labour process theory is being utilised, the direction in which it is heading, and its theoretical basis. This is particularly so in terms of the impact of technology on the worker, the work environment and society. Also, the pressures and decisions which impact on the type of technology developed and the ways it is implemented are very effectively demonstrated. The case studies highlight the non-determinist nature of technology and the importance of controlling and understanding the process, and being aware of its aims and options. One way of doing so is through using labour process theory to understand the developments: it has the potential to be a very successful tool.

REFERENCE

1. See Karl Marx, *Capital,* vol. 1, part IV, 'The production of relative surplus value'.

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Technology and Competition in the International Telecommunications Industry
by David Charles, Peter Monk and Ed Sciberras
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That the telecommunication industry is undergoing structural adjustment will come as no surprise to most readers. Neither will it surprise that competitiveness depends on a complex set of organisational and technological factors. This is particularly true in the telecommunication subscriber equipment (TSE) sector, the subject of a detailed analysis based on the perceptions of 20, primarily large, US, Japanese and European TSE supplier firms. TSE includes private switching equipment (i.e., PABXs, key systems) as well as voice and non-voice terminals (i.e., cordless and cellular telephones, modems, and data, facsimile and video terminals, etc.).

The authors' objective is to examine the importance of firm size (scale), product variety (scope), structure (including horizontal and vertical integration), and the characteristics of manufacturing processes as determinants of technical innovation and international competitiveness in the TSE marketplace. The approach is refreshing. The first part of the book assesses the contribution of the theoretical literature on economies of scale and scope to the explanation of complex firm behaviour. The authors remark that:

> measurable constructs of scale and scope were found to be meaningless because of their lack of replicability. In practice, they proved unhelpful in portraying the real world advantages or disadvantages associated with large size or multidivisional activities. (p. 8)

The challenge is to explore the complexity of real world firm behaviour through empirical analysis.

The study focuses on the 'manufacturing' activities of TSE producing firms, the activity of physically producing hardware. Complementary activities, such as R&D, marketing, sales, corporate finance and administration, are discussed but not given detailed treatment. Chapter two reviews literature pertinent to manufacturing and competitiveness, touching on competitive strategies, the role

of capital investment, changes in product design, automation, labour mobility and skills, quality and supplier-user relationships.

Part II provides details of firms' responses to the main research questions: Do TSE firms compete directly with each other? What are the main aspects of competition and the main factors contributing to competitiveness? What is the relationship between product and process technologies in production, and to what extent does size of firm (scale) and the range of outputs (scope) contribute to the ability to compete with rivals? Of what importance are 'best practice' technologies and what (if any) barriers to market entry and exit exist?

The TSE market is substantially dependent on the regulatory environment and a chapter is devoted to trends in TSE production and the liberalisation of markets. Inevitably in a fast moving industry, the account of developments is outdated, but the overall message is clear. Market liberalisation offers new opportunities for growth for those TSE firms, be they of US, Japanese or European origin, that manage to combine organisational and production systems effectively. The outstanding question is how existing players in the market will fare.

Chapters four and five concern how TSE firms exploit economies of scale and scope. Observations are made on minimum necessary production volumes for telephones and PABXs (e.g., European volumes are in the range of 1.0 and 1.5 million telephone sets regardless of firm size) and on ways of organising and standardising component supply. The need for large scale production is found to be closely related to increasing overhead costs associated with R&D, marketing and sales. With respect to scope economies, advantage appears to accrue to firms that are best able to use excess plant capacity, organise the sharing of inputs to manufacturing, and, importantly, to make efficient use of information. Firms participating in this study perceived convergence between information processing and telecommunications to be crucial to future competitive strategies. Firms regarded themselves as " 'technology makers' not 'technology takers' " (p. 123).

Chapter six provides an interesting discussion of firms' perceptions of 'efficiency' in manufacturing and other production-related activities. The authors boldly state that:

> competitive strategies in the TSE industry are strongly influenced (albeit unknowingly in most cases) by the economics of information rather than physical goods production. (p. 140)

Here, and in subsequent chapters, this observation receives little elaboration except with regard to the importance of information in the R&D process. Given that software now comprises more than 50 per cent of total R&D costs associated with TSE production (some would give a much higher figure), that software design and production is a central feature of service applications, and that software activities are inordinately information-intensive, it is odd that the authors choose not to give equal treatment to 'non-manufacturing' activities.

The final chapters sketch some of the main characteristics of the future of the TSE industry. Convergent telecommunications and IT technologies are leading to convergent innovative activities and commercial strategies. Although efficient and flexible manufacturing is a precondition for success, quality, corporate image and the ability to organise the marriage of telecommunications and information processing are increasingly important. By the mid-1990s, it is suggested, "it is very likely that the TSE industry will accommodate only very large 'total technology' firms and small niche producers" (p. 155).

Despite a clear analysis of facets of the TSE industry, this book gives relatively cursory attention to the very aspects of competitiveness that it designates most crucial — information and software. Several additional shortcomings do not detract from the overall contribution. First, it is widely recognised that the future of the TSE segment is deeply interwoven with the evolution of the public switching market. The location of 'intelligent' software centralised in public networks, decentralised in PABXs or in end-user terminals is a tension that has yet to be relieved. Competencies in software design, production and implementation are likely to be major elements in the survival of firms across the telecommunications and related industries, not just in the TSE segment.

Second, the premise that convergent technologies (i.e., telecommunications and data processing) necessarily result in convergent innovation and commercialisation strategies is not challenged. This may be a reflection of the supply orientation of the study. Large users often tell a different (or at least more cautious) tale of the demand for, and applicability of, integrated technologies.

Finally, the authors suggest that firms will seek to 'monopolise' segments of the TSE industry through development of 'new' TSE products. They also argue that product differentiation will derive from 'quality' and from software-related applications. Innovation in TSE involves complex packaging of applications that allow users to access, organise and use information. Few wholly new products seem likely to emerge in the 1990s. For example, communication applications such as call forwarding and voice messaging as well as other transaction and information services exist today. The problems are related to the design of complex standards, gateways between services, investment in telecommunication infrastructure (digitalisation, for instance) and so on. Other problems relate to software design which will enable better management, control, security and flexibility of network-based service applications. In addition, both TSE and public switch suppliers are competing in the face of vaguely defined user demand in the business and the domestic consumer market.

Creating a 'monopoly' supply environment in this complex (and confused) market would appear to be unlikely through 'new' products. Nevertheless, market dominance could be sustained (or achieved) in other ways through the use of different combinations of proprietary and open standards. Standards can be used to 'lock-in' (or 'out') competitors in the TSE market, as well as users. The economic implications of standardisation for the shape of competition in global telecommunications markets is an area that could usefully be explored.

In summary, this book makes a strong contribution to analysis of the parameters of technological change and international competitiveness. In rejecting the rigours of neoclassical analysis, the authors have to struggle in the muddy waters of qualitative observation. Further analysis of the role of 'non-manufacturing' activities is clearly needed. TSE is one component of a technological system that supports a host of information-related activities. This analysis does not indicate whether European, US or Japanese firms will ultimately succeed in the marketplace, which may disappoint some policy-oriented readers. This book is recommended to them as a good example of why there are no easy answers in designing industrial policies to accommodate the dual objectives of international competitiveness and universal access to telecommunications networks and services.

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