

## Recent Findings of Research in Economic &amp; Social History

The factory was one of the great visible symbols of the industrial revolution. What brought it into being? What role did it play in the rise of industry? Here David Jenkins reviews traditional and more recent explanations and shows that the reasons for the creation of the factory system are more complex than appear at first sight.

# Factories and the Industrial Revolution

The term industrial revolution implies some fundamental change in the role and organization of industry. In the case of Britain the factory has often been recognized as the most conspicuous sign of that change. The factories which came to tower over the landscape of many of the industrial districts, generating inanimate power, and employing labour on a grand scale have been regarded as both the symbol of the new industrial age and as the means by which that age was created.

Factories have been seen as the way that new technology was innovated (i.e. implemented) in many industries. Factories allowed developments in power and the combining of processes to permit mass production. They created new employment relations and contributed to the proletarianisation of the workforce. They were recognized as being responsible for some of the social evils of the time. Thus, in the debate about the causes and nature of the industrial revolution, factories have often had a central role.

However as ideas about the industrial revolution have changed [see Crafts in ReFRESH 41, so questions have been asked about the significance of the factory. How essential a role did it play in the rise of industrial output and productivity? Why was only some production reorganized in factories? How does one explain the timing of the creation of factories, Historians have come to recognize that there was no straightforward relationship between new technology, the reorganization of industrial production, factories and the rise of industrial output. Changes in methods of production were slow and complex. They varied between industries, and over time. Recent debate has questioned the central role of the factory and stimulated new ideas about why factories were established. This article discusses these issues, but is not concerned with the social conditions of factory work.

## *Nature of the factory*

It may seem pedantic to pose the question: what was a factory? But it is essential. To do so. Our concept of the early factory has been influenced by a few contemporary pictures of large buildings, by the scale of some which have survived to the present time, as well as by later types of factory organization.

We should be wary of assuming that surviving contemporary illustrations depict the typical factory. Moreover we should recognize that many of the factories which survive conspicuously in and around our major industrial areas date from the mid-nineteenth century and later, and are not necessarily typical of the first fifty years of the new industrial era.

It is not very instructive to define or describe factories in terms of their

physical nature and size. It was primarily their function and operation which distinguished them from other means of production. Two definitions are suggested in boxes 1 and 2. The first defines the factory in terms of how labour and capital was organized and the advantages of that organization. The second puts more emphasis on the integration of work which was possible in a factory. Neither is wholly satisfactory because historians of individual industries realize that a wide variety of new forms of industrial organization were encompassed by the factory system. Various types of authority existed in the relationships between employer and labour. Factories did not always incorporate new technology or inanimate power. They could contain single rather than integrated processes. As the factory inspectors found in the 1830s some 'factories' were collections of separate workshops. Room and power was often sublet to small industrial entrepreneurs. Some factories were operated on a cooperative basis. The factory inspectors did not stipulate the nature of ownership of premises, or the way work was to be organized and carried out, when they decided what to inspect. We should thus avoid a stereotypical view of the factory. We should recognize that a variety of organizational forms were being innovated and that factories immensely in scale.

The textile factory has been taken as the archetypal example of the factory era. This is not surprising, in view of the leading role of the textile industries in industrial growth and because of the contemporary debate about conditions in textile factories. But even within the textile industries the nature of the factory differed. Other industries found various means to change their organization and scale of production. Larger units developed in ironworks, mining, engineering and brewing, and in a host of less significant industries. The term factory was applied in such diverse trades as sugar refining, distilling, tobacco and snuff processing, the manufacture of leather, glass, soap and candles and a wide variety of other industrial activities. But the debate about the nature of, reasons for, and consequences of factory development has mainly focussed on the textile trades.

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"The Factory ... a system of industrial organization under which the manufacturer was the possessor and manager of a whole or part of the buildings or several buildings where the wage earning workers, with the aid of the manufacturers' machinery or fixed instruments of production, were concentrated under the supervision of the manufacturer or his foreman, to manufacture raw materials under a closely related series of subdivided processes."

Source: H.D. Fong, *The Rise of the Factory System in England*, Tientsin, 1930.

Box 1

"The Factory ... an establishment where several workmen are collected together for the purpose of obtaining greater and cheaper convenience for labour than they could procure individually at their homes; for producing results by their combined efforts which they could not accomplish separately; and for saving the loss of time which the carrying of an article from place to place during the several processes necessary to complete its manufacture would occasion. The principle of a factory is that each labourer, working separately is controlled by some associated principle which directs his producing powers to effecting a common result which is the object of all collectively to obtain."

