

The International Context for Textile Sites

This comparative study was compiled by the Textile Special Interest Section of the International Committee for the Conservation of the Industrial Heritage (TICCIH). The text was discussed at meetings of the section in London, UK, in 2000, Barcelona, Spain, in 2001, in Euskirchen, Germany, in 2003 and Sedan, France, in 2007.¹

The draft list was also displayed on the TICCIH website, was presented to the Association for Industrial Archaeology Conference in 2002 to the Society for Industrial Archeology in 2004 and to TICCIH in Terni in 2006.

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1. Preface

This list is one of a series of industry-by-industry lists offered to ICOMOS for use in providing guidance to the World Heritage Committee as to sites that could be considered of international significance. This is not a sum of proposals from individual countries, neither does it make any formal nominations for World Heritage Site inscription: States Parties do that. A thematic study presents examples, and omission here does not rule out future consideration. The study attempts to arrive at a consensus of expert opinion on what might make sites, monuments and landscapes significant. This follows the Global Strategy for a representative, balanced and credible world heritage list. Industrial sites are among the types of international monuments that are at present considered to be under-represented on the World Heritage List. They offer the opportunity to engage countries that are under-represented under the thematic headings Movement of Peoples, Developing Technologies and Utilisation of Natural Resources.²

While the bulk of mills of the industrial revolution period are inevitably found in Europe and North America, they depended upon a supply network that was world-wide. As the lead sector for industrialisation in many countries, textile sites have importance for bringing modernity to many countries around the world, and the majority of textile products are now made in Asia. Study of textile production in Africa and Asia helps the understanding of domestic production and of industrialisation elsewhere.

2. Universal Significance of Textile History

¹ A committee was appointed in 2001 comprising Dr Gracia Dorel-Ferrer (secretary), Professor Claudio Zanier, Detlef Stender, Artur Zbiegieni, Carin Reinders, Dr Keith Falconer, Dr José Manuel Lopes Cordeiro, Olga Deligianni-Traganou, Mark Watson and James Douet. Useful comment has further been received from Adriana Eckert Miranda (Brazil), Sarah Jane Brazil and Cameron Hartnell (Australia), Sophia Labadi (France), Bartosz Walczak (Poland), Jose Manuel Lopez Cordeiro (Portugal), Michaela Ryskova (Czech), Garry Miley (Ireland), Michael Mende, Detlef Stender and Eckhard Bolenz (Germany). The text is still at a consultation stage. Suggested additions and alterations will be welcome. Send them to ticcitextile@yahoo.co.uk

² ICOMOS 2004: The world heritage list: filling the gaps: whc04-28com-inf13ae[1].pdf

Making textiles has been a cultural activity since time immemorial.³ Trade in textiles rose along with tastes for luxury. The silk route, like that for spices, formed links between Asia and Europe, well in advance of other consumer goods such as sugar, tea and coffee. Great medieval architecture owes much to the textile trade, from Flemish cloth halls (such as Ypres) to English monasteries (Fountains Abbey WHS) and parish churches. Conversely the textile products of some nomadic communities are the principal cultural artefacts by which they can be represented, whether now in museum collections or still in living communities.

The textile business was and is a world-wide industry drawing on raw materials produced all over the world. It was to produce textiles that development occurred in otherwise non-productive places, such as the vast sheep farms in Australia and New Zealand. Production of sisal (in Mexico and St Helena), and of coir (Zanzibar), manila (Philippines), hemp and jute (Bangladesh) enabled parts of South and South East Asia to develop, or to be exploited. Most famously, the growing of cotton moved from India to the Southern United States, to be worked in large slave plantations, the conservation of evidence for which is a thorny issue. Since then cotton growing has moved on to Egypt and the former Soviet republics of central Asia, followed by manufacturing plants in those places, at the expense of the older spinning and weaving districts.

The textile industry was the lead sector in many countries' experience of the industrial revolution. New forms of technology, power generation, finance, labour, and industrial organisation were combined in a textile mill on a scale that foreshadowed today's industrialised and urbanised society. A high proportion of the workforce would be female, or child, so the need for factory legislation, and for education arose at textile sites at a time when such consideration did not exist for adult males. Sometimes the gender imbalance would be temporary, and met by specially built lodging house barracks for young unmarried women (the "Yankee girls" of Lowell, USA). Social consequences of there being higher wage earners amongst women than men could be deep-seated, as in Bradford and Dundee, UK, driving men to seek work abroad or in engineering. The engineering industry would evolve as the textile industry matured and would seek out new markets, either to export the latest machinery so as to create competition with home markets or to diversify into new products. Where men retained a role in production (as did mule spinners in the UK) they might accumulate sufficient funds to develop new economic models: the Co-operative movement and the first limited liability companies both came from the Lancashire cotton districts of Rochdale and Oldham, and were copied world-wide. The significance of textile history can then be very wide-ranging and aspects may claim universal value.

3. Definition of a textile site:

A textile site is a place which is or was indelibly associated with the manufacture of or trade in textiles and in which the cultural imprint of that activity is physically evident. It may be of outstanding universal value from the point of view of history or technology, either intrinsically or as an exceptional example representative of this category of cultural property. It may be a single monument or an integral component of a complex cultural landscape. It may demonstrate a connection with similar sites in other countries through the transfer of technology, of goods and of migrants ("Movement of Peoples, Developing Technologies and Utilisation of Natural Resources"). The TICCIH Textile

³ The early history of textiles is given in http://www.etn-net.org/routes/index_indust_intro_GB.htm

Section acknowledges the need for further study so as to bring in non-European sites and landscapes.

The terms *pioneer*, *flagship*, *giant*, *international interchange* and *time capsule* are more fully explained through the examples given at the end of the list. They are intended to be applicable to other forms of industry besides textile. The TICCIH Textile Section agreed that approaches to universal significance that related to human perceptions of a place were more useful than categorisation simply by each branch of the industry.

Internationally significant sites might also be categorised as belonging to one of three monument types according to the scale and unity of the site:

(i) Individual significant mills and their contents that stand alone. These will be the most difficult to have accepted by non-specialists. They may be sub-classified as *pioneer*, *flagship*, *giant*, *time capsule* or with others elsewhere a representative of *international interchange*. No single textile building has yet been inscribed on this basis as it is more useful to consider the possibility of designating a landscape. However, a parallel example in the paper industry is the Verla Board Mill WHS in Finland, a time capsule within a small landscape, and also the medieval cloth hall in Valencia, Spain: built for trading in oil, a single building in an urban context.

(ii) Large textile complexes and adjoining workers' settlement and facilities, that may or may not be considered "model". The inscribed World Heritage Sites at Crespi d'Adda and San Leucio, Italy, Saltaire and New Lanark in the United Kingdom fall into this category. The criterion for these is *urbanism*, although mills within them may also, but not necessarily, be considered *pioneer*, *flagship*, *giant* or *time capsule*.

(iii) Integrated textile landscapes comprising more than one enterprise, some with associated processing activities, transport and power infrastructure, housing and worker settlement institutions. Other industries (agriculture, machine-making, soap-works etc) may exist but are mostly subordinate to or supportive of the principal textile industry. The inscribed World Heritage Sites of the Derwent Valley Mills in the United Kingdom, and Shirakawa-go and Gokayama, Japan, fall into this category. One or more of the mills within them may also be considered *pioneer*, *flagship*, *giant* or *time capsule*.

These cultural landscapes are divided according to whether they are broadly speaking urban or rural, and by the principal raw material: cotton; wool, linen (flax jute hemp and other vegetable fibres) and silk. A relict landscape has changed its function. A living landscape is still partly or fully devoted to textile production.

All sites must:

1. Meet the test of authenticity in design, material, workmanship or setting and in the case of cultural landscapes their distinctive character and components. And:
2. Have adequate legal and/or traditional protection and management mechanisms to ensure the conservation of the nominated cultural property or cultural landscapes.

On **authenticity**, guidance is given in the Nara Document on Authenticity (Nara, Japan, 1994). Essentially it allows each culture to define its own level of authenticity. However international fora such as the TICCIH Textile section will have to define authenticity on the basis of what it considers authentic. The World Heritage Committee stresses that

reconstruction is only acceptable if it is carried out on the basis of complete and detailed documentation on the original and to no extent on conjecture.

Therefore excluded from this list are collections that have been created for museum purposes rather than to meet the social and economic needs of the societies they portray. The relocated woollen mills at Upper Canada Village, Ontario, Canada and at the Welsh Folk Museum, St Fagan's, Wales, UK, the collection of fulling mills at Astra, Sibiu, Romania, the replica weaving shed at Bocholt⁴, Germany, are each very valuable for the meticulous research that went into their documentation and rebuilding. But they lack the authenticity that can only be given by preservation *in situ*.

