argues that the turnpikes ‘did not raise freight charges by levying tolls’, but on the contrary helped to reduce 20 per cent of these costs.⁸ For 18th-century Brabant, Bruno Blondé strongly believes that favourable tariff conditions for agriculture were stimulating town-countryside transportation volumes in the second half of the 18th century; a claim he made by cautiously studying the evolution of collected barrier receipts.⁹

When a still widening consensus amongst economic and transport historians has been reached concerning the improved market access of rural production by the grace of the new transport infrastructure,¹⁰ the question whether the new roads and waterways also favoured agricultural productivity (through the supply of off-farm fertilisers) still needs to be scrutinised. By referring to the pitiable state of roads in the *ancien régime*, authors like Mark Overton and Donald Woodward relativise the magnitude of off-farm manures before 1800.¹¹ But when transport facilities improved and transportation costs would lower, then – in line with these historians – the use of urban waste could spread on a wider scale. In contrast, the British historian Liam Brunt formulated that if transport improvement indeed meant a lowering of transaction costs, this would not automatically result in a wider spread of urban manure use. A reduction of transport costs would be largely offset by the higher amount of money farmers were willing to pay for the fertilisers and hence the actual price of the product and the extent of its use would remain more or less the same.¹² The observation that the quick rise in the rural demand for urban fertilisers in Inland Flanders from the mid-18th century onwards was paralleled by major infrastructural improvements of both networks of water and road transport (cf. *infra*), insists on exploring the impact of better quality transport on the manure allocation. On the basis of the combined information of appraisals and tax lists, I will assess the difference of fertiliser inputs on the level of the village in the 1730s compared to what was needed in the later 18th century. I will relate this to the transport potential within my sample villages and

⁷ E.g. Buyst, Dercon and Van Campenhout, ‘Road expansion and market integration’, 185-219. This concerns a study of the market integration of wheat markets in the Austrian Netherlands, based on the analysis of monthly wheat prices.

⁸ Bogart, ‘Turnpike trusts’, 501.

⁹ Blondé, ‘Feeding cities’, 126-127, 134-136; idem, *Een economie met verschillende snelheden*, 156-162, 245-252; see also Dejongh, *Tussen immobiliteit en revolutie*, 236, 282-314.

¹⁰ Next to authors like Szostak, Bogart, Blondé, see also the recent contribution by Uebele and Gallardo-Albarrán, ‘Paving the way to modernity’, 69-92 with regard to the relation between market integration and the construction of paved roads in early 19th-century Westphalia. Also compare with: Hindle, *Roads and tracks*, 95-96. For a broader theoretical overview on market integration in Europe with references to transportation, see e.g.: Federico, ‘How much do we know about market integration’, 470-497.

¹¹ Overton, *Agricultural revolution*, 109; Woodward, ‘An essay on manures’, 267.

¹² Brunt, ‘“Where there’s muck, there’s brass”’.

survey the role of infrastructural improvements in the increasing application of off-farm fertilisers. In doing so, this chapter aims to enrich the corpus of literature dealing with the stimuli of improved transport for market access to sell agricultural produce, by looking at the access to farm inputs.

8.1 The rising rural demand for off-farm fertilisers on village level

Urban and industrial fertilisers had to find their way from the cities and towns to the countryside and the increasing use of these substances cannot but have resulted in a substantial increase of manure transports.¹³ In order to assess the aggregated rise in purchased fertilisers on the level of the village and to rate the extra transport needed, I related the farm level information of the *prijzijen* to two taxation lists of the seignior of Lichtervelde, one from 1730 and the other from 1780. I made use of the overall mean share of the popular off-farm fertilisers (night soil, ashes, lime and dove's dung) and the mean intensity level of application of these manures.¹⁴ On the basis of tax lists or *pointingen & zettingen*, I was able to calculate the total surface area on which farming households of the different size categories (0-1, 1-2.5, 2.5-5, 5-10 and more than 10 hectares) lived, pastured their livestock and grew arable crops.¹⁵ Though, the issue that some families not residing in the seignior of Lichtervelde, might have cultivated some plots of land within this jurisdiction, can distort the picture of farm size reconstructions.¹⁶ Nevertheless, the general trend of fragmentising farms still holds true. As the purchased fertilisers only ended up on arable fields, I tried to filter out the amount of arable land from the total taxed area. In our sample region, arable land made up the lion's share of the land use, and specifically for the region around Tielt, a census of 1765 pointed to a proportion of sowing land of 71 per cent of the total surface area.¹⁷ Even though it is most likely that the small peasant families kept even higher shares of their farms under cropland (by putting their cattle out to pasture along roads and creeks, which lowered the necessity of pastures of their own), whereas the larger farmers

¹³ Compare also Debaenst, *Historische stront*, chapter 4.

¹⁴ Because of the scarcer data for the latter half of the 18th century and as the difference between degrees and levels of off-farm manure use were clearly divergent in the first and second half of the century (cf. chapters 3 and 4), I calculated both the mean shares and the intensity levels for the 1720s-1740s and 1750s-1800s respectively. Because information on the specific numbers of barrels and wagons of applied fertilisers are even more scant, I did not diversify into farm size categories for calculating levels of manuring intensity (cf. chapter 3XXX). The levels of intensity were standardised in terms of *mudde* (i.e. the equivalent of one wagonload). 1 *mudde* = 12 barrels or *kuipen* = 24 baskets or *manden* = 48 casks or *vaten*: SAB, INV 121, *Aanwinsten*, no. 3263 and SAB, INV 121, *Aanwinsten*, 1145.

¹⁵ SAB, INV 129/6, *Archief van Lichtervelde (oud)*, no. 293, 295.

¹⁶ Critical attitude elaborated in Vermoesen, *Markttoegang*, 23-31. See also chapter 2.

¹⁷ Callens, *Leven en werken*, 201-202; see also Vanderpijpen, *De landbouw*, 36-38 on the basis of the *Mémoire statistique territoriale* of 1834, pointing to approximately 81% of cropland by then.

might have held a larger amount of meadows, our inability to differentiate between the farm size groups urged us to adopt the 71 per cent level as a rule of thumb to assess the arable land of the various social groups of households within the tax lists. The obtained amounts of arable land per farm size category were then multiplied by the overall mean rates of manure application of each kind of off-farm fertiliser and the average number of *mudde* (or one wagonload) of these fertilisers with which one hectare of arable land was dressed. In the case of the small cottagers applying urban night soil for instance, the overall application rate (i.e. taking into account both applying and non-applying households in this size category in the first half of the century) amounted to 3.7 per cent of the arable land under their cultivation in 1730 (sc. 34.2 hectares) at approximately 10.9 wagons a hectare, so that a total of 14 wagons was required around 1730. By 1780, the arable land cultivated by small cottagers (i.e. 47.8 hectares) was dressed with urban night soil for some 8.2 per cent at an intensity level of 21.8 wagons per hectare, which resulted in a total number of 86 wagons of urban night soil. This exercise was repeated for the other farm size categories and kinds of off-farm fertilisers, which finally resulted in the estimated aggregate numbers of wagons of off-farm fertilisers needed for the years 1730 and 1780, presented in table 8.1XXX.

Table 8.1 Estimated numbers of required wagons of off-farm fertilisers in 1730 and 1780 in the seignior of Lichtervelde

	Farm Size	N_{wagons} of night soil	N_{wagons} of ashes	N_{wagons} of lime	N_{wagons} of pigeon dung	Total N_{wagons} of off-farm fertilisers
1730	0-1 ha	14.0	0.5	0.0	3.5	18.0
	1-2.5 ha	20.0	1.4	0.0	2.7	23.9
	2.5-5 ha	52.6	3.5	0.0	6.7	62.8
	5-10 ha	65.6	15.5	4.0	25.3	110.4
	>10 ha	116.3	36.1	3.5	15.5	171.4
	<i>Total</i>	268.5	57.0	7.5	53.7	386.5
1780	0-1 ha	86.0	37.2	11.3	6.5	141.1
	1-2.5 ha	28.5	65.6	14.4	15.7	124.1
	2.5-5 ha	127.4	179.4	154.3	22.5	483.7
	5-10 ha	117.5	252.8	186.4	24.3	581.0
	>10 ha	39.4	351.6	203.6	19.8	614.3
	<i>Total</i>	398.8	886.6	570.1	88.8	1944.2

Source: database and SAB, INV 129/6, *Archief van Lichtervelde (oud)*, no. 293, 295.

According to the mean share and intensity of manuring with off-farm fertilisers in the appraisals and combined with the surface areas in the taxation lists, the total amount of required

wagons, loaded with urban and industrial fertilisers, for the seignior of Lichtervelde sharply increased from 387 wagonloads in 1730 to 1944 wagonloads in 1780. Due to the fact that more arable land was fertilised with urban manures¹⁸ and that more wagons of these soil improving nutrients were conveyed per unit area of land, the needed amounts of night soil, pigeon dung, ashes and lime all increased to a large extent, with the newly introduced lime and the clover boosting ashes recording the greatest rise. A more than fifteen-fold increase in the number of wagons loaded with ashes was needed, whereas the expansion of lime dressings also remarkably contributed to the rise of the estimated fertiliser transports in the course of the 18th century. The increase in the use of night soil (and pigeon dung too) was not so profound and hence did not challenge the existing transport infrastructure as much as the ash and lime soil improvers did.¹⁹ On the level of the farm size categories, our conclusions in the third chapter about the increasing impact of cottagers, small and middle-small peasant families adopting off-farm fertilisers indeed results in the increasing numbers of estimated wagons of off-farm fertilisers to be allocated to these farmsteads (with especially great impact of night soil and ashes). Whereas in the first half of the 18th century, no less than 72 per cent of all the manure transports were destined for the middle-large and large farmers, this proportion shrank to 61 per cent in the second half of the century, because a greater share of the supplied urban fertilisers was taken up by the peasant layers of the village community (28 per cent in the period before 1750 versus 39 per cent thereafter). The middle-large farmers slightly enhanced their inputs of urban night soil, whilst the large farmers downsized its application. The farm categories with more than 5 hectares under the plough foremost purchased ashes and lime, resulting in steep increases in the number of wagons needed. All in all, the extra 1557 wagonloads of off-farm fertilisers needed in 1780 in comparison to 1730 must have profoundly challenged the transport capacity in the area under study.²⁰

8.2 Transport potential: horses and wagons

Horsepower was the most important source of traction before the Industrial Revolution (with the breakthrough of steam power). Both with regard to road transport and inland navigation,

¹⁸ Although the overall share of night soil applications only increased sharply for the smallest cottage families and even lowered in the case of the large farmers, cf. chapter XXXX.