Source: W. Cooke-Taylor, *Factories and the Factory System*, London, 1891.

Box 2

## Location

Whilst the nature of the factory- is being questioned one more point should be made. It has often been assumed that the transition, production to the factory involved the relocation of work from the countryside to the town, reversing the process which had led to the creation of protoindustry. [see Hudson in ReFRESH 10] But the textile factory of the first half of the nineteenth century was mainly located outside the town. An examination of the early Ordnance survey maps of Lancashire and Yorkshire of the 1840s and 1850s proves the point. Factories became urbanized not by being constructed within towns, but by later urban growth encroaching upon them. Even today there are many surviving examples, in the valleys of Yorkshire and Lancashire, of nineteenth century factories nestling in rural locations, still well outside the urban growth of the twentieth century, let alone that of the nineteenth. This should not come as a great surprise. It surely stands to reason that mill builders, whilst seeking sites close to labour supply, lines of communication, and commercial facilities, would have been influenced by building land availability and prices, and by a good supply of water. Even where water was not required for power, it was still essential for many of the processes of textile manufacture.

## Transition to factory work

For the main textile trades of cotton, wool, worsted and flax the decade of the 1780s is recognized as the beginning of the new factory era. Since national statistics on textile factories were only collected from the 1830s, estimates of early factory growth are somewhat rudimentary. They are dependent on contemporary data, some of which was not necessarily well informed, and may have been collected for reasons that encouraged either under or over estimation. Or estimates emanate from more recent attempts to identify and count factory building in different areas. Although the accuracy of the data may be questioned in detail, there is little dispute about the chronology of growth of factories in the major textile trades.

In cotton the spread of spinning mills was rapid from the 1780s. In the

The worsted industry followed more closely the experience of cotton. The longer wool fibre used for worsted manufacture could better stand the strain of mechanized spinning and weaving. Spinning mills, using the water-frame, were being built from the 1780s. Power loom weaving commenced on a commercial basis in the late 1820s but took another two decades to become widespread.

Thus the development of factory production in cotton and wool textiles took many decades. The factory returns of 1835 and later (see Tables 1 and 2) provide us with the first relatively comprehensive assessment of the number of factories and employment in them. They are instructive. Over half a century into the creation of a factory system only 345,000 worked in the textile mills. The 1841 Census of Population counted about 883,000 textile workers nationally. Thus the implication is that even in the textile trades, the first sector to experience a major transition to factory work, only about 40 per cent of workers were located within the factory. The figures show that it was primarily the relatively new cotton trade that made the transition most rapidly. And arguably the cotton industry was the only major industry by the 1830s that had gone over to large scale units of production. Table 1 suggests an average factory size for cotton of 177 workers in 1835, although the average is skewed by a few extremely large Lancashire factories employing thousands of workers.

## Role of factories

This evidence suggests therefore that factories should not be seen as a great discontinuity or sudden revolutionary change in methods of industrial production. Historians now recognize an essential and ongoing relationship between domestic systems and factory work. That relationship was a complex one. Factories often could not function independently of other forms of production. Where only one, or a few,

	Cotton	Woollen	Worsted	Flax	Silk	Totals
No. of mills working	1217	1085	213	320	237	3071
No. of workers (000s)	215.3	51.3	17.8	28.4	32.2	345
Average workers per mill	177	47	84	89	136	112

	Cotton	Woollen	Worsted	Flax	Silk	Totals
No. of mills working	1921	1488	499	324	277	4509
No. of workers (000s)	329.2	73.9	79.7	47.3	42.6	572.7
Average workers per mill	171	50	160	146	154	127

first three decades of the nineteenth century construction of cotton spinning mills continued apace, with only quite short periods of investment downturns. From the 1820s the innovations of power loom weaving encouraged further factory expansion.

In the wool textile industry, the woollen and worsted branches experienced different routes to factory development. In the woollen branch, the preparatory processes of scribbling and carding were the first to be mechanized, again from the 1780s. The early mills were thus primarily scribbling and carding mills. Some incorporated the fulling process. A few, like Benjamin Gott's Park Mills in Leeds were particularly large because of the amount of preparatory machinery they housed, and because they also accommodated hand processes, notably jenny spinning. Only in the 1820s did power spinning, using the mule, begin to be innovated in the factory. Power weaving of woollen cloth was even slower to come. The strain that the power loom imposed on the yarn spun from short woollen fibres initially created frequent breakages and gave little or no advantage over the skilled use of the handloom. Only in the 1850s and 1860 did powered factory weaving become established.