There are also museums that contain working machinery brought from elsewhere. Thus the principal textile museums in the Netherlands, at Tilberg, in Norway, at Solingstadt, in America at the Museum of American Textile History (a machine shop in Lowell) and in the UK at for example Bradford Industrial Museum (Moorside Mills) and Dundee Industrial Heritage (Verdant Works), contain valuable and in some respects unique collections that inform studies of textile history. In themselves the buildings they occupy are interesting but not internationally remarkable. Some may however qualify as focal points for the interpretation of textile landscapes that are of outstanding value: so Lowell National Park as a whole is identified as a universally significant landscape.

Yet there are some museums that occupy buildings that could themselves be described as internationally significant: Leeds Industrial Museum in Armley Mills (UK), for example, is the second or third extant oldest iron-framed building in the world, and the oldest fireproof mill to contain cylindrical cast-iron columns. Its significance to the textile comparative list lies in that fact, rather than in its collection brought from elsewhere.

Protection Mechanisms: On prospects for preservation, it is important that the list should not be dominated by "sites at risk". It has to be recognised that no textile mill in Western Europe or North America can be considered secure if it is still in its original use. The fact that the textile sector is at the leading edge for industrialisation around the world, including countries where wages are very much lower, means that what textile industry does survive in areas that saw industrialisation in previous centuries can only do so on a limited, but high-value, scale. The future for Crespi d'Adda, the first textile site to be inscribed on the World Heritage List, is under consideration following closure of the mill.

Conservation of textile mills and their landscapes therefore depends on promotion of active re-use. Lowell (USA) has survived thanks to its second-generation role in the micro-electronics industry. Much of the Oldham (UK) landscape is based on mills now serving as large mail-order warehouses. In Dundee (UK) a dozen mills are now converted to flats. The impressive landscapes of Norrköping (Sweden), Tampere (Finland) and Lille (France) depend on imaginative mixed-use developments. Such is the robust quality of the textile mill that conversion can be celebrated as reinforcing rather than detracting from authenticity, but some rules need to be applied:

- Documentation, inside and out, of the buildings before conversion to gain an understanding of its significance.

⁴ <http://www.lwl.org/LWL/Kultur/wim/S/bocholt>

- Application of conservation controls to ensure that elements essential to the character of the textile mill survive: chimneys, identifiable power houses, structural systems (so a preference against “facadism”) and landscape features: mill ponds, lades, canals etc

Where a textile landscape is presented as of international significance it needs to have adequate safeguards as a landscape rather than a series of individual monuments. So in Britain the “conservation area” is the designation used to convey the cultural significance of landscapes and townscapes at Holbeck and Bank, Leeds; Nottingham Lace Market; Ancoats, Manchester; Blackness, Dundee; Saltaire and Little Germany, Bradford; New Lanark and Deanston, Scotland; Cromford, Milford, Belper and Darley Abbey, Derbyshire. Wider landscapes still are presented through tourist mill trails. In America, National Park designation was utilised to safeguard and promote Lowell and other large-scale landscapes are denoted as National Heritage Areas. More limited area might be National Landmark areas, like Harrisville, NH. In Norkopping, Sweden the Riksantikvariebetet similarly declared a landmark area around the Motala Strom.

4. Textile Mill Typologies.

Domestic workshops: Vernacular architecture around the world includes provision for textile working. There are large Gassho-style houses in Japan in which the roof space is given over to silkworm raising (a key element in the Shirikawa-go and Gokayama WHS). Similarly large houses, but for linen weaving, exist in a row as the “Twelve Apostles” at Chelmo Slaskie, Poland.

Whilst spinning as a domestic activity leaves little archaeological trace, the larger room required by looms can be traced in building types, and by pits and loom-weights. Linen and cotton required a relatively humid atmosphere, and would best be woven on earthen ground floors or in basements (examples in Preston and Barnsley, England, Angus and Fife in Eastern Scotland, and Bretagne, France, often with separate external steps). Preliminary warping, beaming and starching, and subsequently tentering, would take place on upper floors, sometimes elsewhere than in the domestic property, being hung to dry in warp lofts or outdoors

Silk weaving shops would similarly occupy top floors, whether in La Croix- Rouse in Lyon, France (a WHS) or in Paradise Street, Macclesfield, England, before giving way to power loom sheds.

Woollen loom shops would also be found on upper floors, to capitalise on natural light, received through mullioned windows in the Yorkshire Pennines (UK). Detached weaving shops, each containing a treadle loom, are characteristic of the Harris tweed industry established in crofts. This is still a living textile landscape, combined with small-scale agriculture, in the Western Isles of Scotland, UK. On the other hand some woollen factories could be on a large scale such as those in Sedan, France, most notably le Dijonval, (1755) even when most processes were by hand.

Tenter frames had also formed part of the proto-industrial woollen landscape, as at Rahmenberg (*Drying Frames' Hill*), Monschau, Germany). In Monschau the Rotes Haus was the centre of a putting-out system: there were parallel systems in most parts of Europe. Perforated teasel houses in Gloucestershire, UK, and timber *trockenturme* in Switzerland illustrate specific building types for the finishing of woollen cloth that illustrate regional responses to a common functional requirement. For fulling (or

waulking) cloth, urine was essential, and monuments even to its collection exist at for example the Secktürmchen (*Urine Tower*) at Bad Münstereifel, Germany.

Hosiery knitting workshops might also be found in detached, non-domestic, workshops in the East Midlands of England, where windows are large, and Hawick, Scotland, where windows are small: each the local responses to available building materials. Bowls of water were used to magnify the light required by each framework knitter.

Carpet weaving in India and across central Asia would generally take place under sheltered awnings in courtyards, children still having the most nimble fingers.

The multi-storey mill

Italian 17th century silk throwing mills were tall because their machinery rose through several floors, and this type was the precursor to all other forms of textile factory.

The ground floors of the early wool mills in France and Italy had shallow-two-directional vaults springing from stone piers, as at Lanificio Zignone, Biella, Como, and at Prato, Tuscany, Italy. Upper floors are of timber, kept dry and separate from wet process like fulling.

From 1772 Richard Arkwright's cotton mills were also multi-storey, of between 3 and 7 storeys, the stages in the process going from floor to floor, partly driven from waterwheels. Here the organisation, or exploitation, of labour was perfected.

Fireproof mills had a similar arrangement. The first cast-iron frame was built in 1797 at Ditherington Mill, Shrewsbury, UK, from which all metal framed buildings are descended. The skyscraper then owes its origin to textile mill construction, and also to practical devices such as the lift that also evolved in textile mills and warehouses. KF Schinkel studied the type while investigating British building technology to inform the building of museums in Berlin. It seems to have been in Prussia (e.g. the Royal flax mill in Myslakowice, now in Poland, 1844) that iron frames first carried multiple arches on a grid of iron beams and joists. This was later matched by patented systems by different Lancashire architects who sought to achieve wider spans that suited the action of the spinning mule. Until then the majority of mule spinning mills (wool and cotton) had timber floors while a flax, jute or worsted mill was more likely to suit fireproof construction.

A European variant of the type -cast iron columns and brick vaults in place of iron beams- occurred in France, Italy and Spain (c 1860, at Le Blan, Lille and Barcelona), Perhaps this was due to inability to cast large beams, or to the persistence of the Italian tradition of ground floor vaults. Timber construction generally persisted to this date in Poland and Russia.

Slow-burning timber construction was the American preference, given plenty of timber to suit the requirements of insurance policies. This limited possible widths of American mills, but not their length. The Waltham system meant greater mechanisation and less skill, necessary given relative labour shortage in the USA.

Shape: Mills relying on spinning frames (e.g. water frame, throstle, ring frame) might have a relatively narrow plan relative to width. In the case of flax, jute and worsted spinning mills, preparatory carding and combing processes could take place in separate

buildings arranged around courtyards (Coffin Mill/Logie Works, Dundee and Le Blan Mills, Lille) and later in single-storey outshots, (as at Camperdown Works, Dundee and Salts Mill, Bradford). There was therefore scope for neo-classical proportions, and perhaps renaissance-style water towers (seen in Bradford and Dundee, UK, and as open dust flues in Lille).

Mule spinning mills (in the cotton and woollen industries) were initially similar, but with characteristic proportions counted in mule lengths when they were laid end to end. From c 1860, a variant with mules running transversely saw a much deeper form of mill, some of them almost square in plan, others rectangular, depending on the number of spindles per mule (so longer in Oldham than in Bolton, UK). Sometimes, when doubled, and linked together, an extraordinary length would be displayed as a unified piece of architecture (as at Scheibler and Poznanski, Lodz, and Houldsworth's, England).