¹⁹ Compare chapters 3 and 7, when I argue that the supply of urban night soil underwent a reshuffle rather than the aggregate flows substantially increased.XXX

²⁰ Compare the observation by Vanderpijpen of the relative scarcity of horses in the countryside around Courtrai on the one hand and the cultivation of nutrient-demanding and hence transport-requiring crops like potatoes and especially flax in the same region on the other: Vanderpijpen, *De landbouw*, 421.

the horse was omnipresent and a sine qua non to harness to carts and track boats.²¹ In terms of transport speed, horses were to be preferred above oxen and mules.²² In Flanders, oxen and mules were hardly used on farms.²³ Like we saw in the previous chapter, large farmers carried out transport services for the smallholding families that did not and were not able to keep horses on their own.²⁴ Differences of horse keeping between the large-scale, market-oriented and specialised way of farming in the coastal region and the interior of Flanders dominated by peasant smallholdings could be discerned from some livestock censuses at the turn of the 18th to 19th centuries. By then, usually more than 10 horses per 100 hectares of land were available in Coastal Flanders, whereas in Inland Flanders this figure was more difficult to reach. Especially in our research area, horse keeping only amounted to 3 to 6 mares, geldings and/or stallions per 100 hectares of acreage in general (table 8.2XXX), which were amongst the lowest figures of Flanders.²⁵

Table 8.2 Number of horses in our sample villages, 1725, 1744, 1809 (related to the surface area of 1834)

Locality	Surface area 1834	N _{horses} 1725	N _{horses} 1725 100ha ⁻¹	N _{horses} 1744	N _{horses} 1744 100ha ⁻¹	N _{horses} 1809	N _{horses} 1809 100ha ⁻¹
Pittem	2416.05	93	(3.85)			138	5.71
Meulebeke	2936.08	75	(2.55)	40	(1.36)	78	2.66
Ingelmunster	1615.58	56	(3.47)	52	(3.22)	53	3.28
Tielt	4257.14	207	(4.86)	140	(3.29)	262	6.15
Egem	1026.38	29	(2.83)	24	(2.34)	33	3.21
Lichtervelde	2591.55	75	(2.89)			106	4.09
Torhout	4415.00	159	(3.60)			184	4.17
Zwevezele	2279.86	49	(2.15)	49	(2.15)	83	3.64

Source: CAA, *Land of Alost*, no. 1111; Callens, *Leven en werken*, 159-160 and Goossens, *De verre reis*, 21-22; Vanderpijpen, *De landbouw*, annexe III-8-11, III-14-16 (census 1809 and surface area 1834).

The results of the 1725 census and the census for some villages in the Castellany of Courtrai in 1744 are in line with the censuses that Vanderpijpen had processed for the later period.²⁶ Table 8.2XXX suggests that the availability of horses per 100 hectares of land slightly increased towards the later 18th century, although a methodological caveat has to be borne in

²¹ E.g. Bagwell, *The transport revolution*, 13-34.

²² Bergenfeldt, *Roads to market*, 92.

²³ Thoen, *Landbouweconomie*, 784-792; for our research area: Callens, *Leven en werken*, 266-268.

²⁴ Chapter 7. Cf. Lambrecht, *Een grote hoeve*, 113-133; Vermoesen, 'Paardenboeren', 3-37. The threshold for keeping horses on farms varied around an acreage of 5 hectares: Thoen, 'A 'commercial survival economy'', 111.

²⁵ Vanderpijpen, *De landbouw*, 416-423 and annexe III-8 until III-11 and III-14 up till III-16.

²⁶ 1725 livestock census: CAA, *Land of Alost*, no. 1111; 1744 inquiry of horses and wagons: SAC, 100/2, *Bruine pakken*, no. 5678.

mind: the 1725 and 1744 relative numbers are related to the 1834 surface area of the villages. Nevertheless, it is doubtful that the jurisdictional boundaries of the 18th-century parishes perfectly fitted with the delineations of the 19th-century localities.²⁷ What's more is that the 1744 figures resulted from an inquiry on behalf of the *hoogpointers* (tax officials) of the Castellany of Courtrai, investigating the numbers of horses and wagons in their jurisdiction in the light of transport service claims during the Austrian War of Succession. Therefore, the incidence of a certain level of fraud and a consequent underestimation of the transport potential is not unthinkable.²⁸ What we would expect concerning the relation between horses and wagons was confirmed: a clear 2:1 ratio of horses to wagons could be discerned from both the 1744 census and probate inventories of the Castellany of Courtrai, meaning that wagons – in contrast to the smaller carts – generally had to be pulled by a couple of horses.²⁹

Downscaling the scope to the level of the farm in the Castellany of Courtrai, Callens could observe that the number of horses per horse keeping household slightly increased during the 18th century, but that at the same time, the number of horse keeping farming families diminished. In the first half of the century, 36.6 per cent of the probates of the Castellany of Courtrai (or 287 out of 784), processed by Callens, registered horses, whereas this share dropped to 32.7 per cent in the second half (or 122 out of 373). Before 1750, 76.3 per cent of the horse keeping families (or 219 out of 287) kept more than one horse, while this proportion rose to 80.3 per cent in the later 18th century (or 98 out of 122).³⁰ He also observed an increase in the number of wagons on individual farms from 1.71 in the first half to 2.04 wagons in the second half of the century, pointing to increasing investments in transport means on the part of the large farmers.³¹ In the light of the ongoing process of the fragmentation of holdings, this seems quite a logical evolution: fewer households could keep horses due to the splitting up of farms – especially in the case of the meso-sized group around 5 to 10 hectares, which were balancing on the edge of being able or not able to keep a horse. Taking the 18th century as a whole, 76 out of 103 (or 73.8 per cent) farmers cultivating more than 5 hectares in our database of appraisals, kept horses.³² If we relate this percentage to the total number of households with farms of more than 5 hectares within the seigniorship of Lichtervelde on the basis of the taxation

²⁷ Therefore, the 1725 and 1744 relative numbers of horses per 100 hectares are between brackets.

²⁸ SAC, 100/2, *Bruine pakken*, no. 5678. This census was processed by Irmgard Callens: Callens, *Leven en werken*, 278-282 and annexe 159-160. Ines Goossens related the information in the census with the 1834 village surfaces within the scope of her bachelor's thesis: Goossens, *De verre reis naar de markt*, 21-22.

²⁹ Callens, *Leven en werken*, 282 and annexe 159-160; Goossens, *De verre reis naar de markt*, 21, 27.

³⁰ Callens, *Leven en werken*, 254-255; similar findings were obtained for our sample locality of Lichtervelde on the basis of probate inventories: Goossens, *De verre reis naar de markt*, 19-21.

³¹ Callens, *Leven en werken*, 281; see also Lambrecht, *Een grote hoeve*, 128-129.

³² 2.5 horses per farm on average, cf. database.

lists (i.e. 92 households in 1730 and 83 households in 1780), this would imply that in 1730 some 68 farm households out of a total of 379 families (or 17.9 per cent) possessed horses, whilst in 1780 this number had decreased to approximately 61 horse keeping farmers to a total of 477 households (or 12.8 per cent). This meant that more wagons of off-farm purchased fertilisers had to be conveyed from the rural depots to the fields of cultivators by fewer farmers with transport means. If we start from the assumption that all farmers with horses carried out transport services with one (pair of) horse(s) and one wagon in a time, each farmer should have undertaken between 5 and 6 journeys with horse and wagon in 1730 to provide the cultivators of Lichtervelde with urban and industrial fertilisers (including their own provision).³³ Under the same conditions, farmers had to head to the collection places for loading their wagons with fertilisers and return to Lichtervelde for unloading them on the fields for no less than 31 times in 1780.³⁴ The real rise in the manure transport activities of large farmers would probably not have been as steep as estimated here. After all, the entrepreneurs of the rural distribution centres who possessed horses and wagons were also able to deliver the fertilisers to the smallholding families. But still, in times of rising demand for off-farm fertilisers, the majority of these substances had to be transported by a decreasing number of farmers owning the required transport means. This situation points to higher levels of specialisation in transport services on the part of the horse keeping farmers (or at least some amongst them), whilst the bond between large farmers and small peasants (who relied on the large farmers' transport services)³⁵ will only have further strengthened.

8.3 Transport improvements between city and countryside: water and land

On map 8.1XXX, the opening up of our sample villages is shown.³⁶ Our sample localities are indicated, together with the main cities of Bruges, Courtrai and Menin, and smaller towns like Furnes, Diksmuide, Roeselare, Nieuwpoort and the important port city of Ostend. Taking a look at the map, the new paved roads – especially the ones connecting Bruges to Menin and Bruges to Courtrai – cut across our research area, so that we can question if they impacted on the waste trade. Like we saw in the previous chapter, the transport of urban manure to depots in the countryside often occurred via waterways. The most important supply routes via water for our sample region consisted of the rivers Lys, flowing through Courtrai, and the river Yser, which

³³ I.e. 387 wagonloads divided by 68 farmers = 5.7 wagonloads per farmer in 1730.