processes were initially and partly transferred to factory production, the home and workshop had to carry out the others. New machinery was sometimes only capable of doing certain types and qualities of work within a particular process. Typically machinery could substitute for handwork for more standard 'run of the mill' products of lower to medium quality. For a long time the hand worker continued to have an essential role for more intricate and high quality work. The setting up of machinery was sometimes not cost effective for the manufacture of patterns, samples and for shorter production runs. As some processes were mechanized within the factory, so pressure resulted on other processes. Until technical solutions enabled mechanical production, hand work within or without the factory had to respond. Thus it should be recognized that the growth of output of the textile trades cannot be explained by factory production alone. Outwork also fulfilled another essential function. The textile trades experienced regular substantial fluctuations in demand. Capacity adapted to the longer term regular trade cycle, but short term peaks of demand occasioned by weather conditions or the suddenness of war, and consequent military demand, could create

production needs beyond the capacity of the factories. Contracting out work to domestic workshops continued well into the nineteenth century in wool textiles.

It should not be assumed that traditional non-factory methods of work were inefficient, backward and unchanging. They responded to new challenges, using new technology and a great range of organization. It is important to recognize the wide variety of production methods which contributed to the growth of industrial output in the late eighteenth and early nineteenth century.[2]

Most industrial workers of the mid-nineteenth century had never set foot in a factory. This therefore begs questions about notions of the great superiority of the factory system over other ways of organizing labour. Why therefore was some work transferred to factory production?

## Why factories?

**The technological explanation.** The rise of the factory, and the factory system, was for a long time explained primarily in terms of technological necessity. Earlier historians argued that the factory was the necessary outcome of the rise of machinery; the consequence of the mechanical discoveries of the time. It was believed that the new innovations in textile machinery in the eighteenth and early nineteenth century were inappropriate for traditional systems of production and that the factory was the inevitable way forward for the advantages of the new technology to be experienced fully.

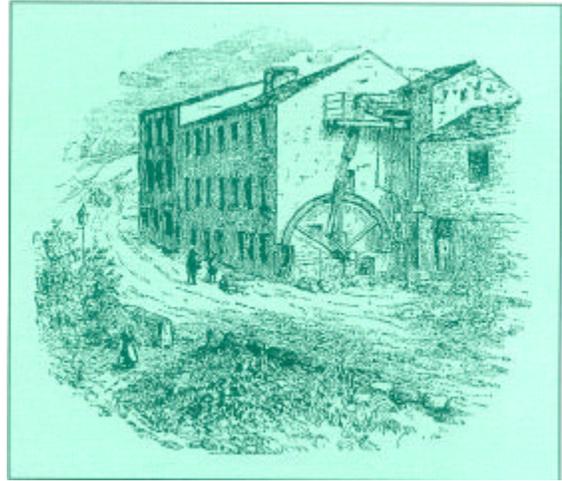
The technological stimulus for factories has been suggested in a number of related ways. It has been argued that to gain sufficient return on the investment in a costly new machine, it had to be worked beyond the hours a domestic worker would countenance, and that cost limited the access of domestic workers to new machinery. It has been suggested that, to be operated effectively and efficiently, new machinery required more power than the human hand could provide and that the factory was necessary for the harnessing of mechanical power - water and steam. There have been arguments that some machinery was too large to be installed in the limited confines of the home or workshop, and that some, to be used efficiently, required a greater integration of production processes than the domestic system could organize. Examples have been cited of suppliers of machinery limiting their production to sizes which were inappropriate for domestic use, so that its use in factories could be monitored and patent interests protected.

But many of these notions are theoretical and not tested. When one looks at the new technology of textile production, invention by invention, the technological case for factories becomes less clear. Many of the new machines of the eighteenth century were designed for domestic and workshop use, and continued to be used in that situation as well as in factories. Mechanical power, albeit on a small scale, was installed in the workshop. Some of the arguments about the inappropriateness of the machinery for domestic use, because of its size, cost or complexity, are notional rather than tested. It has been shown that some early factories made little or no use of mechanical power.

It has become apparent that the relationship between new technology and the factory was not a straightforward one. It varied from industry to industry and new technology cannot be suggested as the sole reason for factory production.