Externally, mills are characterised by regular repetition of windows to suit the operations and operatives within. Window size progressively increased throughout the 19th and early 20th centuries, until virtually forming a glazed curtain wall: something more often achieved on continental Europe than in the UK. The textile mill led the way in European reinforced concrete just as did the motor car factory in America, slightly later. It was first tried in a large building in 1895 by Francois Hennebique at the Charles V Spinning mill, Tourcoing, France (demolished). There are relatively few reinforced concrete mills in Britain, but more on the continent, e.g. Brede, Denmark, (Hennebique) and Bendix, Dulmen, Germany (Koenen system), both 1908, and they became standard in 1920s in the Netherlands, in Brno, Moravia, in Italy and elsewhere.

The Roof form was largely dictated by the width of the building:

- a) Steep pitch with extra attic accommodation (e.g. early mills in Switzerland, Saxony, USA and Gloucestershire UK), (1800-1860)
- b) Shallow pitches without roof lights (favoured in USA, Russia, Poland and Catalan colonies 1835-1900)
- c) Shallow pitches with roof lights (wrought-iron as in train sheds, circa 1845-65).
- d) Curved lamellar roofs: the capriata roof in Italy.
- e) Shallow pitches with monitor lights (e.g. Ravensberger Spinnerei, Bielefeld, Germany,)
- f) Steep pitch with cast iron mansard: Dundee, UK (1850-85). Mansards are also known at various periods in France and Sweden, with timber structures.
- g) Saw-toothed: in woollen mills and as UK cotton mills got deeper for mules, sometimes top-lit like a weaving shed. (1850- 1900)
- h) Flat water reservoir (favoured in Lancashire UK 1890-1907 and in France and Germany).
- i) Broad and high steel spans in some of the Ghent cotton mills, Belgium.

National and regional characteristics come to the fore more in the form of the roof and of the tower than in the basic plan, layout and proportions, which often conform to an international type dictated by machines. Therefore the textile museum at Borås, Sweden, has a later East European shallow pitch zinc roof over a PS Stott-designed mill that otherwise would have sported multiple pitches if it were in Lancashire. The 17 cotton mills built to PS Stott designs in West Munsterland and nearby parts of the Netherlands gave a similar nod towards local style with helmeted water towers.

The weaving shed is often considered the prototype of the typical modern factory with everything arranged for ease of supervision on one level. Weaving could be in multi-

storey factories, found in the USA and UK up to 1870, when the speed of looms increased. Spinning might also be sometimes performed in a single storey shed- more so in jute (from 1865), worsted and wool than cotton. The choice of single storey shed layout can also be influenced by available land holdings, power sources etc, but regional and national variations can be detected.

Weaving sheds developed in Britain from around 1820. Roofs were usually saw-toothed and north-lit but there are variants:

- a) South-lit in the Southern hemisphere, (e.g. Brazil, where large spans were favoured)
- b) Domed vaults (Deanston and Leeds, UK, Issenheim, France): fireproof but expensive and relatively dark.
- c) Catalan brick vaulting in single-storey factories. Catalan colonies however were of two or three storeys due to topography and water power: weaving at ground level, spinning above.
- d) Flat roofs on vaults with monitor lights (Kolkata, India, and Italy) helped reduce heat and direct light.
- e) Some larger forms of shed had scope for overhead passes for supervision (e.g. woollen tweed in Roxburghshire, UK) and in lace mills (e.g. Nottinghamshire, UK).
- f) Longer spans could be achieved by directing power systems from below rather than above (as at Salts WHS, Bradford, and in Dundee, UK).
- g) Some sheds are two-storey, one carrying out subsidiary functions, e.g. jute and linen factories in Kirriemuir, Angus, Scotland, 1865.
- h) The Tonnendach type in central and northern Europe has a broad span in a shallow curve, with raised transverse roof lights. Sequin-Brunner of Ruti, Switzerland, patented such a system in 1885. They were more flexible regarding layout and could sustain heavy snowfalls.
- i) Formed in small section timber, without raised rooflights: the curved “Belfast Roof” favoured in Ireland (as at Barbour Threads, Hilden, Northern Ireland, UK and at Port Law, Eire).
- j) Wrought iron or steel lattice trusses were favoured in France from around 1870.

Power systems

Hand/foot: even large factories were initially hand-powered for most or all processes (e.g. le Dijonval, Sedan, France). Hand processes continue to this day in some industries, such as in lace and central Asian carpets. Sometimes the work was/is put out domestically, and sometimes organised in factories.

Animal: used in small-scale enterprises, e.g. horse power in small dyeworks in Hungary and Slovenia.

Waterwheels: were mainly used from the 1770s-1850s, initially of timber, then with increasing quantities of iron. Width was more important than diameter for regularity of power. Use of wheels persists at smaller locations.

Turbines:⁵ developed in France (by Girard: see Zyradow, Poland) and USA (by James B Francis at Lowell from the 1840s). These were the prime power source in Catalan and Brazilian colonies like Colonia Vidal.

Steam power allowed creation of the first great industrial cities, notably Manchester (the oldest extant being Murray’s Mill, 1798) and was important in the development of other textile cities such as Leeds, Dundee, Lille, Ghent, Lodz, Fall River, New Bedford, Puebla, Mumbai and Kolkata. Engine houses might be detached, or at the end of a building, or in the centre of a double mill. Once rope races came to be used, c. 1870-1890, an Oldham-type of cotton mill evolved where the engine projected asymmetrically

⁵ <http://www.history.tampere.fi/rapids/vesi/index.html>

from the mill, the rope race providing a fire barrier between blowing and spinning departments. A water tower with ornamental roof would be placed at that point.

Electricity raised by steam or water turbine was used for lighting from the 1880s, firstly in USA. The first in Nordic countries was at Plevna weaving shed, Finlayson Mill, Tampere, Finland, 1882, Edison system, and for power in the early 20th century: early examples in UK and Germany date from 1906/7.

Power Transmission from whichever source tended at first to be directed horizontally along the ground floor and then upwards to groups of machines in the same way that groups of stones were driven in corn mills. Over time the horizontal (or lying) line shaft evolved from timber to wrought iron: square bar and then round. The main transmission would be vertical from bronze bearings close to the power source. Bevel gearing was progressively replaced by ropes, or leather or canvas belting, which required more space, so engine houses would project from the mill. America led the way in the switch from gearing to pulleys driven by belts in the 1820s. They were less noisy and more easily repaired. Electric motors at first drove groups of machines, and later individual machines.

Sprinkler systems, known in France as Grinnells, were first automated in Rhode Island, America, patented by Frederick Grinnell in 1881 and then became widespread in Europe in the 1880s. Mather and Platt of Manchester had distribution rights in the eastern hemisphere from 1883. This resulted in a renewed architectural focus on the water tower. In cotton mills the tower would be placed at the location of the rope race from the engine that also served to separate the hazardous blowing rooms from the spinning flats. In the 1880s-1890s these were generally 2/3 of the way along the mill. By 1905 the corner was the favoured location for a tower that would also carry a variety of roof forms (French-style pavilion, or even Byzantine) and the name of the mill. Flemish cotton mill roofs in Ghent could be particularly tall and ornamented, like the local Hotels de Ville. German roofs from Rheine to Lodz more often followed an ogee curved helmeted type, like a pickelhaub.

Gardens. However the woodland walks above New Lanark were a significant aspect of Owen's environmental ideas. Public parks might be provided by paternalist mill owners for the general enhancement of a town, such as Lister Park, Bradford, and Baxter Park, Dundee. As these were not especially close to the owners' Manningham and Dens Mills respectively they are seen as important facilities for the entire city as well as underpinning a textile landscape shaped by a single company.

More closely identifiable as parts of textile landscapes is the treatment of parks along the power canals at Lowell (USA). The immediate settings of Ravensberger Spinnerei and of Nordwolle, Delmenhorst (Germany) are much enhanced by small parks. Parks also played their part in the paternalist colonies of Catalonia and Italy, such as that opposite Lanificio Rossi in Schio, containing a grotto and a theatre.

Where the climate was particularly oppressive to European sensibilities gardens have a still more significant role. They are places of respite in the grounds of jute mills in Kolkata and of woollen and cotton mills in Brazil and Mexico, where their creation would have been all the more of a challenge. They sought to show the benefits brought by industry so as to retain a happy workforce and management.

5. List of Known Textile Sites of International Significance

The aim of this analysis has been to provide a framework to guide governments and the World Heritage Committee. The TICCIH and ICOMOS thematic studies only present examples that may help guide States Parties in their selection of sites for inclusion in the World Heritage List. Not all of the sites mentioned will on detailed examination prove to be of universal value, sufficiently authentic or adequately protected. Not all will be priority for nomination by the relevant state party. The majority are here to give context to the few that are or may become world heritage sites.

