

developments generally, perhaps even by anyone interested in railways as such. The illustrations and figures are most appropriate, and directed at what is sometimes called the intelligent layman. There is thus no need to be a railway specialist, or economic historian, to be able to benefit from this well told story.

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The Australian Wool Supply Pipeline, Technology and Marketing Logistics: Low Cost Alternatives, by *Peter Cassidy, Ian Toft and Owen McCarthy*. (Brisbane College of Advanced Education, Brisbane, 1986) pp. 104, ISBN 0 86856 6446.

This is not an easy book to read, but it is worth the effort for those interested in the rigorous, applied analysis of processing and transport flows, and anyone with a real commitment to improved efficiency in the Australian wool industry. At a time when wool prices are booming, efficiency considerations are inclined to lose their force to an extent. But it is in boom times that profits are available to invest in capital and improved technology to aid competitiveness in future, and with that in mind, the findings of this volume are timely.

The novelty of the study lies as much as anything in the focus of its attention: not the business of producing wool, upon which so much research effort has **already** been expended, but instead, the efficiency with which it is marketed. This focus is not only novel in connection with wool industry research, but is also quite unusual in connection with the theoretical study of productivity and technological change more generally.

Prospective readers should not infer from this that the study is about the characteristics of wool and its saleability in various markets, the focus of other research in wool marketing. Rather, the authors have addressed the problem of devising a number of low-cost, distribution systems for Australian wool by integrating the processes of assembly, packaging, transport and shipping. As must be apparent from such a description, the central task of the work was to look to spatial equilibrium analysis for models which could allow alternative outcomes to be considered for the entire system of wool distribution in Australia. The set of models over which the authors had to exercise their choice included activity models, approaches based on dynamic programming, and modified transportation and transshipment formulations. In the end a transshipment formulation of a transportation linear programming model was adopted to provide the analytical framework, and was put to work on the basis of 59 supply regions from which wool flowed through 12 possible regional centres and to six possible ports.

This, then, is the framework within which the analysis is conducted. But what are the alternatives broached? Put broadly, the study asks questions about where, and by what methods, the interdependent operations of packaging, handling and transport should take place in order to maximise net

industry benefits. The principal technological advance, of which the distribution end of the industry can these days take advantage, is the very high density packaging of wool for exports. By repackaging traditional bales of wool in the form of super-dense modules, container space can be better used, container payloads almost doubled, space on board ship used more efficiently, **and cost savings achieved as a result.** Choices arise in selecting from different techniques of super-dense packaging and in deciding upon optimal locations for storage and performing the repackaging operation.

The authors considered six different options. The first involved storing wool at inland regional centres, selling it at a central point (using another innovation, sample/separation), and converting it into super-density packs after sale at shipping ports. The second envisaged compressing all wool, before sale, at Albury, and only then taking it to the shipping ports. A third option involved taking wool to the shipping ports first for storage, and then compressing it at portside before sale. In the fourth alternative, wool is received and stored both at a central sales area and at shipping ports where, in each case, it is compressed into super-dense packs before sale. Little would be gained by detailing the remaining options for, as the empirical results suggest, it is this fourth case which turns out to dominate. Basically, the best results were found when packaging was assumed to be done at the major shipment ports before sale, packaging at regional centres coming out of the comparison with rather less to recommend it.

Given this finding, the authors conclude (p. 91) that ultimately it is likely that Australia as a whole will adopt the "Queensland Model" of centralised, metropolitan, shipping port storage in pre-sale, super-dense dumped packages. However, as with all innovations, this predicted process of diffusion will depend upon aspects of the environment in which it occurs. In particular, the authors observe, the nation-wide adoption of the "Queensland Model" presupposes that woolbuyers and their COMECON customers will learn over time to accept and utilise super-dense wools, and that support for super-dense packaging by the Reserve Price Scheme continues. All shipping ports might thus eventually be involved but the study also suggests that Melbourne should be the first choice if costs are to be minimised.

This book successfully exploits fairly ambitious quantitative techniques to derive clear answers to questions of considerable complexity but great importance in a country whose future still rests heavily on the international competitiveness of its wool exports. Regrettably, the substance of the book is less accessible than it should be: not so much because of its technical content (which is unavoidable and presented with great explicitness), but rather because large parts of the verbal exposition called for more editing skills than seem to have been applied to it. I was constantly stumbling over infelicitous expression and awkward, tangled sentence construction.

My other regret is that this careful and rigorous case study of the innovation process at work was not supported with the sort of insights which general analysis of the subject has yielded in recent years. But for those excited by system-wide innovation, innovations in distribution, and the quantitative analysis of the consequences of innovation, this book is certainly worth more than a cursory glance.

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