A recent study of the silk industry, where factories were being operated at an early date for the throwing processes, has argued a close chronological relationship between technological development and organizational change into factories.[6] But it also showed that the domestic system of the industry did find means of using the new technology to compete with the factory. A technological need for the factory seems apparent in cotton, where the scale of new spinning machinery rapidly became inappropriate for workshop use. The same perhaps applies for worsted spinning mills. In the woollen industry it is less clear that new technology was a sufficient stimulus for the construction of new m-tins. A historian of the hosiery trades has suggested that a link between technological innovation and organizational change was created through the factory being adapted primarily to maintain innovations in secret.[3] However the factory made less progress in hosiery than in other areas of textiles.

It has also been recognized that the direction of causation between new technology and the factory may not have been just one way. It has been argued that the reorganization of work within factories created the need for new technological improvements, increased the perception of the possibilities of technical change and directed the search for that change to technology particularly appropriate for factory use. It is conceivable that the factory system ultimately became more dominant not because early



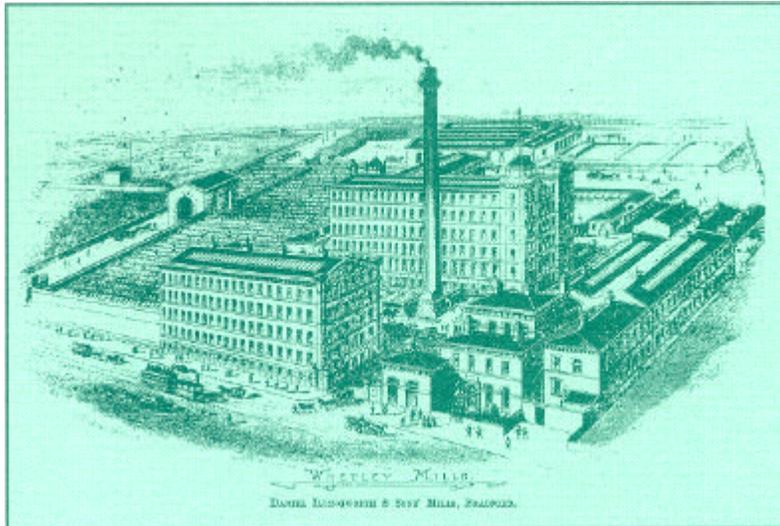
technological change gave it great advantages over other organization of production, but because factories stimulated technical progress in a direction more appropriate for factory work.

There is no denying that much technological progress brought about profound change in the control and organization of work. In many instances the factory was the outcome of that change. But it has also been suggested that change occurred without a technological stimulus, Transaction cost theory. It is the contention of this theory that where there is more than one way of organizing production, decisions will be influenced primarily by the relative organizational or transaction costs involved.[10] Thus the argument is that factories began to be established where entrepreneurs believed they could save some of the costs associated with putting out work, and gain advantage from the closer monitoring of the production process. Such costs might have included transport of raw materials and finished products; the maintenance of stocks of raw material, semi-finished products, and the final product held at the point of production or in transit; the loss of materials and products through damage, wastage and embezzlement; and losses through poor quality control in outwork production. This theory implicitly takes a pessimistic view of the efficiency of outwork. It sees disadvantages in the lower levels of work intensity, poor standardization of product, difficulties in supervising the work process and the use of materials. It believes that the putting out system had a slow response mechanism to demand. On the other hand the thesis sees the factory as providing organizational and security cost savings, and cost advantages in the use of capital and labour, sufficient to encourage production to be transferred to it.

The second part of the protoindustrialization thesis [see ReFRESH 10] argues that proto-industry gave way to factories because of increasing diseconomies of putting out as a result of rising transaction costs. The suggested relationship between proto-industry and factory industry is on the one hand that labour and other costs, including distribution, supervision, embezzlement and damage to materials, rose as proto-industry expanded and extended further afield. A point was supposedly reached in some areas where it became advantageous to centralize production and labour in a factory. On the other hand the thesis suggests that proto-industry created and provided many of the essential elements for factory production: capital accumulation, labour attitudes and skills, entrepreneurial and managerial ability and drive, technical knowledge, and merchandising and distribution systems.

But empirical testing of the proto-industry theory in relation to different areas and textile trades, whilst producing evidence for some elements of it, has suggested much more complex relationships between cottage industry and factory industry. It has shown that there were many routes to more capital intensive forms of industrial organization and that it is unrealistic to put so much emphasis on the proto-industry route.