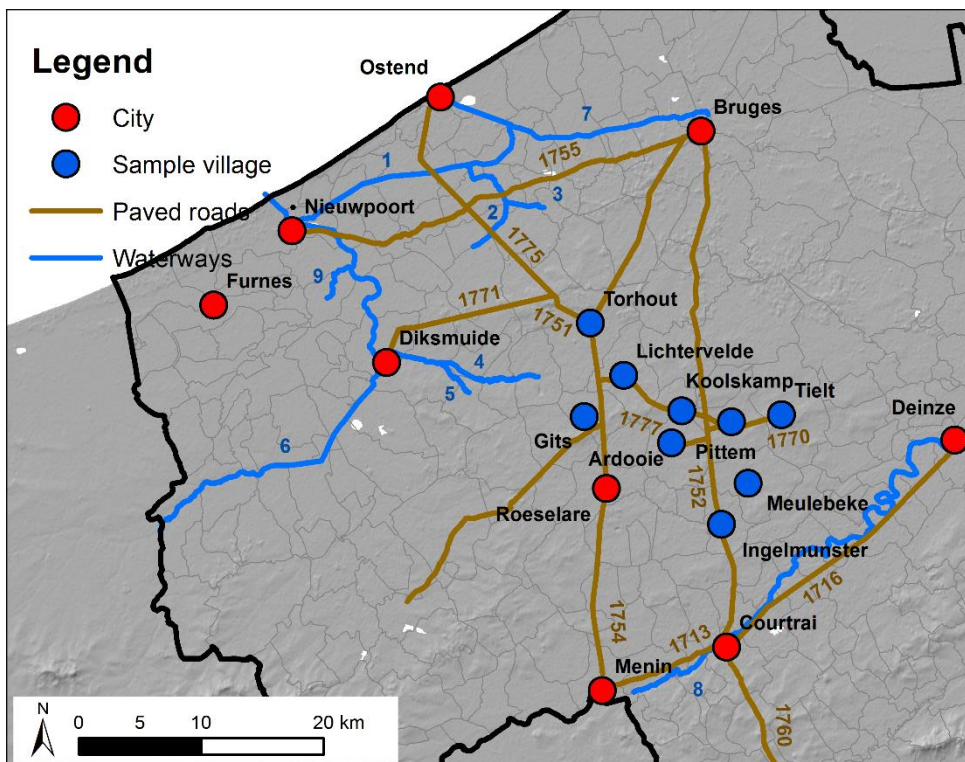
³⁴ I.e. 1944 wagonloads divided by 61 farmers = 31.9 wagonloads per farmer in 1780.

³⁵ Lambrecht, 'Reciprocal exchange', 243-245; idem, *Een grote hoeve*, 123-131.

³⁶ Not all the newly constructed paved roads and improved waterways had been depicted on this map ; only the transport routes that were or could have been of importance for our sample villages, are shown.

demarcated for a large part the border between the Franc of Bruges and the Castellany of Furnes. Apart from these rivers, some canals and canalised rivers helped to bridge the distance between towns and countryside: the canalised rivers Zarrenbeek and Handzamevaart and the canals Moerdijkvaart and Bourgognevaart, which are on their part flowing into the larger canal between Nieuwpoort and Plassendale.

Map 8.1 Water and road transport and the opening up of the Land of Wijnendale and the district of Tielt, 18th century



Source: Haelewyn, *Oostenrijkse wegen in West-Vlaanderen*, 21-49; Urbain, 'La formation du réseau des voies navigables', 273, 278-279, 300; Ferraris map; map layout: Iason Jongepier (Gistorical Antwerp). 1 = Nieuwpoort-Plassendale canal; 2 = Moerdijkvaart; 3 = Bourgognevaart; 4 = Handzamevaart; 5 = Zarrenbeek; 6 = Yser; 7 = Bruges-Ostend canal; 8 = Scheldt.

The transport of bulk goods – among which fertilisers too – must have benefitted from some infrastructural improvements to the existing waterways. Indeed, the waterways central to the manure supply of our sample region were already existent from the 16th or 17th centuries. The canal of Handzame and its southern arm (i.e. the Zarrenbeek) were already dug in the 16th century, whereas the Nieuwpoort-Plassendale canal was constructed between 1638 and 1640, aiming at connecting Bruges over Nieuwpoort to the at the time important port of Dunkerque.³⁷

³⁷ Urbain, 'La formation du réseau des voies navigables', 273, 278-279.

During the reign of the Austrian Habsburg monarchy, considerable investments in the improvement of the waterway network were made. In the later 18th century, the river Lys was canalised by means of several artificial meander cut-offs, which stimulated the shipping activities.³⁸ The existing canal of the Moerdijkvaart (and Bourdognevaart) underwent considerable repair works around the middle of the 18th century, that boosted the manure transports on this waterway as we will see below.³⁹

Besides the canalisation projects, the road building program really took off in the second half of the 18th century. In Flanders, the Austrian central government together with regional policy makers at the level of the Estates of Flanders and the constituent castellanies not only aimed at stimulating the transit trade (which heavily relied on the port of Ostend), but in the light of their physiocratic viewpoints also tried to encourage agricultural production.⁴⁰ The opening up of our region had started with the construction of the paved road between Courtrai and Menin in 1713, and between Courtrai and Ghent in 1716-1722.⁴¹ However, these new roads shall not have directly influenced the connection of the rural area under study to the cities and towns in its vicinity. The actual breakthrough of the stone slab paved roads in this area commenced from the 1750s onwards, with the construction of the following transport arteries:⁴²

- 1750-1752: Courtrai-Bruges, a paved road running across the district of Tielt, on the territories of the villages of Ingelmunster, Meulebeke and Pittem;⁴³
- 1751-1754: Menin-Bruges, traversing the Land of Wijnendale including our sample localities of Gits, Lichtervelde and Torhout;⁴⁴
- 1751: Torhout-Wijnendale, a road connecting Torhout to the castle of Wijnendale, which was a project instigated by the lord of Wijnendale, Karl Theodor von Neuburg, Elector of the Palatinate;⁴⁵
- 1755: Nieuwpoort-Bruges, crossing both the paved roads from Courtrai and Menin to Bruges, and the Moerdijkvaart;

³⁸ Ibidem, 300; see also: Balduck, 'Aanpassingen aan de Leie', 381-394.

³⁹ Urbain, 'La formation du réseau des voies navigables', 295; SAB, TBO 126, *Kerkfabriek Eernegem*, no. 13-14; see also Vandenbussche, 'Binnenschippers', 346-379.

⁴⁰ A.o. on the transit trade: Coenen, *Carriers of growth*, 255-270; Serruys, 'The Austrian Netherlands' transit policy', 150-170; on the motives of the road building program: Blondé, 'Feeding cities', 124; Dejongh, *Tussen immobiliteit en revolutie*, 285-286; Haelewyn, *Oostenrijkse wegen in West-Vlaanderen*, 10-11.

⁴¹ Arickx, *De aanleg van de steenweg Kortrijk-Gent*; Haelewyn, *Oostenrijkse wegen in West-Vlaanderen*, 21-22.

⁴² Haelewyn, *Oostenrijkse wegen in West-Vlaanderen*, 21-49.

⁴³ Haerynck, *De verbinding Brugge-Kortrijk*, 63-69 (with regard to the precise location line).

⁴⁴ Delameilleure, Frédéric, *Tracé, aanleg, financieel beheer*, 42-55.

⁴⁵ Haelewyn, *Oostenrijkse wegen in West-Vlaanderen*, 30.

- 1760: Courtrai-Tournai, a former Roman road or *heirbaan*, by then completely dilapidated.⁴⁶ The location line was complementary to the trajectory from Bruges to Courtrai;
- 1770: Tielt-Ardoeie, which consisted in fact of two so-called ‘*armsteenwegen*’ or paved roads branching off from the main transport artery (which was in this case the connection between Courtrai and Bruges).
- 1769-1771: Diksmuide-Wijnendale;
- 1764-1775: Wijnendale-Ostend, which intersected the Moerdijkvaart, the canal Nieuwpoort-Plassendale and the paved road between Nieuwpoort and Bruges;
- 1775-1777: Lichtervelde-Koolskamp-Tielt, connecting the main roads from Menin and Courtrai to Bruges. From Pittem, the location line was attached to the ‘*armsteenweg*’ to Tielt.
- Ypres-Poelkapelle and Poelkapelle-Gits, connecting the city of Ypres to our sample villages in the Land of Wijnendale. The road from Ypres to Poelkapelle had been already paved in the 17th century. Little is known about the finalisation of the connection to Gits, since its construction had started without official patent request and was completed piece by piece. The part of the road connecting Hooglede and Gits figures on the map of Ferraris (1777-1778).⁴⁷

The opening up of both the district of Tielt and the Land of Wijnendale had been improved in the later 18th century by the abovementioned infrastructural works to both water and road transport. The question remains than if and how these improvements to the transport network impacted on the manure trade.

8.4 Manure transport over land and water: complementarity or competition?

Water transport had some advantages in comparison to transportation over land. It was cheaper to carry bulk goods on rivers and canals than on roads, as with a comparable tractive power a lot more of cargo could be moved.⁴⁸ However, shipping goods was considerably slower vis-à-vis carting on roads.⁴⁹ Seasonal instabilities impacted on transport in the case of water as well as land. Paved roads reduced the impact of seasonality, because they enabled transport during the winter months, unlike their sandy counterparts that were often in poor condition then due to

⁴⁶ Ibidem, 48-49.

⁴⁷ Ibidem, 43.

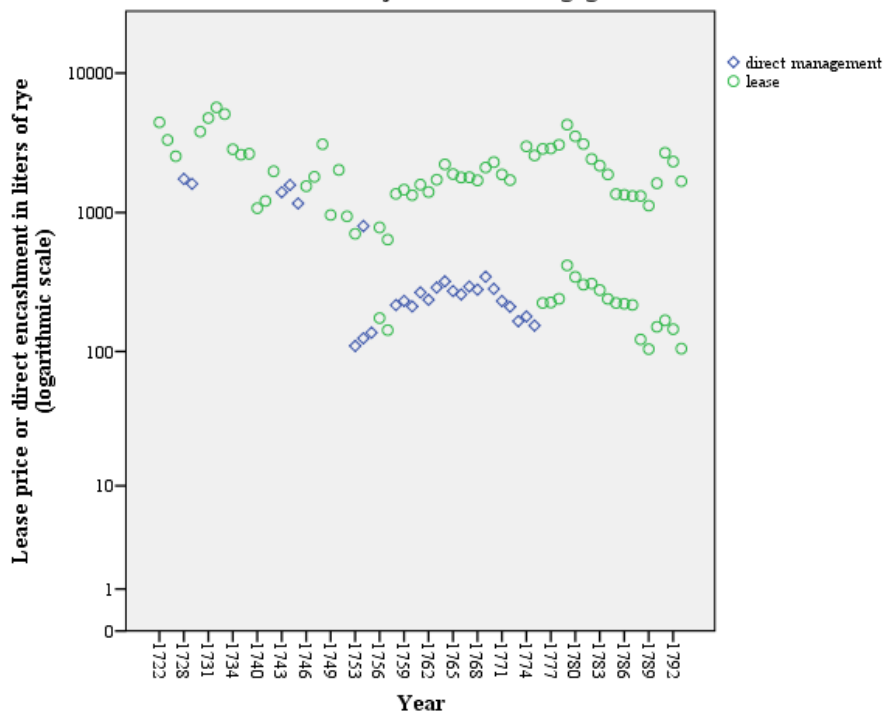
⁴⁸ A.o. Blondé and van Uytven, ‘Langs land- en waterwegen’, 136; van Uytven, ‘Transport- en verbindingswegen’, 219; Barker and Gerhold, *The rise and rise of road transport*, 3; Hindley, *A history of roads*, 58-59.

