

Water powered grain milling in southern and eastern England between the 5th and 11th centuries

The use of water powered grain mills can be linked with the evolution of a flexible low capital input cereal farming economy in these regions during the Anglo-Saxon period. The determining factor in the farming system was that the weather in these regions was normally warm and dry enough in late summer to allow crops to be air-dried in the fields where they were harvested. Such were the advantages of air drying crops in the harvest field that the practice was to endure as a key factor in the mixed farming regimes of southern and eastern England until the 1950s when the current method of harvesting and conserving grain crops, based on combine harvesters and grain driers, was introduced (Bowie 2017b 7).

Crops were reaped, bound into sheaves and built into stooks or shocks where they were dried in the sun and the breeze until the moisture content of the grain had been reduced to 15-16%. This was just dry enough to allow the crop to be stored medium-term in the sheaf and the threshed grain to be kept short-term in the sack. Above this percentage the sheaves might ferment and catch fire in storage. The sheaves were usually built into temporary free-standing ricks which were then thatched to make them weather-proof for the winter; these were dismantled when the sheaves were needed for threshing. The sheaves could be threshed, sacked off and milled more or less simultaneously – from start to finish without needing intermediate storage facilities. Storing grain in the sheaf also offered flexibility as the sheaves could be threshed during the autumn and winter as and when the need arose or the market price for the grain became favourable (Bowie 2019 9). Light and temporary structures were adequate for the cereal farming activity, which helps to explain the lack of archaeological evidence for substantial non-domestic farm buildings in these regions during the period. Furthermore, domestic farm buildings were normally built to be just adequate for purpose, with little concept of longevity - timber-built dwellings with no footings and a limited lifespan of about 30 years (Addyman et al 1972 13-35). It is also evident that water powered grain mills were the only significant form of capital investment made in this farming system before the late 12th century.

A current theory claims that there was a 'transformation' in the agriculture and rural economy of southern and eastern England in a 'long eighth century', c 670-820 (McKerracher 2018 2-5). This can be linked to the concept of a 'Middle Saxon Shuffle', when cereal cultivation was expanding into areas of untilled 'waste' and cereal output increased (Hamerow 1991 1-17). However, major change in an agrarian economy is usually indicated by an enhanced capital investment in the non-domestic built environment and it has been explained above that substantive evidence for this is lacking in these regions between the 5th and the 9th centuries. Others have also agreed that what changes there were in the long eighth century appear to have been 'evolutionary' rather than revolutionary (eg: Blair 2018 311). This can be appreciated in terms of the construction of water powered grain mills. They do not feature in the 5th and 6th centuries, and the technology appears to have been introduced from Western Europe in the early 7th century (Bowie 2016 2). Even then the archaeological evidence for them is undeniably small and only a handful of mill sites have been found which can be dated to the Early and Middle Saxon periods.

However, there is sufficient archaeological and archival data to suggest that this 'transformation' was actually a feature of the 10th and 11th centuries. It is probable that the main phase in the intensification and spread of English arable farming took place after about 920, a development which was 'driven by a step change in the market for rural surpluses' (Blair 2018 337-8). Other changes in social organisation supported the establishment of this emerging agrarian economy, albeit in an indirect way. This included measures which helped to stabilise rural society and its economy: a novel way of micro-managing the state coinage and the establishment of a local government structure – a framework of shires / wapentakes and hundreds with regulated legislative institutions (Faith 2020 40-44;91-92).

There is also substantive evidence for a radical restructuring of settlement patterns in parts of southern and eastern England, a process which appears to have begun in the early 10th century. Here, fairly compact villages came to replace a landscape of scattered hamlets and farmsteads (Blair 2018 322; 329). These compact settlements usually consisted of a number of farm units located close together, and provided the customer-base needed to make an investment in a water powered grain mill a viable proposition. The investment in such a mill would be justified where it supported a market-orientated farming sector which had an emphasis on cultivating crops to regularly supply an external market, and this reflected in a dramatic way by an investment in water power technology: the transformation in the agrarian economies of southern and eastern England was such that there were more than five thousand water powered grain mills at work in these regions by the time of the Domesday Survey, 1086. Such

mills were also needed to meet the needs of novel urban markets. For example, the spread of planned fortified settlements (*burhs*) north and east from Wessex during the first half of the 10th century created new urban markets for agricultural produce. The existing settlement at Winchester, Hampshire, was converted into a fortified burh, c 890-905. There were probably only 2-3 water powered grain mills at work in the area at that time, but archival evidence shows that by the middle of the 10th century at least 8 were at work in the burh and its immediate area, a clear indication of the development of an urban market economy for flour and meal there (Biddle 1976, 282-84).

This farming economy was radically modified with the introduction of the demesne farming system in the late 12th and early 13th centuries. Amongst other things, landowners had to recognise that in order to make a profit from their estates it was necessary to become directly involved with investing in new farm infrastructure (Britnell 2004 296-7; Bowie 2019 8). It is also no coincidence that an alternative to the water powered grain mill was invented at this time - a practical and cost efficient wind powered grain mill was introduced in England in the late 12th century (Bowie 2017a 28-29).

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