The transaction cost thesis is vague on how significant those costs, and potential savings, were in relation to total costs in the factory. Some may have been quite high. In the eighteenth century textile entrepreneurs came to expect significant losses of materials and complained bitterly,



**Illustration 2** : A late 19<sup>th</sup> century Yorkshire worsted mill,  
Source: *The Century Progress*, 1893.

gaining the support of the law for tougher penalties.[9] The efficient operation of outwork would appear to have required high inventories, with associated costs. But full employment of capital in factories also required stocks to be maintained at adequate levels. The differences in inventory costs for outwork and factory production have yet to be calculated. Factory manufacturers as well as domestic entrepreneurs could be left with stocks of surplus or outmoded finished products as a result of market changes.

There are other reasons to question the transaction cost argument. Whereas factories may indeed have saved on certain costs, they increased others. Labour wage rates were typically higher. Factories inevitably required higher fixed capital costs. As a result they may have provided less flexibility in the use of capital. Factories created new forms of supervision costs. It is not clear that factory production was necessarily more responsive to the market. It probably reduced embezzlement and other raw material losses. However there has been insufficient investigation of the comparative financial costs and benefits of domestic systems, compared with factory systems of production, to be certain that transaction cost savings did outweigh the rise of other costs to an extent which encouraged factory production. The continued rise of domestic manufacture in the early decades of the new factory era might, in itself, cast into question the superiority of the factory on those grounds. Indeed some factories were built in quite remote rural locations where there would have been little saving in transport costs.

**Labour exploitation.** This thesis, advocated particularly by Stephen Marglin, sees the factory resulting not primarily from technological need or organizational efficiency, but from the desire of the capitalist to obtain greater control over the workforce and to claim a higher proportion of the labour surplus.[8] For Marglin, the key to the creation of the factory was social power, hierarchy, and the control and discipline of labour. This power and control, he argues, gave the factory superior cost advantages over domestic systems. It enabled manufacturers to increase the hours and intensity of work - the exertion of the labour force. It allowed a careful watch to be kept on the work process, reducing embezzlement, and ensuring better quality and more uniform standard of work. And it allowed manufactures to employ directly cheaper labour - women, paupers and children. In Marglin's words 'the key to the success of the factory, as well as its aspiration, was the substitution of capitalists' for workers' control of the production process: discipline and supervision could *and* did reduce costs *without* being technologically superior'. This might explain why some manufacturers innovated factory production before any technological requirement or stimulus.

This labour exploitation thesis is not necessarily an alternative to technological or transaction cost theories. Potential efficiencies in the use of labour might in some instances have been encouraged by technological change. Labour cost savings and transaction cost savings are surely quite likely to have been considered alongside each other by manufacturers. But the thesis does beg several questions. New forms of labour control were undoubtedly created within the factory, but were they uppermost in the minds of manufacturers considering commencing factory production, or were they more a gradual outcome of the development of the factory system? To what extent could potential advantages be seen in advance? Was it clear that higher wage rates for some would be outweighed by the increased 'efficiency' of labour use? Or did the factory itself stimulate a

search for new means of labour supervision and control?

The evidence for manufacturers establishing themselves in factories to gain advantages in labour use is scant. But perhaps such manufacturers, if they existed, were not likely to admit to so explicit a reason. Again savings would have had to outweigh additional costs of creating the factory. However new management methods of labour did often go hand in hand with the new organization of production methods. Wedgwood, for example, deliberately sought a transformation of production methods through new labour management systems, work discipline, recruitment and training of new labour and greater subdivision of work. Moreover very early in the era of the new factories there emerged a recognition of the role of the factory in controlling and disciplining labour.

The Marglin thesis assumes that labour itself was limited in its ability to organize and own its own capital, and that entrepreneurs with organizational skill and access to capital could gain control over labour. But the experience of the Yorkshire woollen industry somewhat contradicts this view. There, many small clothiers were instrumental themselves in converting to factory production, albeit often on a very small scale. Some got together to form joint stock or 'company' mills; others created their own enterprises using the labour of their family, apprentices and journeymen. At least in the early stages of such factories, notions of labour exploitation seen misplaced. Marglin's article has been indicted for misreading history and of being essentially ideological.[7] Marglin has also been accused of seeing division of labour solely in terms of social hierarchy, without recognizing the productivity gains to be made from 'manipulating gender, age and skill divisions across the labour force' through the use of new mechanized technologies.[1]

## Conclusions

Although an emphasis on technological explanations for the factory has been questioned, the paramount role of technology has not been disproved. Other explanations, rather than being alternatives, may be supplementary. To a great extent all explanations still depend on hypotheses and assumptions. There is clearly a need to test these for different industries and over time. However there is no doubt that the role of the factory in the Industrial Revolution and its relationship to other forms of production is now seen in a new light. The factory played a part in the ongoing process of change, rather than dominating that change.

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