Reference

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'Ribbon of Fire' How Europe adopted and developed US strip mill technology (1920-2000), edited by Jonathan Aylen and Ruggero Ranieri, Maesteg, Mid Glamorgan, Pendragon/Fondazione Ranieri di Sorbello, 2012, 410 pp., €45, ISBN 978-8865982389

This book is the belated result of a conference of experts held in Manchester in 2001. Although the experts apparently produced texts on their individual topics, the editors and others have put another 10 years of work into extending and refining the contributions. The result is an academic text akin to a dissertation presented for the attainment of a higher university degree. It really should come with a health warning: "not suitable for readers without thorough knowledge of the steel industry". The book contains a glossary of terms, but again, this is not sufficient to enlighten the uninitiated. The text was published in digital form and, as an afterthought, in book form.

The book consists of three parts, each authored by a different expert:

Part I Wide strip mills: economic and technical; developments

Part II Case studies in wide strip mill installation and development

Part III Plant suppliers, automation and users: the wider context of wide strip mill development.

Part I looks like the most enlightening part of the book, but is very hard to understand without prior detailed knowledge of steel rolling procedures for the production of various forms of sheets or strips of steel. Steel in these forms is in great demand for the production of automobile bodies, cans for food and drink products, and a variety of white goods, such as refrigerators. The wide strip mill (WSM) is an American invention which underwent several stages of further development. Most of these stages happened between about 1920 and 1940. Some thinning of the steel was achieved by cold rolling, often as a further stage after WSM. The advantage of cold rolling is that it produces a better surface finish and ductile steel suitable for deep drawing, making it ideal for automobile body manufacture. At the end of the shaping and thinning processes, the strips are usually formed into large rolls and sold in this form. As an integral part of the manufacture of strips or sheets of mild steel, various coating procedures can be applied. The steel is often coated with zinc either by electrolysis or by hot dipping to protect it from corrosion, or with tin to make it suitable for the production of tin cans.

The introduction of WSM was a true revolution in steel making. It reduced the cost significantly and increased productivity. The authors make the point that many

technical developments were necessary as preconditions for the success of WSM; for example, efficient and powerful electric motors and suitable control gear. Technical preconditions are common for major technological innovations. The authors also point out that this major process innovation led to many product innovations; another common feature of technological innovation.

The power requirements of WSMs increased from generation to generation and, more significantly, with increased rolling speed. Several generations of WSMs were built and used at the same time. A generation II mill in the 1960s used about 60MkW and rolled steel at a speed of about 20m/sec. Full computer control of WSMs became standard after about 1964. A radical shift of policy is represented by the fifth generation of mills. These mills were smaller and less capital intensive than the earlier generations, and thus suitable for small manufacturers who wished to enter niche markets. The operational principle of the new generation was the rolling of a continuously-cast thin slab through finishing stands into a coil. The technical breakthrough that enabled this technology was the continuous casting of thin slabs of steel, avoiding the need for a roughing train in more conventional hot rolling mills.

The book describes in some detail the technical evolution of WSMs. Unfortunately the detail, though substantial, is insufficient to provide real understanding for the generalist reader. The development of WSMs is divided into five generations, each a little more sophisticated and capable than its predecessor generation. By 1940, there were 28 wide strip mills in operation in the United States, and six WSMs were completed or under construction in other countries, two each in Britain and Japan. The construction of imported strip mills in Europe started in earnest only after WWII. The Marshall plan was instrumental in bringing American WSMs to Europe:

> Construction of a hot strip mill and associated cold strip mills and finishing units was the key to a range of fast growing manufacturing sectors that helped fuel rapidly rising living standards of the 1950s and 1960s.(p.58)

For the reader interested in the diffusion of process innovations, Part II is the more rewarding reading.

> Rapid growth in output of thin flat products after the Second World War was driven by the three ‘c’s’- cars, cans, and consumer durables (p.37)

The growth in consumption of the three c’s is discussed in some detail, underpinned by useful tables. The spread of WSM technology in post-war Europe is discussed country by country and these case studies are of real interest even to readers without detailed knowledge of the steel industry.

The two WSMs installed in France after the war were ordered by private firms created by mergers of smaller firms. French engineers toured the US and American suppliers of equipment for the steel industry are said to have toured France. The French government had set up a planning authority that was instrumental in the purchase of two WSMs from the US. One was installed in the North-East, owned by Usinor, and the other was set up by Sollac in Lorraine. In all cases, gifted and enthusiastic individuals were essential as leaders of the enterprises. The importance of leadership cannot be over-emphasized.

In Britain, particularly in South Wales, many small tinplate hand mills were closed with government help and the Steel Company of Wales was formed by a series of mergers of existing steel companies. Two high ranking experts were sent to the US to study wide strip mills operating in the US. On their return, they recommended the purchase and installation of a two metre wide strip mill to be part of an integrated steel plant. The actors involved in the purchase and installation of a WSM were usually a steel industry association, government departments, and a new large company formed by mergers. This pattern, in one form or another, is repeated in all the brief country case studies: France, Britain, Italy, Austria, the Netherlands, Belgium and West Germany. The respective roles of various factors and actors are briefly described for each country. This includes the role of demand, the role of American consultants, geographic considerations in the choice of location, and availability of capital, as well as more country specific circumstances and actors.

A separate section discusses the managerial and organizational changes necessitated by the radical new technology. These changes are in management practice as well as in labour organization. Much change was imported along with the machinery, and the authors speak of 'Americanization' of the industry. All these matters are subjects of a general discussion and are also part of the country studies. It took many years to bring this successful US technology to Europe. Two delaying factors are mentioned: difficulties in raising sufficient capital, and fears of possibly creating over capacity in an uncertain market.

Part II of the book is the most interesting reading for the non-expert on the steel industry. Its introduction includes a discussion on the role of the Marshall Plan, vital to the post-war reconstruction of a devastated Europe. Help from the Marshall Plan played a vital role in making WSMs an integral part of the post-war steel industry in Europe. Part II contains mostly case studies of the introduction of WSMs in a variety of European locations. Each of these case studies is written by an expert on the particular installation, including the circumstances of its construction and the resultant products and productivity. The case studies illustrate the difficulties of establishing a radical process innovation. WSMs are extremely capital intensive and highly productive. This means that they have to operate day and night, and weekends. Thus, a new organization of labour is required and this needs to be negotiated. Because of the high productivity, new markets have to be established and this can bring about conflicts within existing industrial structures.

The book can be read either as a study of a major process innovation, or as a highly specialized study of a specific process innovation in the steel industry. Very few people are likely to read the book from cover to cover; the more likely reader will select the bits of particular interest to him or her. The long gestation period of this text has proved fruitful; the text is immaculately researched and provided with ample references, though these are not for the generalist reader.

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