⁴⁹ A.o. Blondé and van Uytven, ‘Langs land- en waterwegen’, 139-140; van Uytven, ‘Transport- en verbindingswegen’, 219-220.

the heavy rains.⁵⁰ In regard to water transport, frosty weather in heavy winters and a low water level in dry summers impeded shipping traffic.⁵¹ This became apparent in the first half of the 18th century for the canals Moerdijkvaart and Bourgognevaart.

From 1722 onwards, the poor table of the village of Eernegem obtained the right to measure the content of the track boats on the Moerdijkvaart and Bourgognevaart, loaded with manure and ashes.⁵² As the description ‘ashes, pellets, night soil and other short manures’ suggests, it most probably concerned the supply of urban night soil and/or solid waste and perhaps also excess stable manure from the coastal region apart from ashes which either originated from the bleach or soap industries of Bruges or were imported from the Republic (i.e. Dutch peat ashes). The right to tax track boats was leased out by auction. Graph 8.1 XXX represents the evolution of the lease price in real terms (deflated for the price of rye).

Graph 8.1 Revenues of the tax right to measure ships loaded with manure and ashes on the Moerdijkvaart and Bourgognevaart



Source: SAB, TBO 126, Kerkfabriek Eernegem, no. 13-14

⁵⁰ See for instance Bogart, ‘Turnpike trusts’, 493; Szostak, *The role of transportation*, 19; Blondé, *Een economie met verschillende snelheden*, 199-200; however, the impassibility of sandy tracks during the winter has been questioned by Gerhold, ‘Productivity change in road transport’, 501.

⁵¹ Bagwell, *The transport revolution*, 13-15;

⁵² SAB, TBO 126, *Kerkfabriek Eernegem*, no. 13, no. 14 (citation in the accounts of 1755: ‘*asschen, cuttels, bout ende ander cort mesch*’); Vandenbussche, ‘Binnenschippers’, 363.

Until 1751, the taxation right for both the Moerdijkvaart and Bourgognevaart was given to a single leaseholder, whereas in the second half of the century, the measuring rights for both canals were separated (which is also visible on the graph). In the years of 1724, 1727, 1743, 1752 and 1754-1755 repair works were carried out or the canals had been dried out due to dry summer seasons (such as in 1752), so that navigation was impossible for a shorter or a longer time in these years.⁵³ That was the reason why during these years, the lease of the tax right was cancelled and only the real cargo of the ships passing by the tollhouse had been taxed in a system of direct management under the control of the aldermen of the poor table (cf. graph 8.1XXX). As manure supply was disturbed in these years, bidders supposed that the demand for fertilisers had increased in the following years and thus they dared to bid higher lease amounts. This situation offers an explanation for the peak values in the first half of the 18th century. At least for the busy lane of the Moerdijkvaart in contrast to the less popular Bourgognevaart, the repair works must have been fruitful, because the records did not mention reduced traffic possibilities and direct encashment was not needed anymore in the second half of the century. Moreover, the lease prices increased in the period 1750-1780, pointing to the increasing supply of manures and ashes in these years of growing rural demand for off-farm fertilisers.⁵⁴ However, in the 1780s, the three-yearly lease prices dropped from 69 Flemish pounds (lb.) *groten* for the period 1780-1782 over 47 lb. *groten* in 1783-1785 to not more than 30 and 31.5 lb. *groten* in 1786-1788 and 1789-1791 respectively, after which it stabilised around 48 lb. *groten* in 1792-1794.⁵⁵ The troublesome and disturbing years of the French Revolution might explain the low amounts at the beginning of the 1790s, but cannot offer an explanation for the sudden drop in the early 1780s, a period characterised by a high demand for off-farm fertilisers in the countryside. The construction of the Austrian paved road from Ostend to Wijnendale, finalised in 1775 with its position parallel to that part of the Moerdijkvaart from the Nieuwpoort-Plassendale canal up to the splitting of the Moerdijkvaart and the Bourgognevaart (cf. map 8.1XXX), most probably resulted in competition to the shipping traffic on these canals. Loads of ashes and perhaps also night soil could be transported faster over the newly paved road than over water. Moreover, at the intersection of the Moerdijkvaart and the Ostend-Wijnendale road, the cargo had to be defreighted from the ship into wagons anyhow in order to reach the inland region. This was a time-consuming effort, like a piece of

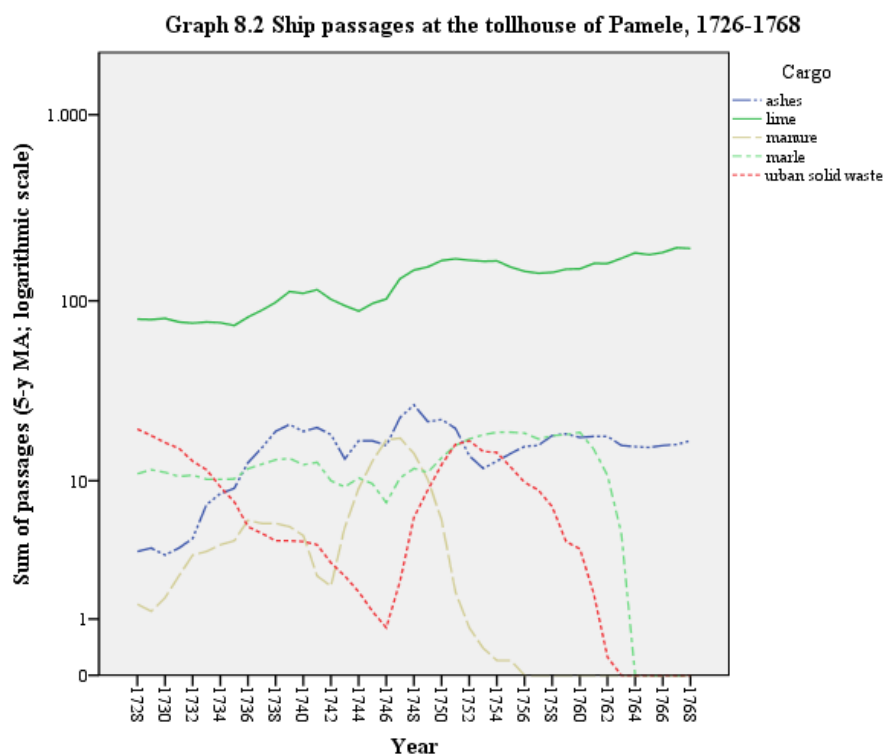
⁵³ Vandenbussche, 'Binnenschippers', 365; SAB, TBO 126, *Kerfabriek Eernegem*, no. 13-14. The account of 1752 mention the dry summer season: '[...] ter oorsaecke heel het somersaeysoen de vaert is gheweest sonder waeter'.

⁵⁴ cf. chapters 3 and 4.

⁵⁵ SAB, TBO 126, *Kerfabriek Eernegem*, no. 14.

litigation of 1746 informs us: to load and unload a ship of manure, the workers of shipmen François Monteyne needed in each case one entire day.⁵⁶ In other words, a trade-off between carrying more freight at a slower speed and lower costs (i.c. navigation) or smaller loads at higher speeds, but also at higher costs (i.c. road transport) had to be made and it was apparently in favour of the latter at the end of the 18th century.⁵⁷

Such an intermodal competition between manure shipping and manure transport on roads might also have played a role in the case of navigation on the major fluvial artery, the Scheldt river. The lordly right of the toll of Pamele, part of the town of Audenarde, left behind registers with the individual ship passages and the tolls levied.⁵⁸ I analysed the transit for the ships loaded with either lime, ashes, marle, unspecified kinds of manure or urban night soil on the basis of these toll registers processed by Van der Meiren. When we compare the number of passages of ships loaded with marl, *rapeling* or (urban) solid street waste, ashes and lime some remarkable findings come to the front (compare graph 8.2XXX).



Source: Van der Meiren, *Transport in Oudenaarde*, 46-61

⁵⁶ SAC, 101/3, OSAK, no. 8010. See also chapter 7XXX.

⁵⁷ Similar examples of intermodal competition can be found in the Duchy of Brabant: e.g. the paved road from Malines to Louvain implied fierce competition to the shipping traffic on the river Dijle. Blondé recognised that transport over water was and remained cheaper, but argued that the difference in transportation costs on tracks with competing alternatives (i.c. a river or canal and a paved road) tended to decrease: Blondé, *Een economie met verschillende snelheden*, 221-224.

⁵⁸ Van der Meiren, *Transport in Oudenaarde*, 46-61; City Archive Audenarde (further CAAu), *Pamele baronie*, no. 75-89. See also chapter 7XXX.

The number of times ships, loaded with marl, passed the tollhouse tended to increase in the 1750s and early 1760s, but then suddenly vanished from sight. We can observe similar trends in the case of both the broad category of manure and (urban) solid waste. In the light of the rising demand for off-farm fertilisers, this seems not a quite logical evolution. However, a number of explanations can be put forward. It is likely that – like in our sample region – solid kinds of fertilisers were less in demand for stimulating flax and clover cultivation, but this cannot explain the sudden drop of the equivalent of lime fertiliser, sc. marl, of which we can expect that demand even increased.

In this case, the gradual pavement of the road connection between Ghent and Audenarde along the river Scheldt (started in 1764 with smaller repair works to the existing pavements and gradually expanded in scope) contributes to the explanation why marl transports dropped: using the paved road for shorter distances was quicker than navigation on the river.⁵⁹ However, transport of ashes by ship remained quite stable, whereas transport of lime steadily increased. This can be clarified by two arguments: first, ashes and lime even more so were not only contributing to agricultural production as a fertiliser, but were also used as building material in the construction industry (lime) or as basic material in glassworks, soap and bleach works (ashes), so that the precise evolution of the shipping traffic cannot be attributed to the fertiliser market only. Secondly, these substances often had to be carried for longer distances. In 1761 for instance, no less than 16 shiploads of lime had to be carried from Audenarde (the lime most likely came from Hainaut) towards the canal of Louvain to be used for the restoration of this canal.⁶⁰ It is not unthinkable that in the case of ashes, imported from the Republic, or lime, originating from Hainaut, larger distances had to be bridged in order to supply the many different rural regions. For longer distances, inland navigation still remained the best solution to carry great amounts of bulk goods.⁶¹

Apart from the intermodal competition, inland shipping and road transport could also be complementary, especially when the waterways and paved roads were not located nearby and parallel to each other, but in line. With regard to the delivery of off-farm fertilisers to the

⁵⁹ On the road connection between Ghent and Audenarde: Génicot, 'Étude sur la construction des routes', 441-443 (the castellanies obtained the right in 1764 to carry out repair works to existing paved roads, but it turned out that this legislation was used by the castellanies to start the construction of new paved roads without official patent request); Van der Meiren, *Transport in Oudenaarde*, 79-82. According to Guy Dejongh, patent requests for roads parallel to existing waterways were not accepted prior to the last quarter of the century, because the government tried to bolster a complementary transport network and avoid intermodal competition: Dejongh, *Tussen immobiliteit en revolutie*, 289-290.