Numbers in brackets relate to the UNESCO cultural criteria (i) to (vi) to which the suggested headings approximate. A site might qualify under more than one criterion, and might for example comprise both a *flagship* and a *time capsule* within an urban textile landscape.

PIONEERS (ii, iv): into this category should be put those that had no real precedent, where innovations were first tried out and to which other textile sites acknowledge their origin.

Caraglio, Italy (silk)

Cromford, UK (first cotton mill, 1772)⁶

Ditherington, Shrewsbury, UK (first iron framed building, flax, 1797)⁷

FLAGSHIPS (i, ii, or iv): these are architectural one-offs or trend-setters. They either:

(i) “*represent a masterpiece of human creative genius*”: (Claims of outstanding status as works of art will only be accepted sparingly, or not at all. One approach may be to sites that produced outstanding designs) or

(ii) *exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design; or are*

(iv) *an outstanding example of a traditional human settlement or land-use which is representative of a culture (or cultures), especially when it has become vulnerable under the impact of irreversible change*

Gobelins, Paris, France

Le Dijonval, Sedan, France (wool) 1755

La Foudre, Roen, France (flax) 1846 Fairbairn fireproof, Girard wet spinning system

Casaramona, Barcelona, Spain (cotton) by Puig i Cadalfach

Vapor Americh, Amat y Jover, Terrassa, Spain (wool)⁸

Manningham Mills, Bradford, UK (velvet)

Saltaire, Bradford, UK (worsted/alpaca) WHS 1853 W. Fairbairn

Templeton's, Glasgow, UK (carpets) by W. Leiper, 1889,

Dens Works, Dundee, UK (flax) 1822-66, P Carmichael

New Lanark, UK, (cotton) WHS 1785

Masson Mills, UK (cotton) WHS,⁹ 1783

Marshall's, Leeds, UK (flax, with Murray's engineering works) 1806-1842

Houldsworth Mill, Stockport, UK, (cotton) 1865

⁶ <http://www.btinternet.com/~jend/arkwright/>

⁷ <http://www.heritageworks.co.uk/dither.htm>

⁸ <http://www.mnactec.com/>

⁹ <http://www.massonmills.co.uk/>

Armley Mill, Leeds, UK (wool) fireproof, 1805.
Stanley Mill, Gloucestershire, (wool) fireproof, 1813
Myslakowice, Silesia/ Slask, Poland (flax)¹⁰ 1844
Ravensberger Spinnerei, Bielefeld, Germany (flax): 1854
Vereinigte Seidenwebereien AG, HE-Bau, Färberei, Krefeld (Nordrhein-Westfalen), Germany, by Mies van der Rohe

GIANTS (iv)

Scale is not itself an indication of quality as a measure of universal value. But as one aspect of the significance of a textile site, and which impressed contemporary visitors, is scale, this is a relevant criterion. Measurement can best be by the size of the workforce, and thereby local economic importance. Other measures can yield very variable results: numbers of spindles increase in accordance with the fine count of the yarn: a Bolton cotton mill can contain many more spindles than an Oldham mill of the same dimensions, which would have more again than a woollen or jute mill.

Largest in World, 1800: vying between **Belper** and **New Lanark, UK** (cotton, WHS);
Largest in Europe, 1910: cotton: **Kreenholm, Narva, Estonia, (458,380 spindles, 2500 looms in 1901)**
or **Scheibler, Lodz, Poland 11,000 workers**
flax: **Zyrdow, Poland (9,000 workers)**
wool: **Dean Clough, Halifax, UK (carpets: 5,000 workers)**
Largest in World, 1912: cotton: **Amoskeag, Manchester, New Hampshire, USA, (15,500 workers).**

INTERNATIONAL INTERCHANGE sites “*exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design*” [UNESCO criterion (ii)]

This criterion reflects universal significance in the form of that interchange. It could either be the source of the technological transfer or the destination, or it could indicate a two-way transmission. In either case the significance is heightened if it led onto greater things, such as Toyota in Japan, or one of the early multinational corporations. Another aspect that could be considered is the production of raw material in one country for processing in another, but they are covered below under textile landscapes.

Chacim (Macedo de Cavaleiros), Royal Silk Twisting Mill, Portugal: in an international perspective, this mill – dating back to 1788 – is extremely important since the Piedmont spinning and throwing techniques were experimented here. Archaeological excavations undertaken in 1997 inside the ruins of the silk mill revealed parts belonging to a Piedmontese circular throwing machine.

Pawtucket, USA (cotton)¹¹: 1793, the first cotton mill in the new world was smuggled across by Samuel Slater who came from **Belper WHS, UK**. It is built of timber, later enlarged, and is beside the stone-built Wilkinson Mill of 1810. Also see J & P Coats, below for the Conant thread mills.

Cromford, Ratingen, Germany (cotton)¹². The first cotton spinning mill in continental Europe to be modelled on **Cromford WHS, UK**

¹⁰ Piotr Gerber in *IAR XIII 2* Spring 1991

¹¹ <http://www.woonsocket.org/histsite.htm>

¹² <http://www.rim.lvr.de>

Tomar, Portugal: first cotton spinning mill of British type established in Portugal (in 1789); in operation until some years ago; the local county studies the possibility to reuse the mill as a museum.

Finlayson, Tampere, Finland. Cotton mills, founded by a Scot in 1828, (later mills are to Fairbairn, UK and Sulzer/Ruti, Swiss, designs),¹³ Edison's electric light was introduced to the Plevna weaving shed in 1882. See cotton urban textile landscapes, below.

Zyrardow, Poland (flax, founded by a Frenchman when it was part of Russia, it later came under Austrian ownership and Scottish management). Also classified as a giant and a company town.¹⁴

Siebenhöfen, Tannenberg, Sachsen, Germany (cotton) Spinnmühle built 1812 by Evan Evans.

Nordwolle/BWK, Delmenhorst, Germany: biggest wool combers in Europe, hub of an international network.

Monschau, Germany and **Ksiezy Myln**, Lodz, Poland. Karl Scheibler migrated eastward, from the Rotes Haus in Monschau, to establish very large cotton mills in Lodz just within the Russian Empire. See textile landscape, below.

Queensbury, Yorkshire UK, (wool) Black Dyke Mills (1835) was linked to Geyer Mill, **Lodz**, (The White Factory, now a museum), Poland. John Foster's mill village is still dominated by a mill chimney and is intangibly associated with a famous brass band.

Kolkata/Calcutta, India (jute) from India to Dundee, machinery transferred back again. The first mill began in 1855. See textile landscape, below.

Paisley, UK: world-wide cotton thread empire formed by the United Thread Mills of J&P Coats and JJ Clark. Coats' Ferguslie Mill is mostly demolished, but Clark's Anchor Mills survives as three substantial buildings (1886 Domestic Finishing Mill, steel floor joists around a lightwell, c 1830 Shawl factory and Mile End ring mill, 1899, now flats and business centres), with adjacent housing and bowling green. Baptist church, town hall and observatory provided by the owners. Branches were at Newark, NJ, USA, (1864, Clark) Conant Mills, Pawtucket, RI (1868, Coats), Nevski, St Petersburg, Russia; Borgonya, Spain; Nici, Lodz, Poland; Budapest, Hungary, Lucca, (1904) Italy, and also in South America. Most of these branches were to avoid import tariffs.

Vapor Vell, Sants, Barcelona, and **Igualada**, Catalonia were each erected by British technicians.

Issenheim, Alsace, France. Edouard Gast built a dome vaulted cotton weaving shed, of the type developed at **Deanston** Mills, Doune, used also at Marshalls', **Leeds**, UK.

Tomioka silk mill, Gunma, Japan. This combined French and Japanese manufacturing and construction methods to propel Japanese industrialisation in a product for which there was world demand for Japanese quality. Built 1872, closed and preserved since 1987 as the oldest factory in Japan.¹⁵

Toyota, Nagoya, Japan. Museum in the cotton mill shed that spawned the car manufacturing giant.

