METHODS OF REPRESENTING THE STRUCTURE OF COMPLEX INDUSTRIAL PRODUCTS ON COMPUTER FILES, TO FACILITATE PLANNING, COSTING AND RELATED MANAGEMENT TASKS.

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ABSTRACT

When the original concepts for the computerisation of product structures were developed in the late 1960's the available computer power was very limited. A modularisation technique was developed to address the situation in which a number of similar products were being manufactured. This technique tried to rationalise these products into family groups.

Each member of the family differed from the others due to the possession of different features or options. However there was also a high degree of commonality to give the product membership of the family. Modularisation involved the identification of the options and features providing the variability. Those parts remaining tended to be common to all members of the family and became known as the common parts. Separate Bills of Material (BOMs) were set up for each of the identified options or features. Another BOM was set up for the common parts. The simple combination of the required options and/or features BOMs with the common parts BOM specified a product. Computer storage requirements and redundancy were reduced to a minimum. The Materials Requirements Planning (MRP) system could manipulate these option and feature BOMs to over plan product variability without over planning the parts common to all members. The modularisation philosophy had wide acceptance and is the foundation of MRP training.

Modularisation, developed for MRP, is generally parts orientated. An unfortunate side effect tends to be the loss of product structure information. Most commercial software would list 6 resistors, Part No. 123, in the common parts BOM without concern as to where the resistors are fitted. This loss of product structure information can hide the fact that two products using these 6 resistors 'in common' are in fact different as they do not use the resistors in the same 6 places. Additional information must be consulted to enable the correct assembly of the 'common' portion of these products.

The electronics industry is especially affected by this situation. This industry has changed considerably since the late 1960's. Product variability can be very high. Changes and enhancements are a constant factor in products having a relatively short life span. The modularisation technique does not have a good mechanism for the situation where an option itself has options or features. This situation can exist down a number of layers of the family tree structure of an electronics product. Maintenance of these BOMs is difficult.

Where there are options within options the designers and production staff need to know the inter-relationship of parts between options to ensure accuracy, compatibility and plan assembly functions. The advent of computerised spreadsheets has made the maintenance of this type of product structure information easier. This matrix is another separate document which must be maintained and cross checked. It will inevitably differ from the BOMs periodically.

This thesis develops a product structure Relational BOM based on the matrix for the family of products. The processing power of the 1990's computer is fully utilised to derive the common parts for any or all of the selected products of the family. All product structure information is retained and the inter-relationship of parts is highly visible. The physical maintenance of the BOMs is simple. The BOM serves all purposes without the need for supplementary information. It is fully integrated into the Sales Order Entry , MRP, Costing, Engineering Design and Computer Aided Manufacturing (CAM) systems.

This technique has been proven by being the only system used in one Electronics Design and Manufacturing organisation for over 1 year without any major problems.

As described in Section 1.6 user satisfaction has been high. The response of the users to the suggestion 'lets buy an "off the shelf" package' is very negative, as it would not incorporate this BOM system. Users have expressed the opinion that EXICOM could not continue, with present staffing levels, using the traditional BOM structure.

ACKNOWLEDGMENTS

I wish to thank the management and staff of EXICOM without whose co-operation this study would not have been possible. The faith they pinned on a totally untried concept demonstrates the desperate situation which had developed. The fact that management were unable to find consultants able to suggest a better course of action is indicative of the lack of understanding within this country, and possibly further afield, of this problem. Most consultants had not thought beyond the accepted methodology as developed in the late 1960s.

One group of consultants which may have been able to assist have been of extensive assistance to me with the writing of this thesis. I refer to the staff of the Production Technology Department of Massey University. I wish to thank Harvey Barraclough for his guidance especially in the wider thinking of how this concept could be applied to other computer systems and Roger Browne for his guidance in the writing of this thesis.

I wish to thank Ned Davies, the contract programmer for EXICOM, who made this concept a reality. During previous projects Ned had given me a good grounding on how the PICK system file structures worked and generally taught me how to use the programming language. At that stage, as I was not permitted to write software code for the corporate computer, I had to rely on Ned's ability to translate my concepts into a robust useable code. He acted as a good sounding board for some of my ideas which initially sounded impossible. His teaching, combined with my own reading, was sufficient to allow me to take over all the programming tasks and maintain the system when his contract was reduced due to changes in the company financial situation.

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