⁶⁰ CAAu, *Pamele baronie*, no. 85, 86.

⁶¹ Compare Bagwell, *The transport revolution*, 13-28; Blondé, *Een economie met verschillende snelheden*, 222.

fields of the cultivators, *door-to-door* transport was a prerequisite. Road transport unequivocally enabled this final step of the supply chain.⁶² Therefore, we can question if the road improvement schemes and the increased demand for off-farm fertilisers acted as converging lines.

8.5 Facilitating fertiliser improvement

The description and depiction of the improvements to waterways and roads at least indicates and visualises the better integration of our sample villages into a transport network. Map 8.1XXX also displays that fertilisers supplied via the Lys, the Handzamevaart and Zarrenbeek, and the Moerdijkvaart and Bourgognevaart, had to be carried from the landing stages to the cultivators' fields by horse and wagon.⁶³ Concerning the north-south connection between our sample villages and cities like Ypres, Menin, Courtrai and Tournai even further to the south, road transport was often the only option left. With the increasing numbers of wagons of off-farm fertilisers needed (and particularly the great boom in the case of ashes and lime) clearly in mind (cf. paragraphs 8.1 and 8.2 above), we can hypothesize that the new paved roads contributed to the fulfilment of the transport requirements and hence stimulated town-countryside traffic (with manure transports as important component).

For the Courtrai-Bruges paved road, Stephanie Haerynck could trace some complete barrier receipts: the revenues from the barrier at the *Brugse Poort* (i.e. a city gate of Courtrai) for the period 1753-1769 and – unfortunately only for a few years (1753-1757) – the receipts of a barrier at the *Ten Doorne* chapel in Ingelmunster, some 12 kilometres from the city.⁶⁴ These barrier receipts are difficult to interpret, since splitting these revenues into their constituent components (town-countryside or inter-urban traffic, traffic of passengers or merchandise, transit trade, etc.) turned out to be impossible.⁶⁵ Furthermore, the favourable tax base for farmers (free passage to their fields or reductions when heading to the urban markets), let to the receipts' bias in favour of inter-urban traffic.⁶⁶

⁶² Blondé, *Een economie met verschillende snelheden*, 222; Dejongh, *Tussen immobiliteit en revolutie*, 286.

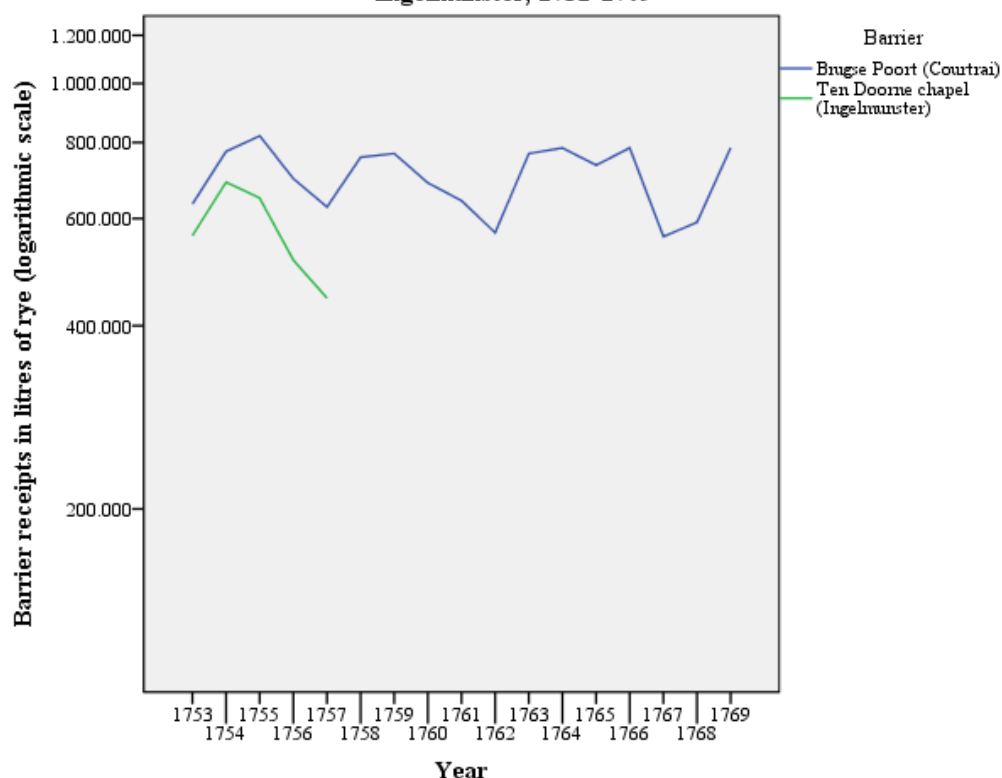
⁶³ See also: Hollevoet, *Markegem*, 241 referring to farmers with their wagons from the district of Tielt heading to the landing stages along the Lys river to obtain manure.

⁶⁴ Haerynck, *De verbinding Brugge-Kortrijk*, 95-101, annexe O2-O11.

⁶⁵ Blondé, 'Feeding cities', 134; idem, *Een economie met verschillende snelheden*, 227-228, 245-253.

⁶⁶ Blondé, 'Feeding cities', 127; idem, 'At the cradle', 90.

Graph 8.3 Barrier receipts at the Brugse Poort in Courtrai and Ten Doorne chapel in Ingelmuuster, 1752-1769



Source: Haerynck, *De verbinding Brugge-Kortrijk*, annexe O2-O11

Little can be said about the evolution of transport volumes on the Courtrai-Bruges paved road due to the limited time scale. Though, the comparison between barrier receipts on one and the same road may provide valuable insights according to Blondé, arguing that ‘by their very nature, barriers located close to the towns were to a larger proportion influenced by ‘agricultural traffic’, and as a result, they (generally speaking) also yielded more revenue’.⁶⁷ This becomes apparent too for the *Brugse Poort* and *Ten Doorne chapel* barriers (graph 8.3XXX). The barrier closest to the city indeed collected more barrier taxes than the other one located 12 kilometres further (at equal barrier tariffs). The dispersion between the two even tended to grow (from a 11 per cent difference in 1753 and 1754 over 21 per cent in 1755 to even differentials of 27 and 29 per cent in 1756 and 1757 respectively), alluding to the possibility of growing town-countryside traffic (although the scarce data hamper firm conclusions on this).

In chapter 4XXX, a logistic regression analysis showed that the cultivator’s decision to buy additional off-farm fertilisers depended on crop choice⁶⁸ as well as the on-farm fertilisation

⁶⁷ Blondé, ‘Feeding cities’, 134-136 (citation on page 134); idem, ‘At the cradle’, 96-98.

⁶⁸ I.e. the stimulating influence of flax and clover cultivation.

strategy⁶⁹ and also made clear that the chance of cultivators buying extra urban and industrial nutrient inputs sharply increased from the mid of the 18th century onwards. In order to assess the impact of the road building program, we should ideally gain access to information on transport speed, the precise evolution of the carrying capacity and the exact share of fertiliser transport to the total amount of wagons on these arteries for a considerable number of years. Unfortunately, we lack this kind of information. Moreover, if we would have such a detailed overview for the period after the construction of the roads, we would still grope in the dark with regard to speed and transport volumes before the road improvements. In order to grasp the impact of a better road network on the purchase of off-farm fertilisers, I estimated the improved opening up of our sample villages by introducing dummy variables into the logistic regression analysis. These dummies represent our localities' proximity to the nearest road arteries, with 1 symbolising the absence of a paved road, 2 the presence of a paved road and 3 the presence of paved roads closer to our sample villages, thereby accounting for the time when the construction of the paved roads had finished.⁷⁰ This variable has been introduced into our model instead of a categorical time variable that merely represented the succeeding decades from the 1720s to the early 1800s. The gradual opening up of our sample villages by the construction of several Austrian paved roads contributed to a significant logistic regression model, assessing the importance of the usage of urban and industrial fertilisers.⁷¹ The transport improvements should not be seen as a factor determining if households turned to the use of off-farm fertilisers or not, but they facilitated the supply of the urban and industrial fertilisers, that grew ever higher in demand.

⁶⁹ With the decline of the fertilisation degree, but the increasing level of fertilisation intensity, which concurred with extra manure purchases.

⁷⁰ For Meulebeke: 1719-1751 = 1; 1752-1800 = 2 (Courtrai-Bruges paved road); Pittem: 1719-1751 = 1; 1752-1769 = 2 (Courtrai-Bruges); 1770-1800 = 3 (Tielt-Ardooie); Ingelmunster: 1719-1751 = 1; 1752-1800 = 2 (Courtrai-Bruges); Tielt: 1719-1751 = 1; 1752-1769 = 2 (Courtrai-Bruges); 1770-1800 = 3 (Tielt-Ardooie); Gits: 1719-1753 = 1; 1754-1779 = 2 (Menin-Bruges); 1780-1800 = 3 (Poelkapelle-Gits, assessed to be finished around 1780); Lichtervelde: 1719-1753 = 1; 1754-1776 = 2 (Menin-Bruges); 1777-1800 = 3 (Lichtervelde-Koolskamp-Tielt); Torhout: 1719-1753 = 1; 1754-1800 = 2 (Menin-Bruges). Proximity village centre – paved road calculated by GIS software.