TIME CAPSULES ("La Belle au Bois Dormante"). These contain rooms full of *in situ* machinery, and are not re-creations: Taking as a model the inscribed WHS of Verla Groundwood and Paper Board Mill, Finland, they may:

bear a unique or at least exceptional testimony to a cultural tradition or to a civilisation which is living or which has disappeared; (criterion iii) or

¹³ <http://www.history.tampere.fi/rapids/index4.htm>

¹⁴ <http://www.zyardow.pl/historia>

¹⁵ <http://www2.city.tomioka.lg.jp/worldheritage/en/outline/index.htm>

be an outstanding example of a type of building or architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history; (criterion iv)

Goteborgs Remfabrik, Gothenburg, Sweden, contains all its weaving and preparation machinery precisely as first installed. 35 single-shuttle looms supplied by Robert Hall and Sons (Bury, UK) in 1904-17, made heavy canvas belting for power transmission and conveyor belts. They are driven from line shafts by belts made at the factory. It closed in 1977 when the workforce had reduced from 50 to 9, but it and its machinery comprise a national building monument owned by the city and operated weekly by volunteers, Foreningen Goteborgs Remfabrik¹⁶. Besides its unique quality as a complete British power loom weaving factory in another country, preserved and operated in a model way, it has international importance as a representative of many factory work floors, giving evidence of power transmission and also power relationships between workforce and manager/owner.

Marzani and Abbadia Lariana, Italy (silk)

Le Manach, Tours, France. Silk weaving by jacquard, est.1829, still in operation.

Tuchfabrik Muller, Euskirchen, (Nordrheinwestfalen), Germany: wool: built as paper mill: closed in 1961. All processes preserved and operated.¹⁷

Watkins Wool Mill, Missouri, USA (wool) all processes preserved and operated, in a rural landscape.¹⁸

Webb Press, Nachitoches, Louisiana, USA (cotton)¹⁹

Blackall Wool Scour, Queensland, Australia (wool scouring by steam)²⁰ 1908, closed 1978, reopened 2002.

Queen Street Mill, Burnley, UK (cotton weaving by steam)

Kannavourgio, Edessa, Greece (hemp twine): 1909 machinery from Leeds, Belfast UK and Bielefeld, Germany. Part of an open-air museum of hydraulic power developed from 1901 by the municipality.

Chatham Docks, UK (hemp rope): machinery operated within the Naval Dockyard that is on the tentative WHS list.

Knockando, Moray, and **Islay**, Argyll, wool mills, Scotland, UK (wool): carding, spinning, weaving and finishing machinery preserved in situ and still weaving. They are in rural cultural landscapes more associated with whisky. At Knockando, once combined with a small agricultural croft, a trust has been formed.²¹

Filature de Calquieres, Haute Loire, France: with a waterwheel and non-self acting mule jenny, this is one of a dozen small wool spinners, dyers and weavers in central and southern France.²²

Filature de Belves, Dordogne, is another, established in 1860.²³

Arseguel, Catalonia, Spain. Small wool mill using mules.

Wäschefabrik Winkel, Bielefeld (Nordrhein-Westfalen) Germany est. 1906 by Juhl family, Jews wiped out by Nazis. Sewing room has *in situ* powered workbenches, sewing and embroidery machines.

Crimmitschau (Sachsen), Germany, wool spinning and weaving.

¹⁶ <http://www.remfabriken.org/>

¹⁷ <http://www.rim.lvr.de>

¹⁸ <http://www.mostateparks.com/wmill/history.htm>;

¹⁹ SIAN 32.1 2003

²⁰ <http://www.epa.qld.gov.au/projects/heritage/index.cgi?place=600033&back=1>

²¹ <http://www.knockandowoolmill.org.uk>

²² <http://pagesperso-orange.fr/atelier.laine/members.htm> connects a network of such businesses

²³ <http://filature.belves.monsite.wanadoo.fr/index.jhtml>

URBANISM: (ii, vi) Outstanding examples of paternalist or utopian town planning could qualify under criterion (ii) in respect of influence on town planning. Only exceptional sites can be considered to fall into UNESCO criterion (vi) as directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance.

New Lanark WHS cotton mills founded 1785, famous for its place in shaping Robert Owen's ideas (Owen was manager and part-owner 1800-1827) and also indirectly socialism, the ideas of Fourier, and the co-operative movement. In a rural landscape.²⁴

Saltaire WHS, UK famous creation of Titus Salt, Bradford, from 1853 for Alpaca worsted cloth. the Mill was engineered by Wm Fairbairn. The Village has an institute a school and a park.²⁵

Crespi d'Adda WHS²⁶ Italy: model village and wool mill, begun in 1878 on a grid, later adopting a radial layout. Impressive cemetery and mausoleum. The mill is mainly single storey, centred on a chimney.

San Leucio/ Ferdinandopolis WHS, Italy (radial plan, incomplete)

San Fernando, Spain: radial plan

Brihuega, Spain: circular plan

Neuro Baztan, Spain: a Manufacture Royale

Schio, Italy: Lanificio Rossi erected by Alessandro Rossi, much influenced by Owen's writings and the examples of New Lanark and Saltaire, and by the bad examples set by other British industrialists. Mill, housing, park with orangerie, grotto and theatre.

Valdagno, Vicenza, Italy. The Marzotto wool mills started in 1836 but were transformed in the 20th century into a single-company *town of harmony*: The mills were substantially enlarged in reinforced concrete in 1922-29, the roof trusses resembling bridges. 1000 homes, welfare, cultural and sporting institutions planned by Francesco Bonfanti followed in 1928-1937. This is probably the biggest model town created by a single textile company.

Val-des-Bois, France

Mulhouse, Alsace, France: village ouvrier developed for the Dolfuss company.

Ludlow, USA

Lowell, Mass., USA: see textile landscape below: urban cotton.

Kuchen bei Göppingen (Baden-Württemberg), Germany, industrial village

Industriekolonie Amerika, Penig (Sachsen), Germany, very large industrial village

Gmindersdorf, Reutlingen (Baden-Württemberg) Germany, industrial village

Himmelmühle/Oelheysche Spinnmühle, Wiesenbad (Sachsen) Germany

Port Law, Ireland. Water-powered cotton mill, est. 1825, converted in 1930s to a tannery that closed in 1987. Efforts are now underway to find a new use for the factory that will help sustain the population, half of its 4,000 peak in the 1850s. Then the village was rebuilt on a trivium plan of 3 radial streets, the houses having Belfast roofs. A large and impressive school underlines Quaker David Malcolmson's paternalist role.

Riba de Ave, Portugal: small town at the centre of a heavily industrialized region, 30 Km N. of Porto; established in 1896. Several other large cotton mills were later established, all belonging to the Ferreira family; this family developed the town infrastructure (workers dwellings, hospital, schools, post offices, church, cultural foundation, local police station, etc) in a paternalist way and was very close to the Portuguese Estado Novo regime (1920-1950s).

²⁴ <http://www.newlanark.org/index.shtml>

²⁵ <http://www.bradford.gov.uk/tourism/trails/saltaire/saltaire.html>

²⁶ <http://www.villaggiocrespi.it/ENG.htm>

TEXTILE LANDSCAPES (iv, v): groups of mills, factories, textile machine works, industries ancillary to textiles and its workforce, workers' and owners' housing, parks, related institutions, water power and transport systems, agricultural landscapes where the raw material is produced and is processed. They may be divided into relict (defunct but with much physical evidence remaining) and living textile landscapes where textiles are still an important aspect of daily life. In Britain the Harris tweed industry of the Western Isles, and the hosiery industry in Hawick may serve as living examples, and in central Asia the manufacture of handmade carpets continues to be a main source of income.

Much here depends on management strategies that safeguard the landscape. According to the potential variously presented by forms of national legislation and local initiatives, some of these landscapes may have to be reduced in scale to more well-defined but conservable areas.

Rural cotton:

Derwent Valley WHS, UK: includes Cromford (pioneer), Masson (flagship), Belper (flagship), Milford, Darley Abbey, each a cotton mill colony attached to small pre-existing settlements along the same river, linked by canal, and later railway.²⁷

Styal, UK, 1784 Quarry Bank Mill, apprentice house and small village. Museum contains relocated textile machinery and a suspension waterwheel.²⁸

Stanley and Deanston, Perthshire, Scotland, UK founded 1786-7 with impressive water systems. Stanley, mostly converted to housing apart from 1786 Bell Mill. Deanston is now a whisky distillery with pioneer vaulted weaving shed by James Smith, 1830, (the model for Marshall's of Leeds) and terraced tenements of 1811 and the 1820s by the power canal.

River Ave Valley, Portugal: large group of textile mills, the oldest dating back to 1845, and some of them very huge. All these mills still work.

Parc Fluvial Navas-Berga, Catalonia, Spain, a linear heritage corridor links 15 colonies each with integrated turbine-powered cotton mills, tenement housing, allotments, managers' and owners' houses, school, church, and theatre. A museum within the MNACTEC system is at Cal Vidal.²⁹

Colonia Sedo and Guell, Catalonia, Spain. Guell has a chapel by Gaudi, itself part of a multi-site WHS.

Melrose and Magnolia Plantations, Louisiana, USA (slave plantations/cotton gins)³⁰

Graniteville, South Carolina, USA (company town)

Metepc, Mexico: single factory town, now the first ecomusee in Mexico.

