precise view of the information society should dominate: the options should be open since our understanding of the implications of IT is so limited.

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CIM Computer Integrated Manufacturing: Computer Steered Industry *by August-Wilhelm Scheer*
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This book provides a refreshing discussion of computer integrated manufacturing (CIM). The book is unique in that it takes a process oriented approach to analysing the potential impacts of information technology-based process restructuring of the activity cost chain of the firm. Business processes are not an end in themselves, but exist only as means to enable the accomplishment of management goals and objectives.[1] Firms restructure their manufacturing processes to achieve both internal management oriented benefits as well as external market oriented benefits. The internal management oriented gains include reduced raw material and work in process inventory, reduced order turnaround time, greater production flexibility, and decreased labour costs. The external market oriented gains include improved responsiveness to changes in market demand, and reduced customer costs. Though some of the components for CIM are commercially available as stand-alone systems, (for example, computer aided design, production planning and control, inventory management), Scheer provides a thorough analysis of the potential of cross functional systems integration and introduces a framework within which a platform for computer integrated manufacturing may be built.

In the first part of the book, Scheer takes a process and data oriented view of the need to integrate production planning and control, computer aided design, computer aided manufacturing, and the traditional information systems activities. In this context, the author builds a convincing case that one of the critical bottlenecks inhibiting the effectiveness and efficiency of CIM is the lack of process and data integration across the activity cost chain of the firm. Business processes that are designed without a systems integration view tend to result in discrete specialised sub-processes that are sub-optimised relative to the needs of the overall process chain of the firm. At the manufacturing level this is often reflected in long lead times, long process throughput times, and the lack of flexibility and managerial control. To address this problem, Scheer makes two propositions: first, manufacturing firms should strive for greater compatibility in the organisational interface connecting processes and sub-processes of the activity cost chain of the firm; and second, the underlying databases supporting the processes should be application-independent. The book examines in detail the basis for process integration in each of the critical functions of CIM (production planning and control, computer aided design, computer aided planning, computer aided manufacturing, computer aided quality control, and maintenance) and discusses within each area the implications of cross functional systems integration. In essence, Scheer argues that it is the dynamic and synergistic effect between process and data that determines the competitive

potential of computer integrated manufacturing.[2] For the reader who wants to understand computer integrated manufacturing at the process level, this part of the book is novel and Scheer provides an excellent discussion of the topic.

The book also addresses some of the implementation issues associated with computer integrated manufacturing. Scheer argues that developing a CIM strategy requires both top-down and bottom-up planning. the top-down planning should focus on the future of the enterprise beginning with the question of location, operational structure, organisational structure, the production programme, the extent of standardisation, the layout of the factories, manufacturing should focus on an analysis of existing procedures from an integration standpoint. The scope of the analysis should address two issues; first, the effectiveness and efficiency of the processing sequence; and second, the extent of compatibility in the organisational interface connecting the automated systems and manual processes. The purpose of the analysis is to identify the critical bottlenecks connecting the subproceses and processes within a process chain.[3] For example, Scheer suggests that the order processing chain might be broken down into the following sub-processes; order acceptance, design, materials management, capacity management, manufacturing, and shipping. Given this breakdown, the systems analyst should search for critical bottlenecks in the co-ordination functions that link the processes and sub-processes. Critical bottlenecks are those areas in which satisfactory results will ensure improvement in the firm's competitive posture or those in which critical resources are being expended unproductively. According to Scheer, the priorities placed on eliminating the critical bottlenecks in the co-ordinating activities should be weighted according to the focus of the production planning and control system. In some firms, the co-ordination activity between materials and capacity management may be the most important area on which to focus, in other firms the interface between the CAD and CAM functions may be the most important. The relative weight given a particular co-ordinating activity should reflect the market and industry structure factors that drive the underlying manufacturing process. This analysis should uncover the areas of the firm in which improvement is needed the most.

The book also discusses briefly several other alternatives that may be used to search for strategic information systems opportunties; Michael Porter's value chain, Rockart's critical success factors, and Ives and Learmouth's customer service value chain. Though this part of the book addresses a number of important issues, Scheer's treatment does not go into substantial depth. For example, the book provides very little discussion of the barriers to systems integration, cost justification criteria, company reward systems, the need for co-ordination and co-operation between functions, and management style. For the most part, Scheer's focus on implementation addresses the technical issues and not the organisational issues.

In the second half of the book, the author describes several prototype systems and considers three areas where further development of computer integrated manufacturing is needed; first, design cost elimination, second, application of decision support systems and expert systems, and third, inter-organisational linkages between customers and suppliers. The discussion of the system prototypes provides a good appreciation for the technical requirements of a state of the art system. Scheer discusses several systems, including prototypes by some of the leading vendors, IBM, Siemens, DEC, and Nixdorf.

Design cost estimation is an important area in manufacturing because practitioners have found that 70-80 per cent of total costs is fixed in the design phase. CAD/CAM systems have the potential to affect this cost by facilitating the quick analyses of alternative designs and process changes. The book introduces and discusses the implications of six approaches to cost estimation. Decision support systems and expert systems have already found wide application within CIM. The applications range from sales support (e.g., DEC's XSEL system) to requirements analysis, and from purchasing support to capacity planning. The author gives several examples of the use of decision support and expert systems and discusses in detail Battele Institute's work scheduling generator (GUMMEX). Just as process chains within the firm can be integrated, information technology can also facilitate inter-organisational linkages with buyers and suppliers. Inter-organisational systems can have a number of positive effects; for example, they may reduce the amount of paper flow between firms, reduce the number of the steps in a process chain, transfer functions between the firms, and eliminate the number of planning steps in the overall process. In the United States, for example, electronic data interchange (EDI) systems have experienced explosive growth. In certain industries the use of EDI is a strategic necessity because EDI is now the dominant mode of electronic business communications. Using the automobile industry, Scheer illustrates the potential before and after effects of an inter-organisational system that links the buyers with the manufacturer and the manufacturer with its suppliers.

Overall this is a very good book. I recommend it for both researchers and practitioners. Scheer offers some interesting practical perspectives and the approach is refreshing.

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