⁷¹ Regression equation: $\ln \frac{\pi(x)}{1-\pi(x)} = -1.304 - 0.018X_1 + 0.047X_2 + 0.070X_3 + 3.059X_4 + 3.577X_5$ with X_1 the on-farm fertilisation degree, X_2 and X_3 the share of respectively clover and flax on the fields to the total cultivated area per household and X_4 and X_5 categorical variables for the dummies representing 2 (the presence of a paved road) and 3 (the presence of a paved road closer to the centre of the village), with dummy value 1 (the absence of a paved road) as reference level. $N_{\text{fertilising with on-farm manure only}}$: 213; $N_{\text{buying extra off-farm manures}}$: 106. The LRT-test with p-value of 0.000 indicates the significance of the entire regression model, as well as the addition of the extra variables, whereas the Wald-tests are significant for all separate variables: p-value of 0.014 for the on-farm fertilisation degree, p-value of 0.036 for the share of clover, p-value of 0.040 for the share of flax, p-value of 0.000 for the dummy variable.

This finding has been often approved by contemporaries. Contemporary travellers or writers sometimes reported on the relevance of transport improvements for the supply of fertilisers in a region. In Yorkshire for instance, it was only after the rivers Aire and Calder, followed by the Don, were made navigable in the course of the 18th century that Yorkshire limestone was quarried and lime became popular as soil improving nutrient.⁷² Also the new paved roads – both in the Austrian Netherlands and abroad – are supposed to have boosted the manure supply, according to contemporary observers like Nicolas Bacon, tradesmen from Brussels (1710-1779).⁷³ A treatise of 1778 that enumerated the advantages of the construction of new paved roads (for the Duchy of Brabant), stressed beneficial effects to agricultural growth and argued that farmers could better provide themselves with manure thanks to adequate transport connections.⁷⁴ The patent requests (or *octrooien*) of the new turnpike roads often incorporated the better facilitation of manure transport as part of their argumentation. The main transport arteries between Courtrai and Bruges and between Menin and Bruges were believed to ease the provision of lime and ashes from Hainault (and especially from the city of Tournai within this province, which figured prominently in the appraisals as locus of origin of lots of lime and ashes).⁷⁵ As the third point of the argumentation of the request for the paved road between Courtrai and Bruges, it was said that ‘*the agriculture cannot be supported if no good manure, neither in quality nor in quantity, could be obtained, and it is to everyone’s knowledge that the warm lime and lime ashes from Tournai, the pigeon dung and other kinds of manure can be supplied easily and in great quantity by means of the paved road to Courtrai.*’⁷⁶ It was also stressed that the manure transport between Tournai and Courtrai accounted for ‘*at least half of the barrier receipts of the paved road from Courtrai to Tournai.*’⁷⁷ Even in the patent request of the paved road from Lichtervelde over Koolskamp to Ardoonie, the initiators of the project appealed to the connection of these villages via Pittem and Tielt with the city of Deinze along the border of the Lys river to enabling the provision of urban manure and even lime.⁷⁸ The reduced impact of seasonality was also an argument in favour of new paved roads in a time

⁷² Hey, *Packmen, carriers and packhorse roads*, 147; see also Szostak, *The role of transportation*, 237.

⁷³ E.g. Gerhold, ‘Productivity change’, 512; Blondé, ‘Feeding cities’, 124; see also remarks of Nicolas Bacon on the importance of the new roads for the provision of the countryside with fertilisers: Hasquin, *Les réflexions*, 64.

⁷⁴ Zylbergeld, ‘Bruxelles et les demandes d’octrois’, 205.

⁷⁵ Haerynck, *De verbinding Kortrijk-Brugge*, 48; Delameilleure, *Aanleg, tracé, financieel beheer*, 138.

⁷⁶ SAC, OSAK, no. 4998, my translation of: ‘[...] *de agriculture niet en can worden bevoordert als geene goede vette nocte in abundantie tot meenen te becomen sijnde ende het is van goede kennisse vande apposanten ende van ieder een dat de waerme calck ende calckasschen van Doornyck, de duyvevette ende andere mesch gemaeckelijck ende in grootte quantiteyt bij middel van de steenwegh op Cortrijck souden connen gehaelt worden*’.

⁷⁷ SAC, OSAK, no. 4998, my translation of: ‘[...] *soo verre dat daervuyt voortcomt ruym de helft van het provanu vande barrieren vande calsjide wegh van Cortrijck op Doornijck*’.

⁷⁸ SAG, *Raad van Vlaanderen*, no. 30839.XXXSAG al gebruikt?XXX

when the number of transport providing farmers came under pressure. After the construction of paved roads, farmers ‘*could augment [their manure transports] when they were at ease for the whole year to be able to get [the fertilisers]*’, whereas before the paved roads, they only had but a short time to provide themselves with off-farm fertilisers, because in winter roads were often in too bad conditions and in summer they needed their wagons for carrying sheaves of grain to the barns.⁷⁹

However, the impact of the new roads should also be nuanced. The collection and distribution depots in Werken, Zarren and Handzame were not directly connected to our sample villages in the Land of Wijnendale by newly constructed paved roads. Nevertheless, 14 out of 93 farming families in the localities of Gits, Lichtervelde and Torhout (or 15.1 per cent), who bought off-farm fertilisers of which the origin is known, obtained either lime from the depot of Werken or night soil or ashes from the landing stages in Handzame. Still, the off-farm fertilisers originating from the cities of Courtrai, Menin or Tournai and applied in the sample area around Lichtervelde (sc. 82 out of 93) are likely to have been conveyed along the new paved roads. So, when the new paved transport arteries did not instigate higher demands for off-farm fertilisers by themselves and were not a determining factor to buy or not, the supply of these urban and industrial fertilisers must have been eased by the better quality road transport. As the aggregate increase in the demand for ashes and lime turned out to be far greater than the rise of urban night soil together with the fact that quite a lot of ashes and lime had to be supplied along the north-south connections between our sample villages and the cities of Courtrai, Menin and Tournai, which were opened up by newly paved roads, the improved road infrastructure first and foremost must have been facilitating the allocation of these industrial off-farm fertilisers.

8.6 Linking transport means to transport infrastructure

To improve transport quality and even to set the scene for a real transport revolution, improving transport infrastructure is not the only way to follow. This can be illustrated by the example of southern Sweden. Like in most preindustrial countries – except for England and the Austrian Netherlands – an institutionalised and centrally overlooked road building and road improving program was non-existent in Sweden. Road maintenance was dealt with on the basis of a system of road allotments, without wider initiatives to improve road transport.⁸⁰ Yet, transportation

⁷⁹ SAC, OSAK, no. 4998: my interpretation and translation of ‘[...] *de voorsc[hreven] landslieden met soo groote difficulteyt geduerende den geseijden corten tijdt als wanneer sij hunne peerden tot den oust meest noodigh hebben in soo groote menichte de voorsc[hreven] vette gaen haelen. Het is licht te begrijpen hoe seer het selve soude augmenteren als wanneer sij geduerende geheel het jaer tselve op hun gemack soudén connen gaen haelen [...]*’.

⁸⁰ Bergenfeldt, *Roads to market*, 64-84; Bergenfeldt, Olsson and Svensson, ‘Wagons at work’, 65-69. Road maintenance systems based on local supervision and financing could be equally effective as centrally overlooked

considerably improved in the province of Scania – a region of pronounced agricultural growth in the period 1700-1850 – by the changes made by individual farmers to their transport means: a greater share of wagons equipped with iron components such as iron axles and iron-rimmed wheels, together with better quality horse breeds.⁸¹ When scrutinising transport improvements in regions characterised by institutional change to the road maintenance system (sc. the finance of the construction and maintenance of roads by levying tolls, like the English turnpike trusts or the toll roads in the Austrian Netherlands), Dorian Gerhold believes that next to these infrastructural improvements, changes to transport means should not be ignored.⁸²

With the improvements to the road network and the signs of increasing levels of specialisation in transport services in mind (cf. supra), we are interested in the on-farm changes to the means of transport. Unfortunately, the appraisals seldom gave us price data of individual horses and mostly valorised younger and older animals together, so that it is rather difficult to grasp the evolution of the quality of the horse breed.⁸³ Yet, the information we have on the value of individual horses, deflated for the price of oats, points to higher valued and hence better quality horses in the second half of the 18th century, even though the differences cannot be proved statistically significant, so that firm conclusions should not be drawn (graph 8.4XXX).⁸⁴

initiatives, like literature on the workings of commons have demonstrated: e.g. the pioneering work on common-pool resources by Elinor Ostrom: Ostrom, *Governing the commons*. In contrast, Jan de Vries argued that it was precisely the lack of a supra-local organisational form that ‘hobbled the ability of the *trekvaart* technology to contribute fully to the economic well-being of Dutch society’: de Vries, *Barges and capitalism*, 327-328.

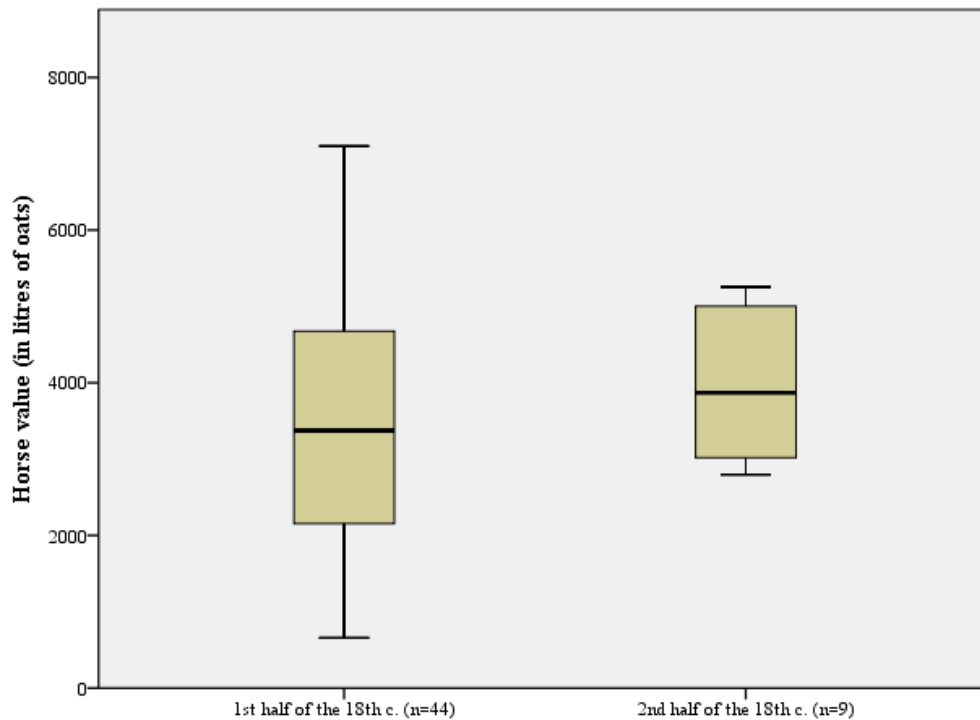
⁸¹ Bergenfeldt, *Roads to market*, 85-108; Bergenfeldt, Olsson and Svensson, ‘Wagons at work’, 73-81.