Maranhão, Brasil, Rio Anil factory, single-storey, now a college.

Urban cotton:

Ancoats, Manchester, UK. The first steam-powered urban district in the world.

Murray's (from 1798) and McConnell, Kennedy and Co Mills, (1818 etc, fireproof) front the Rochdale Canal, source of condensing water and a transport link. Development continued in the form of concrete-floored, electric-powered, Royal and Paragon mills. Improved housing is at Sanitary Street and Victoria Buildings near the Daily Express curtain-walled printing works, 1939.³¹

²⁷ <http://www.btinternet.com/~jend/arkwright/>

²⁸ <http://www.quarrybankmill.org.uk/default.asp>

²⁹ <http://www.parcfluvial.com>

³⁰ <http://crm.cr.nps.gov/archive/20-14/20-14-5.pdf>

³¹ http://www.ancoatsbpt.co.uk/projects_mills.htm

Oldham, Lancashire, UK, had 12.4% of the world's cotton spindles in 1890, more than any single country other than UK and USA, peaking at 17.7 million spindles, mostly mule (some ring from 1884), spinning medium and coarse counts. Here the joint-stock limited liability company was fully exploited, so most mills are of similar size. Amongst the best in landscape terms are Manor, Fernhurst, Ram, Gorse, Ace, Rugby, Heron, Devon, Durban, Maple, Belgrave, Nile, Cairo, Majestic, Orme, Orb, Vine, Grape, Lilac, Briar and Lily. Surviving parts of engineering works -Hartford Works, East Works and Asa Lees'- represent the largest textile machinery maker in the world (15,000 employees at 1906 peak): Platt Brothers, to whom Werneth and Alexandra Parks and extensions to the Lyceum are owed.

Bolton, Lancashire, UK for fine spinning of Egyptian cotton, notably Atlas (6 mills had 350,000 spindles, but most of these are demolished. Northern Mill Engine Society displays working steam engines here), Beehive and Swan Lane Mills (3 mills, 330,000 spindles): large scale flagships of private enterprise.

Wigan Pier, Lancashire, UK: Trencherfield Mill with engine, Eckersley's mills (ring) and canal basin visitor centre making a literary connection to George Orwell's *Road to Wigan Pier*. Also the model flagship Gidlow Works, 1865, with a park, is a separate conservation area.

Tampere, Finland. The third largest city in Finland was sited by rapids at the drop in levels between two lakes. Cotton mills and a machine shop were the foundation for other industries: linen, wool, paper and cardboard. In the 1860s at least 20 different production plants relied on the Tammerkoski. A broadcloth factory (Tampereen verkatehdas) 1856, a roofing felt factory, 1866 (start of Nokia) and Liljeroos wool mill was added in the 1890's. Tako paperboard factory is still working in the heart of the city. The landscape is well preserved thanks to adaptive re-use (Finlayson cotton mill from 1828, Frenckel paper mill, 1840, power stations, Tampella engineering shop and linen factory). Interpreted at the Museum of Labour³² in the Finlayson cotton mills (see technological transfer), the Vapriikki museum in the Tampella engineering and linen works on the other side of the river and workers housing which has its own museum, Amuri³³. The area is well safeguarded by lakes and parks.

Narva and Ivangorod, Estonia and Russia: Kreenholm cotton and Steiglitz flax mills: with workers barracks and tenements- both brick and timber, hospital, administration buildings. Water-powered complexes to either side of a waterfall: now an international boundary. The creation of a manufacturing city at a waterfall mirrors Tampere in Finland, Norkopping in Sweden, Lowell, Lawrence, Manchester, Saco and Troy in USA. Kreenholm Mills are by far the largest operating cotton mills in Europe.

Ksiezy Mlyn, Lodz, Poland (from 1873, Scheibler and Grohmann, now Uniontext) covers 500 hectares with hospital, fire station, owners houses (Villa Herbst a museum and film school) and grid-plan model village axial to the mill. The firm had 11,000 employees in 1913 after Scheibler and Grohmann had united. Grohmann's factory in Targowa Street has a gothic entrance.

Poznanski, Lodz, Poland (from 1878) The other large employer with both mills and 5-storey workers tenements on a more monumental scale than Scheibler, albeit in a smaller area. The owner's house is very ostentatious, serving also as showrooms and business chambers, now the main museum for Lodz. The mills are now under development as "Manufaktura", a retail and entertainment complex.

Lodz: Another 400 mills in this archetypal mill city mean that the whole city could be considered a textile landscape. Some were for wool production, such as Schweikert, now part of Lodz Technical University. The Museum of the Textile industry is in the White

³² www.tkm.fi

³³ www.history.tampere.fi and <http://www.tampere.fi/amuri/museumquarter.htm>

Factory, the first of the steam-powered spinning mills, established in 1838 by Ludwig Geyer with a Cockerill steam engine. It has neo-classical facades and a timber internal structure.

Ghent Cotton Harbour, Belgium 1885 steel-framed raw cotton warehouses near cotton mills of 1860, 1910 and 1925. Mills by canals around the city include Louisiana, Texas (1876) and New Orleans (1899) Mills, illustrating the source of the cotton, Pipyn Mill (1923) and the modernist UCO offices (1958). Small housing courts. Also Filature du Rabot (jute, art nouveau, 1899/1912). The industry is interpreted by MIAT in de Smet-Guequier cotton mill.

Oudenaarde, Belgium, Gevaert Bros mill and housing 1888/1897

Dolfuss, Mulhouse, France (company housing from 1847)

Spinnereien und weberei Kumpers, Rheine (Nordrhein-Westfalen) Germany: by PS Stott, also Technological Transfer.

Augsburg (Bayern), Mechan. Baumwollspinnerei und Weberei Augsburg, Germany

Chemnitz (Sachsen): Kattundruckerei Schiffner, (1851) and Chemnitzer Aktienspinnerei, (a pair of Mills by PS Stott 1896/1903).

Chemnitz-Hartau, spinning mill Bernhard (1803/1812) Germany

Flöha-Plaue and **Flöha-Tal** (Sachsen), Germany, Claussche Spinnerei, all important steps of industrial production and architecture from 1806 to 1893.³⁴

Mumbai, India. Massive urban growth here was in part due to expansion of the cotton industry in the 1880s, that had begun in the 1850s. 60 redundant mills are ripe for development in the harbour area. INTACH and INTBAU India are studying adaptive re-use projects at, for example, India United Mills No 1.

Lowell National Park, USA: city laid out from 1821 by the Boston Associates to suit water-powered cotton mills (notably Boott, Suffolk, Lawrence, Massachusetts, Market, Hamilton and Appleton Mills) power canals with planted promenade walks, early turbines and flood control systems, reconstructed boarding houses for the “Yankee girls” and then waves of immigrants (Greek, Portuguese etc).³⁵ The Museum of American Textile History occupies the Kitson Machine Shop. See urbanism, and also on the Lowell model are:

Saco-Biddeford and **Lewiston**, Maine, USA;³⁶

Nashua and **Manchester** (see Giants, above), NH, USA;

Troy NY, USA

Fall River, Mass., USA: mainly steam-powered and the biggest concentration of mills in New England, overtaking Lowell. A dense group of cotton mills, the majority of stone, built in 1850-80, with central Italianate campanile towers. Some are arranged in parallel pairs, with an office/warehouses between the two. Durfee Mills retain pitched roofs, Union Mills and a number of others have had an additional flatter storey added. Engine houses are mostly small, but there is a big gothic one in brick of 1909, attached to a very wide addition to Metacomet Mill.³⁷

New Bedford, Mass., has similar steam-powered mills, housing and French Canadian/Portuguese/ Cap Verde immigrant communities.

Puebla, Mexico: La Constancia Mexicana (est 1835, closed 1991) is to become a cultural complex, enclosing a series of courtyard gardens.

Salto, Sao Paulo, Brazil. Paternalist factory town on the falls of the Tiete River factories were originally built and equipped to British models (Galvao 1873, Barros Junior 1880)

³⁴ More in Germany are suggested at <http://www.freunde-rim-euskirchen.de/downloads/liste-textildenkmaeler-d.pdf>

³⁵ <http://www.cr.nps.gov/nr/twhp/wwwlps/lessons/21boott/21locate2.htm>

³⁶ <http://ci.lewiston.me.us/files/pdf/tourbrochure.pdf>

³⁷ <http://www.sailsinc.org/durfee/fallriver.htm#mills> for postcard views, interiors and exteriors

They were then in 1904 invigorated by Italian immigration and investment (Fabrica de Tecidos Italo- Americana, or, from 1919, Brasital SA). The mills are now teaching facilities.