⁸² Gerhold, ‘Productivity change’, 511-512; see also Barker and Gerhold, *The rise and rise of road transport*, 23-30.

⁸³ That’s most probably also the reason why Irmgard Callens in his research on the basis of probate inventories does not elaborate on the value of horses, Callens, *Leven en werken*, 252-256.

⁸⁴ A Mann-Whitney U test with p-value of 0.320. The mean value of the horses increased from 11 lb. *groten* (or the equivalent of 3487.1 litres of oats) to 15.2 lb. *groten* (or 3948.5 litres of oats).

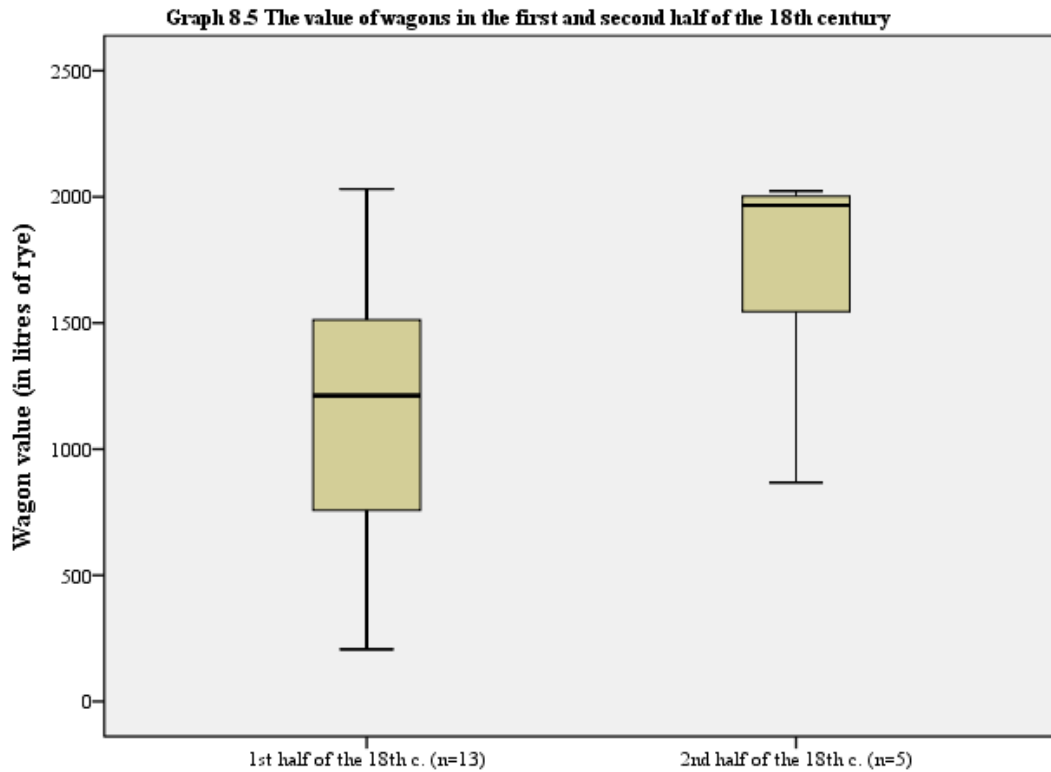
Graph 8.4 The value of horses in the first and second half of the 18th century



Source: database

Very much alike the Swedish case, the value of the four-wheeled wagons – expressed in litres of rye – seems to have increased when we compare the first half of the 18th century to the second half (graph 8.5XXX): a mean equivalent of 1112 litres of rye before 1750 (or 5.4 lb. *groten*), compared to an equivalent value of 1681 litres of rye after 1750 (or 12.1 lb. *groten*, which represents more than a 50 per cent increase in real terms). Even though the observed differences did not pass the test of significance,⁸⁵ the value increase of the wagons are backed up by qualitative descriptions, pointing to technical improvements to the transportation means.

⁸⁵ A Mann-Whitney U test with p-value of 0.068 and mean rank values of 8.08 for the first half and 13.2 for the second half of the 18th century.



Source: database

Flemish farmers (and the large *censiers* of Brabant alike) made changes to some technical aspects of their wagons and these changes followed the new road constructions with a small time lag. From the 1760s onwards, the appraisers started to differentiate between ‘*aardewagens*’ or light wagons intended to drive with on sandy tracks on the one hand and ‘*kalsijdewagens*’ or literally ‘cobble wagons’ designed to ride on the stone slab paved roads on the other.⁸⁶ The latter wagons were built with more iron components, so that they turned out to be better shockproof. In the same period, Thijs Lambrecht could notice on the basis of an account book of a local cartwright that the large tenant farmer from Markegem – Gillis Coucke – had increased his expenditures for buying and repairing implements (such as wagons).⁸⁷ The technical changes to the transport means nicely fit with the earlier observation of increased levels of specialisation in transport services on the part of horse keeping farming families. So, in a time of higher demand for transport services and of a decreasing number of households able to carry out such services (due to processes of fragmentation of holdings), large farmers invested in better transport means to optimise the advantages the new road infrastructure offered

⁸⁶ Database; on the basis of probate inventories for the seignior of Lichtervelde, the same conclusions can be drawn: Goossens, *De verre reis naar de markt*, 24-26; similar findings for Brabantine large farmers: Blondé, *Een economie met verschillende snelheden*, 198-199.

⁸⁷ Lambrecht, *Een grote hoeve*, 128-131.

them. Hence, in line with the statement of Gerhold and Barker, we can argue that the implementation of new road infrastructure needs to be seen in the context of broader evolutions like demand for transport and specialisation in transport with concurrent changes to the quality of both draught animals and wagons.

8.7 Transportation costs

Arguing that the construction of new transport infrastructure – in close relation to the improvement of transport means – assisted in the allocation of off-farm fertilisers from cities to the countryside, raises questions about the impact and evolution of transport costs. In general, transportation costs were rather high, as toll levies artificially put up these costs both in the case of water transport and transport on the new turnpikes. The above-mentioned piece of litigation of 1746 concerning the payment of toll levies between a shipmen on the Lys river transporting manure – named François Monteyne – and the buyer of the shipload of manure – Jan-Baptiste Parée – informs us about the freight rates and the impact of the tolls. Monteyne had to ship off a substantial amount of manure from the landing stage along the Lys in Kuurne to the depot in the village of Lauwe along the same river, which is a 10.7 kilometres journey that he had to undertake three times for which he required a total of 9 days (i.e. for each journey one day of shipping from Kuurne to Lauwe and back again, including one full day for loading as well as unloading the cargo).⁸⁸ For one journey (loading, navigating to Lauwe, unloading and shipping back to Kuurne), a total transportation cost of 2.33 lb. *groten* was involved, of which the share of the tolls levied, when passing sluices and barriers, accounted for 0.83 lb. *groten* or no less than 35 per cent of the total freight rate.⁸⁹ This example illustrates the large impact of levying tolls on waterways to the total transportation cost, but this cannot be interpreted as a proxy to freight rates of manure shipping activities in general. Freight rates depended on a lot of factors, such as the sort of tractive power (manpower or horsepower), the kind of goods (and most probably also the kind of fertiliser), the journey's distance, the season with the related demand for transportation services, upstream or downstream journeys, the freight capacity of the track boats and the prospect of a loaded or empty return voyage.⁹⁰

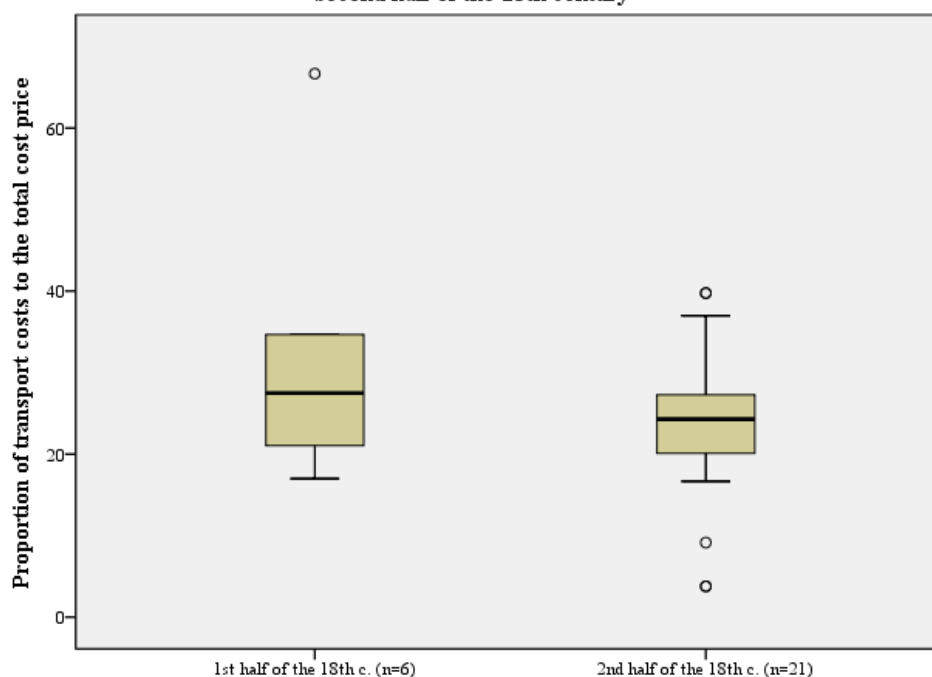
⁸⁸ SAC, 101/3, OSAK, no. 8010. The distance between Kuurne and Lauwe, following the Lys river, was calculated by applying GIS software.

⁸⁹ SAC, 101/3, OSAK, no. 8010; tolls levied at sluices and barriers: '[...] *de passagie rechten vande sleusen, draeyboomen ende andere in het passeren ende repasseren met sijn schip met deselve vette ofte ijdel*'. Transportation costs for one journey = 1.5 lb. *groten* actual transport cost including the labour of (un)loading the ship + 0.83 lb. *groten* tolls levied = 2.33 lb. *groten* in total.

⁹⁰ Van der Hertten, *België onder stoom*, 226-227.

Some 30 observations in our database of appraisals give information on the relation of transportation costs of manure to the total value of the purchases of these urban and industrial wastes.⁹¹ The average impact of transport varied around a considerable 26 per cent of the total value of the fertilisers.⁹² Though, when we compare the mean relation of the total transportation cost to the value of the fertilisers in the first half to the second half of the 18th century, a decrease from 32 per cent to 24 per cent can be noticed (graph 8.6XXX),⁹³ pointing to the potentially lowering effects of improved transport facilities to the freight rates. However, this difference cannot be underwritten by a test of significance, so that weighty explanatory value cannot be attached to this finding.⁹⁴ In the case of nine purchases of off-farm fertilisers, the paid barrier tariffs are given. As most of these bought manures will have followed the same allocation route and hence passed the same barriers, the proportion of the barrier tariffs to the total freight rate pointed to the same figure: a share of one fourth of the total cost of transportation or around 8 per cent of the total value of the fertilisers.⁹⁵

Graph 8.6 The proportion of the transport costs to the total manure value in the first and second half of the 18th century



Source: database

⁹¹ It concerned the transportation cost of the final step in the allocation chain, namely the transport service provided by large farmers for cultivators without animal traction, cf. chapter 7XXX.

⁹² Database; although with some dispersion in the data: a standard deviation of 12 per cent and an interquartile range of 10 per cent.

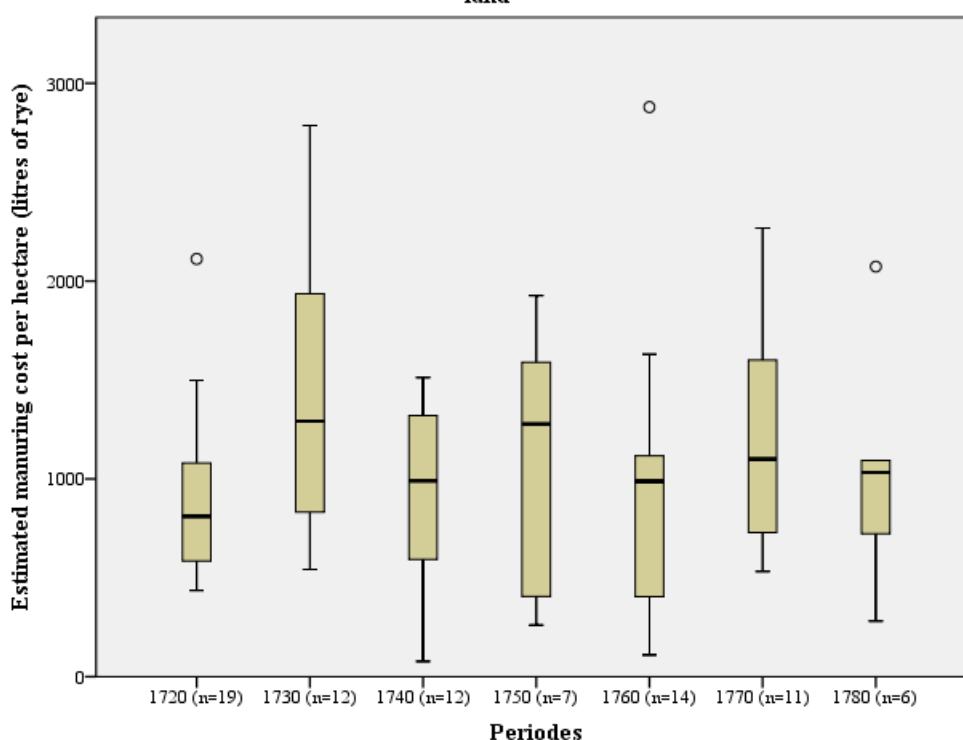
⁹³ A difference of median values of 28 per cent in the first half and 24 per cent in the second half of the 18th century, database.

⁹⁴ A Kruskal-Wallis test with p-value of 0.144.

⁹⁵ Database.

When studying the impact of improved transport infrastructure and transport means, we can wonder if the transport costs would have lowered by consequence. Either the freight charges could have been lowered thanks to the road improvement with its concurrent reduction in seasonal price and time differentials or they could have been increased due to the toll levies.⁹⁶ Moreover, the qualitative changes of the wagons (and perhaps the horse breed) most probably resulted in higher freight capacity or higher transport speed, thereby lowering transport costs on the level of the individual farmer-transporter.⁹⁷ With the proviso of insignificant test results, graph 8.6XXX touches upon the explanation of declining transportation costs. Unfortunately, when we further split our price data of off-farm fertilisers by sort of fertiliser, the information is too scant to inform about the evolution of the manure value and the possible impact of transportation costs.

Graph 8.7 Estimated manuring cost of bought manures (litres of rye) per hectare of arable land



Source: database

In chapter 3XXX, we estimated the manuring costs per hectare of fertilised land by subtracting cultivation and labour costs and costs for sowing seed. This exercise clarifies that the costs involved for dressing one unit area of land with off-farm fertilisers – irrespective of

⁹⁶ Bogart, 'Turnpike trusts', 488; favouring the first line of thought: Blondé, 'At the cradle', 106-107; stressing the impeding effects of the tolls: Buyst, Dercon and Van Campenhout, 'Road expansion and market integration', 185-219.

⁹⁷ Cf. Bergenfeldt, *Roads to market*, 107-108; Bergenfeldt, Olsson and Svensson, 'Wagons at work', 63-82.

the number of barrels, wagons or wheelbarrows of these manures – did not significantly alter in the course of the 18th century (graph 8.7XXX).⁹⁸ However, in the same chapter 3, we observed that in the second half of the 18th century, the amounts of off-farm fertilisers applied to a specific unit area of land increased. Correlation coefficients between the estimated fertilisation costs and the known quantities of applied off-farm manures turned out to be insignificant in most cases.⁹⁹ So, when the fertilising intensity was on the rise at the same time when the total cost of manuring one hectare of arable land remained more or less the same, the cost price of one barrel, basket, cask or wagon of urban manure must have been decreasing. When the rising demand for urban and industrial fertilisers was followed by an increasing supply of these manures, it was possible that the cost price of the off-farm fertilisers at least remained stable or even downsized. When it concerns the industrial processed fertilisers like lime and ashes, such a story fits within the bounds of possibility. Apart from the impact of transportation costs, factory gate prices of these kinds of fertilisers could have been on the decrease by boosting production or imported volumes. The case of urban night soil, however, is different as the aggregated marketable volume of this substance was closely related to the size of the urban population, which was far from moving upwards in the course of the 18th century.¹⁰⁰ Therefore, it is most probable that the improved road network together with the better transport means impacted on the transportation costs, so that fertilisers could be allocated more easily to those regions where these soil improving nutrients were in great demand.¹⁰¹

8.8 Conclusion

The reconstruction of the required quantities of urban and industrial fertilisers on the basis of 1730 and 1780 taxation registers demonstrated that the increased demand for off-farm manures challenged the existent transport potential. Our sample villages were part of those regions in the interior of Flanders that were least provided with horses and wagons per 100 hectares. Moreover, the ever advancing process of splitting up of holdings in the course of the 18th

⁹⁸ Calculated for those households cultivating cereal crops or registering untilled or ploughed yet unsown plots of land for which fertilising costs could be estimated, cf. chapter 3XXX. A Kruskal-Wallis test does not indicate significant differences among the different periods of the 18th century: p-value of 0.329.

⁹⁹ Database: estimated manuring cost ha⁻¹ – number of barrels of night soil ha⁻¹: p-value_{pearson}=0.883, p-value_{spearman's rho}=0.260, n=55; estimated manuring cost ha⁻¹ – number of casks of ashes ha⁻¹: p-value_{spearman's rho}=0.099, n=16; estimated manuring cost ha⁻¹ – number of baskets of dove's dung: p-value_{spearman's rho}=0.079; only in the case of lime fertilisation, significant correlation coefficients were observed between the estimated manuring cost ha⁻¹ and the number of baskets of lime ha⁻¹: R_{pearson}=0.615, p-value_{pearson}=0.000, R_{spearman's rho}=0.602, p-value_{spearman's rho}=0.000: still, this is only a moderate correlation as one would expect a clear overlap between the cost of liming and the intensity of liming.

¹⁰⁰ Cf. chapter 7XXX.

¹⁰¹ In line with the viewpoints of Bogart and Blondé for example.

century further reduced the number of horse keeping farming families that were able to carry out transport services. However, both changes on the level of the individual farmer-transporter and improvements to the overall transport infrastructure (water as well as roads) helped to take up the challenge.

Improved quality water and road transport both stimulated – or at least could stimulate – manure transports from cities to the countryside and according to the distance of the allocation line, the timing of the infrastructural improvements as well as the geographic location of waterways and roads relative to each other (parallel or in line), either one of the two transport modes could be favoured or the two could join forces and stimulate manure transports on the same allocation chain from a particular city to the countryside. Especially for connecting landing stages in the countryside (i.e. the final end of the chain) or for making the north-south connection between our sample villages and cities like Menin, Courtrai and Tournai, paved roads were of importance. When we take into consideration that the provision of urban night soil was basically a story of reshuffling supplies, rather than considerable increases in the total amounts of this soil improver, we can wonder if the impact of transport improvements would have been as considerable as we think they were when leaving the evolution in ash and lime fertilisation outside, which did progress with great strides in the course of the second half of the 18th century (cf. steep increases in the required supplies). As the north-south allocation chain between our sample villages and the cities of Menin, Courtrai and Tournai turned out to be important for ash and lime transports in particular together with the fact that especially this allocation line was improved by new paved roads, I hypothesise that it would not. The better quality road transport was not a factor determining whether off-farm fertilisers were bought or not, but it must have facilitated the manure transports (and particularly have eased the supply of ashes and lime), as both contemporary observations and the introduction of these roads as dummy variables into the logistic regression analysis indicated.

The claim that access to farm inputs was eased by the transport improvements could also be underpinned by the fact that farmers-transporters adjusted their transport means to the new road infrastructure – stronger and more expensive wagons and perhaps also better horse breeds – in the light of increasing levels of transport specialisation. The overall as well as on-farm transport improvements are likely to have reduced transportation costs, as both the scant information on the proportion of freight rates to the total manure value and the comparison between estimated fertilisation costs and fertilising intensity per unit area of land reveal. Grouping all evidence together, we can safely argue that the parallel improvements to the transport infrastructure and the transport means not only impacted on the supply of foodstuffs

for cities, but also influenced agricultural production and productivity itself by paving the way for fertiliser supply.