Urban lace:

Nottingham Lace Market, UK. A district of lace factories, some of them tenemented, for finishing and merchandising the product that was also made in more uniform manufacturing areas such as Long Eaton and Beeston, Nottinghamshire, and Darvel and Newmilns, Ayrshire, UK.

Spitzenherstellung, Voigtland/Plauen (Sachsen), Germany

Rural linen:

Nova Sol (Neusalz), Walim and Chelmo Slaskie, Silesia, Poland

Sumperk, Moravia, Czech Republic, (1839-42): now weaving cotton

Großschönau, Oberlausitz (Sachsen), Zentrum der Damastweberei, Gebildweberei, damask linen weaving.

Westmünsterland (Nordrhein-Westfalen/Niedersachsen), Germany: Baumwoll- und Jutespinner und weberei: Emsdetten, Rheine-Mesum, Burgsteinfurt, Borghorst (Jute) / Gronau, Rheine, Ochtrup, Greven, Nordhorn, Verbindungen zu Enschede / NL, cotton and flax. See ETN routes³⁸.

Sion Mills, Tyrone, Northern Ireland, UK. Herdman's still spin here, but the disused old mill is subject to conservation proposals at the heart of this paternalist company village.

Blairgowrie and Rattray, Perthshire, UK: 12 flax and jute mills with 4 waterwheels, 2 turbines and 2 steam engines in situ, including Keathbank and Ashgrove Mills, (1865). Most are paired beside small waterfalls on either side of the River Erich.

Cromarty UK, hemp works 1772, hand powered factory, now converted to housing.

Kortrijk, Flanders, Belgium: finest quality flax grown here: National Vlas Museum.

Yucatan, Mexico (haciendas that worked sisal: some now are hotels, e.g. Temozon)

Urban linen:

Holbeck, Leeds, UK Conservation Area, contains Marshall's Mills (see flagship), Murray's Foundry and Tower Pin Works. Matthew Murray was notable for his numerous inventions and early steam locomotives as well as textile machinery and structural castings produced for Marshall and others. The foundry now hosts the Academy for Sustainable Communities and an "urban village".³⁹ Tower Pin Works has chimneys and flues copied from three Italian renaissance campaniles.

Bank and East Mills, Leeds UK: a conservation area containing converted flax mills of 1822-34 by the river Aire. Downstream is Hunslet Mill and Victoria Mill, upstream are Castleton and Armley Mills. (wool, fireproof 1805: Leeds Industrial Museum)

Dens Works, Dundee, UK: Baxter Bros expanded from 1822-1866: 4 spinning mills exist, with engineering dept, warehouses, office, housing and Baxter Park (by Paxton, 1863). Adjacent calenders, warehouses, docks, spinning mills and hand-loom factories make this a complex linen landscape close to Victoria Dock for import/exports.

Broadford Works, Aberdeen (Maberley/Richards) 1808 fireproof mill (built by Leeds engineers Matthew Murray) at heart of site that continued to be enlarged through to 1914, the final buildings in reinforced concrete. Pioneered gas lighting (1814), power looms (1822), canvas and hose-pipe weaving. Closed 2003: urban village development proposed; Bastille raw flax warehouse developed as flats.

³⁸ http://www.etn-net.org/routes/index_geo_GB.htm

³⁹ <http://www.cabe.org.uk/default.aspx?contentitemid=1270&aspectid=23>

Grandholm Works, Aberdeen (1792 onwards): large flax mill, from 1850 was J&J Crombie's woollen mill, with Boving water turbine, developed 2000 for housing.

Kirkcaldy: Sinclairtown, UK. Nairn's Scottish Linoleum Works (North factory still in production: South floorcloth factory closed, Weaving Factory now a college, head office now flats). Adjacent to engineering works of Douglas and Grant (made Corliss steam engines and rice machinery), Fife Forge, Coal Wynd flax spinning mills (c1809 and 1860s) and harbour.

Dunfermline: UK. Damask linen factories -Pilmuir, Canmore, St Margarets, Victoria, and Albany Works- 1849 onwards, swimming baths, and St Leonards Works (from 1851; warehouse converted to flats) to the south. Andrew Carnegie's house (the US steel magnate, son of linen weaver) is now a museum.

Moulins, Lille, France, the area of the Le Blan flax mills, Wallaerts cotton mills, and engineering works, that have been radically transformed as mixed-use "tertiaries" by architects Reichen & Robert for Lille University. Single-aspect housing courts provided by artisan rentiers, not mill owners, are overshadowed by mills.

Bielefeld (Nordrhein-Westfalen) Germany: Ravensberger Spinnerei, Mechan. Weberei, Wäschefabrik Winkel, Wäschefabrik Baumhöfener & Heise), cotton, flax, underwear.

Zyardow, Poland (see international interchange). Largest flax mill in east/central Europe. Reinforced concrete mill. 9,000 employees, 1300 family houses, dormitories, hospital and People's Palace.⁴⁰

Urban jute:

Camperdown Works, Lochee, Dundee, UK. (Cox's, 1850-68), largest integrated jute and hemp works, with railway, school, owner's house and park. Had 5,000 employees. Spinning mill and warehouses now converted to housing and calender is a supermarket.

Blackness, Dundee. West from the medieval centre along Scouringburn (for engine feed water) are: 13 flax and jute spinning mills (1799-1889), 4 weaving factories (1839-1865), 3 finishing works, an Ward Foundry (Carmichael steam engines, est. 1810), hackle and leather works (for machinery parts), a Girl's Industrial School and the pioneering Logie council housing estate (1919). Interpreted at Verdant Works (1833) by Dundee Heritage⁴¹:

Kolkota (Calcutta), India: Tithagur, Samugger, Howrah, Ludlow, Hasting and Champdany Mills, Victoria and Angus Works and others, integrated single-storey fireproof mills with clerestorey rooflights, mostly built from the 1880s to the 1920s. Jetties on river Hooghly, gardens around offices and expatriate management bungalows, initially used by Dundee management. The first mill was established in 1855⁴².

Bangladesh: plantations for jute growing and packing: factories developed after the 1947 partition and 1972 independence.

Buenos Aires, Argentina, Alpagartas Factory.

Rural wool:

Yorkshire Pennines, UK: Golcar, Hebden Bridge, Sowerby Bridge etc, possess typical mullioned weavers' windows at hand-operated proto-industrial factories. Water-powered mills and a scatter of steam powered mills dominate the landscape, all built of local millstone grit, cut through by canals, and railways, tunnels and viaducts due to the topography.

Clackmannanshire, UK. A spectacular hilly backdrop to mills in Alva, Menstrie and Tillicoultry, now flats (J and D Paton's, 1836, and Strude Mills, 1827), visitor centre (Glentana Mills, 1887), small business centre (Clock Mill, 1824) and large shop

⁴⁰ http://www.zyardow.pl/galeria.seria_dawny

⁴¹ <http://www.rrs-discovery.co.uk/verdant/index.htm>

⁴² <http://www.dundee.ac.uk/archives/IndiaExhib/IndiaExhibitionTop.htm>

(Devonvale Mills) within mill towns bisected by streams for water power. Biggest mill was Kilncraigs in Alloa, centre of Paton's empire of hand knitting yarns, from 1814. The impressive office/yarn store (1850/1903/1936) and half time school is a small business centre. Co-operative-built housing (from 1851) and Institutes (1859, 1864) in Tillicoultry illustrate the self-help of mule spinners.

Harris, UK. The Orb mark registered by the Harris Tweed Association in 1909 defines tweed made from pure wool produced in Scotland, spun, dyed and finished in the Outer Hebrides, and hand woven in their own homes by the islanders. Hattersley treadle looms mostly replaced the big wooden looms in the 1920s, and since 1993 have given way to double looms operated by pedals. The weavers are self-employed agricultural crofters in small tin sheds, weaving yarn spun in Stornoway, Lewis, the largest of the Western Isles. This still living cultural landscape was the inspiration for traditional "waulking" songs in Gaelic amongst the women who communally fulled cloth around large tables. There are around 400 of these weavers on Harris and Lewis.

Harrisville, NH, USA: two small wool mills, Harris and Cheshire, with associated boarding houses, store, library, owner's and worker's houses, now a Historic Landmark District. Preserved by a foundation after closure in 1969.⁴³

Te Waimate and Coldstream, Timaru, and Otago, New Zealand

Turkey, Iran, Afghanistan (for carpets: specific sites still to be located)

Geelong Woolstores Conservation Area, (Victoria), Australia. A row of woolstores unequalled in terms of intactness and coherence elsewhere in Victoria. With harbour, custom's house (1855) and sailor's rest.

Monschau: (Nordrhein-Westfalen) Germany. Rotes Haus (1752ff, Stiftung Scheibler Museum) and other sites on the Wollroute in der Nordeifel.⁴⁴

Radevormwald Dahlerau, Dahlhausen, Vogelsmühle, (Nordrhein-Westfalen), Germany⁴⁵ Museum at Dahlerau, with steam engine and 1922 water turbine. In 1859 workers housing provided for 100 families Mill developed 1836/1859/1872/1890.

Covilhã, Portugal: 225 Km NE of Lisbon, which developed around the fast-flowing streams of the area. Many remarkable industrial buildings survive, among them the former royal cloth factory (dating back to 1763-67) in which is now located the Wool Museum of the University of Beira Interior.

Ville Neuville, Languedoc, France, 1770s

Biella, Piedmont, Italy. Pira Mill was established in 1824 under French influences, expanded across the river in 1864 and has an important archive of cloth samples. Also Lanificio Trombetta and Sella amongst others are fine features in the landscape. These are connected by a wool route: "La Strada della Lana" and interpreted by a museum in Fabricca della Ruota, (the former Zignone wool mill in Pray) which is connected to its waterwheel by a long rope drive⁴⁶.

Brede, Lyngby-Bogen, Denmark: from 1832, with paternalist settlement on German cluster-house models for 80% of employees and a 1908 reinforced concrete mill, the earliest to survive in Denmark. The mill is now a store for the National Museum service.⁴⁷

Urban wool:

Halifax, UK, Piece Hall 18th century wool exchange, Dean Clough Carpet Mills (see Giants), Akroyden and Copley model villages, and People's Park (by Paxton).

⁴³ <http://www.historicharrisville.org/harrisville/tour.cfm>

⁴⁴ <http://www.ETN-net.org/routes>

⁴⁵ <http://www.bergisches-staedtedreieck.de/wuelfingmuseum> and www.weulfingmuseum.de

⁴⁶ <http://www.docbi.it/stradalana.htm>

⁴⁷ Jeppe Toensberg, *Brede Klaedefabrik* (2004)

Huddersfield, UK, large wool manufacturing town, some mills now used by the University, in a landscape of canals and railways (neo-classical station and warehouse), with outlying villages in Pennine Hills.

Bradford, UK. Little Germany conservation area⁴⁸ is filled with mercantile warehouses, a wool exchange and a conditioning house. Dominating the town is Manningham Mills (artificial silk, with campanile chimney, the source of funds for Lister Park and Art Gallery).

Selkirk, UK: the flat plain below the old town contains 3 big water-driven mills (Etrick, Forest and Dunsdale/Riverside, 1835-8) and later spinning and tweed weaving sheds, some still working (Heather and Whinfeld Mills, and part of Forest). They were established by manufacturers from nearby Galashiels, where the tweed industry first developed on a large scale but which had run out of water-powered sites. Netherdale Mill in Galashiels, 1873, is now Scottish College of Textiles.

Hawick, UK: a living textile landscape of hosiery factories, once hand-, water- and steam-powered. An archive hub has been formed in Tower Mill (1851, with large waterwheel), a spinning mill that spans the River Slitrig. Several other mills were sited so as to use water power, such as Wilton Mills, which was early to use power looms (1830) and powered knitwear frames. Some knitwear factories were founded as tweed weaving mills (Eastfield, now Johnston's, and Glebe Mills, now Pringle's, 1881) with large span sheds. The earliest hand frame shops, in fact operated by foot treadles, e.g. Buccleuch Mills, have small square windows beside later powered framed shops have bigger areas of glass. Hosiery makers such as Peter Scott and Hawick Cashmere offer mill tours.

Verviers, Belgium: Iwan Simonis "au chat" mill: the first continental wool spinning machine was installed here by William Cockerill. Les Grandes Rames, earliest continental multi-storey workers housing (1808) and other early wool mills include Maison Closset and that of Thier-Bettonville (now Centre Touristique de la Laine et de la Mode)⁴⁹. S.A. Solvent Belge do wool scouring by the solventing process, 1899, and steam technology is preserved). Assorted machines such as a "leviathan" are displayed as public sculpture around the town. The Canal de l'Industrie and Harmony Park complete the textile landscape.

Roubaix, France, wool mills begin with Usine Delattre, 1840. The Centre des Archives du Monde de Travail is in the turreted Motte-Bossut cotton and wool mill "Le Monstre", 1865/1876, radically converted to Les Archives du Monde de Travail in 1993. Also in the chateau style, L'Usine Motte, a 1903 velour weaving shed, is now a factory-outlet shopping complex. La Manufacture des Flandres demonstrates historic Jacquard looms. Ornate polychromatic wool conditioning house, 1901. Housing is mostly speculator-built inward-facing cours, e.g. Cour Dubar-Dekien, 1840 and 1880, each of two rooms, one door and one window.

Tourcoing, France, is similar to Roubaix, with a large statue of a sheep.

Mazamet, Tarn, France: important for fellmongers (sheepskin tanneries) where wool was pulled (delainage) in its megisseries. There is a conditioning house near the station.

Nordwolle, Delmenhorst (Niedersachsen), Germany's largest wool scouring works, with model industrial village, est. 1884. Contains Fabrikmuseum and Stadtmuseum in power station. Sheds are adapted to housing in an innovative way.

Albstadt, (Baden-Württemberg), Germany, tricot/hosiery

Forst (Brandenburg), Germany

Aachen, Germany. Part of the "Wollroute in der Nordeifel"⁵⁰

⁴⁸ <http://www.bradford.gov.uk/little-germany>

⁴⁹ <http://www.verviersima.be/pages/england.html>

⁵⁰ www.ETN.org/routes

Norrköping, Sweden. Factory founded 1642, hand spinning supplemented from 1790 by prisoners. Water-powered sites at rapids. Besides wool, knitting, tailoring, cotton (1854), paper and beer was produced. Now the area is a landmark and part, by the Holmen fire and clock tower, is a campus for Linköpings University. Interpreted at Stadsmuseet and Arbetets Museum (of Work).

Nevskaya Manufactory, St Petersburg, Russia, founded by Englishman James Thornton in St. Petersburg in 1841. Known as "Integrated Industrial Plant named after Ernst Thälmann" during the Soviet period, it was reorganised into a joint-stock company in 1992. The brick buildings of the Thornton Mill constructed in 1866 were later extended and remodelled. Today "Nevskaya Manufactory" is the largest producer of woollen fabrics and technical textiles in north-western Russia. The company is well-known in the world market. The factory preserves and develops the design traditions and production techniques of classic "English" cloth, applying ecological principles.⁵¹

Lawrence, Mass., USA, a planned cotton city on Lowell model along two power canals from 1845, but became better known for its large wool mills, e.g. Ayer Mill, 1909, Wood Mill, (1906), both for the American Woollen Co; Everett Wool, c1890 pier and panel walls absorbing the Lawrence Machine Shop, 1847; Duck Mill, Pemberton Mill (first mill collapsed in 1854: blamed on poor column castings); Bay State Mills (in brick and reinforced concrete); Pacific and Atlantic Mills (now incomplete). Some boarding houses survive, and terraced houses for the mechanics of the Essex Company.

Rural Silk:

San Leucio WHS, Italy utopian colony, also with 1820s cotton factory.

Gard, Cevennes, Drome, Ardeche, France

Soufli, Thrace, Greece, and elsewhere on the European Silk Route⁵²

Shirakawa-go and Gokayama WHS, Japan

Urban silk:

La Croix Rousse, Lyon, France (WHS)

Krefeld (Nordrhein-Westfalen), Germany, Samt und Seide

Macclesfield, UK: Paradise Mill and Paradise Street domestic weavers' shops

Bukhara WHS, Uzbekistan: city on the silk route

Merv WHS, Turkmenistan: city on the silk route

Fez, Morocco

Aleppo, Syria

Tomioaka, Gunma, Japan (see international interchange)

Urban tailoring:

Glasgow Merchant City⁵³, and Wallace Scott Tailoring Institute, UK

Spitalfields, London UK (initially for Huguenot silk weavers)

Leeds Burton Factory, UK

Londonderry and Belfast, Northern Ireland, UK

Rue St Denis, Paris, France

Bielefeld, Germany: see Time Capsule for Winkel, but other shirt factories exist.

SoHo, New York, USA. An extraordinary collection of cast iron facades from the second half of the 19th century, and magnet for immigrant tailors.

⁵¹ www.ETN.org/routes

⁵² http://www.coe.int/T/E/Cultural_Co-operation/Heritage/European_Cultural_Routes/The_Cultural_Routes/4Soie.asp

⁵³ <http://www.glasgowmerchantcity.net/merchant.htm>